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Enhancing Physiotherapy Education Through Simulation: Academic, Psychological, and Motivational Outcomes

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ABSTRACT

Purpose: This study aimed to investigate the effects of simulation-based training on physiotherapy students' academic performance, satisfaction, self-confidence, motivation, and perceptions of the quality of educational practices in neurological physiotherapy and rehabilitation.

Method: Students enrolled in the Neurological Rehabilitation course were assigned to either a simulation group or a control group. The simulation group received simulation-supported training using anatomical models and mannequins, whereas the control group underwent traditional instruction with practical demonstrations performed on students. Academic performance was evaluated in both groups using a rubric-based assessment form. Students' perceptions of simulation-supported education were assessed with the Student Satisfaction and Self-Confidence in Learning Scale (SSSCLS) and the Educational Practices Questionnaire (EPQ).

Results: No significant difference was observed between the groups in the Collaboration subscale of the EPQ ($p=0.373$). However, scores for the Active Learning ($p=0.001$), Diverse Ways of Learning ($p<0.001$), and High Expectations ($p<0.001$), subscales, as well as the total score ($p<0.001$), were significantly higher in the simulation group. Similarly, in the SSSCLS, the simulation group achieved significantly higher scores in both subscales ($p=0.001$) and the total score ($p<0.001$). Academic performance scores were also significantly higher in the simulation group ($p=0.001$).

Conclusion: In conclusion, this study highlights the benefits of simulation-based education in neurological rehabilitation, showing improvements in students' active learning, satisfaction, self-confidence, and academic performance. These findings may also guide the use of simulation in other physiotherapy courses.

Key Words: Health Education, Learning, Neurological Rehabilitation, Students.

INTRODUCTION

Simulation-based education is an instructional approach that replicates or augments real-life experiences within an interactive, structured, and supervised environment. It enables students to engage in practice within a safe and controlled setting (1). In recent years, this method has gained increasing prominence in the education and training of healthcare professionals. A key advantage of simulation in healthcare education is its capacity to provide learners with repeated, risk-free exposure to potentially hazardous scenarios that they are likely to encounter in clinical practice (2).

Physiotherapy and rehabilitation education encompass a wide range of content, extending from basic sciences to advanced clinical skills, and require extensive practice and repetition, particularly for the development of psychomotor competencies (3). In the traditional training model, theoretical instruction is followed by instructor-led demonstrations, after which students practice skills on healthy volunteers or peers through role-play before applying them in real clinical settings (4). In disciplines such as neurological rehabilitation, however, it is well established that students frequently experience feelings of inadequacy, fear of harming patients, and anxiety about making mistakes during their initial clinical encounters (5). Such emotions may impede the effective transfer of theoretical knowledge and practical skills to actual patient care (6). Simulation-based training addresses this challenge by providing a safe and controlled environment in which students can practice repeatedly, make and correct errors without risk, and gradually build competence. This approach facilitates a smoother transition into clinical environments and enhances students' confidence (6, 7). Within physiotherapy and rehabilitation education, low-technology applications as anatomical models, task trainers, and plastic mannequins—are among the most frequently utilized approaches (8).

A study examining the learning outcomes of physiotherapy students through simulation-based training divided 51 final-year students into two groups: one receiving standard lecture-based instruction and the other receiving simulation-enhanced teaching. The simulation group participated in patient scenario sessions specifically designed to facilitate learning. Findings indicated that the simulation group achieved significantly higher knowledge and clinical skills scores compared to the control group, with clinical performance scores being 43.70% higher (9).

Moreover, simulation is also utilized in acute and intensive care settings. For example, Shoemaker et al. employed a high-fidelity patient mannequin in intensive care scenarios with physiotherapy students, which resulted in increased self-confidence and motivation to learn (10).

A review of the literature indicates that systematic evidence on the effects of simulation-based training employing low-technology (non-high-fidelity) mannequins remains limited. Accordingly, the present study aimed to investigate the effects of low-technology, mannequin-based simulation in neurological physiotherapy and rehabilitation on students' perceptions of educational practice quality, academic performance, satisfaction, self-confidence, and motivation.

METHODS

Study Design

This descriptive, prospective study was conducted at the Faculty of Physical Therapy and Rehabilitation, Hacettepe University, during the spring semester of the 2023-2024 academic year. Ethical approval was obtained from the Hacettepe University Senate Ethics Commission before data collection (Approval Date: 03.05.2023, Approval Number: E-81471704-710.03-00002826850). All participants were informed about the study and provided written informed consent.

Participants

The study population consisted of undergraduate students from the Department of Physiotherapy and Rehabilitation, Faculty of Physical Therapy and Rehabilitation at Hacettepe University. The inclusion criteria were: being 18 years of age or older, providing voluntary consent to participate, being actively enrolled in the program, and taking the Neurological Rehabilitation course. Exclusion criteria included students who were not actively enrolled in the program and those who did not provide voluntary consent to participate.

Procedure

Prior to the course registration week at the beginning of the semester, students registering for the Neurological Rehabilitation course were informed that one section of the course would serve as the study group. Students who opted to participate were enrolled in this section, while those who did not participate selected one of the other two available sections.

In the simulation group, the topic "Spinal Cord Injuries and Rehabilitation", which encompasses content requiring intensive practice, such as in-bed exercises, positioning, complication prevention, functional training, gait training, patient and family education, and patient transfers, was delivered using anatomical models and mannequins for simulation-based practice. The same topic was taught to the control group using traditional instruction, supplemented by practical demonstrations. During reinforcement sessions, control group students practiced on each other, whereas students in the simulation group repeated the exercises using mannequins. The training sessions were conducted over four weeks, with each session lasting approximately 120 minutes. Student attendance and active participation were recorded for each session to ensure engagement and adherence to the study protocol.

Academic performance in both groups was assessed using a stepwise evaluation form based on a rubric. At the conclusion of each topic, both groups completed the Educational Practices Questionnaire (EPQ) and the Student Satisfaction and Self-Confidence in Learning Scale (SSSCLS) online via Google Forms. Details of the assessment tools are provided below.

Assessments

Evaluation of Educational Practices

The EPQ was employed to assess educational practices. The EPQ comprises 16 items across four subscales: Active Learning, Collaboration, Diverse Ways of Learning, and High Expectations. The EPQ consists of two parts. The first part utilizes a Likert scale ranging from “Strongly disagree” to “Strongly agree,” with an additional “Not applicable” option, to evaluate the extent to which optimal simulation design elements were implemented. The second part assesses students’ perceived importance of these elements using a five-point scale: “Not important,” “Somewhat important,” “Undecided,” “Important,” and “Very important.” Scores are calculated by dividing the sum of total or subscale item scores by the number of items. The original questionnaire was developed by Jeffries and Rizzolo (11), and Ünver et al. conducted the Turkish validity and reliability study (12). Permission to use the Turkish version was obtained from the authors.

Evaluation of Student Satisfaction and Self-Confidence

Student satisfaction and self-confidence were assessed using the SSSCLS. The original scale, developed by Jeffries and Rizzolo, comprises 13 items; the Turkish version contains 12 items. The scale includes two subscales: Satisfaction with Current Learning (five items) and Self-Confidence in Learning (seven items). All items are rated using a five-point Likert scale and are not negatively worded. Higher scores indicate greater satisfaction and self-confidence (11). Ünver et al. conducted the Turkish validity and reliability study (12), and permission to use the Turkish version was obtained from the authors.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics, version 25.0. The Shapiro–Wilk test was applied to assess the normality of data distribution. Quantitative variables are presented as mean±standard deviation (X ± SD), and categorical variables as number (n) and percentage (%). Depending on the results of the normality assessment, comparisons between the two groups were performed using either the Independent Samples T-Test or the Mann–Whitney U test for demographic characteristics, academic performance scores, educational practice scores, and student satisfaction and self-confidence scores. Statistical significance was set at p<0.05.

RESULTS

A total of 57 female and 9 male students participated in the study. The descriptive characteristics of the participants are presented in Table 1.

Table 1. Descriptive characteristics of the students.

Descriptive Characteristics	Simulation Group (n=28)	Control Group (n=38)	p
Age (years)	23.1±2.99	22.3±2.03	0.220[a]
Gender (F/M)	25/3	32/6	0.553[b]
Year of Enrollment (2019/2020/2021)	0/8/20	1/5/32	0.221[b]
Class Level (3rd/4th year)	21/7	32/6	0.352[b]

Data are presented as mean ± standard deviation.
[a]Independent Samples T-Test
[b]Chi-square test

Comparison of the subscale and total scores of the EPQ between the simulation and control groups revealed no significant difference in the Collaboration subscale (p=0.373). However, scores for the Active Learning (p=0.001), Different Ways of Learning (p<0.001), and High Expectations (p<0.001) subscales, as well as the total EPQ score ($p<0.001$), were significantly higher in the simulation group (Table 2).

Table 2. Comparison of the Educational Practices Questionnaire Results

EPQ Subscales	Simulation Group (n=28)	Control Group (n=38)	p
Active Learning	42.9±4.44	38.1±5.99	**0.001**[a]
Collaboration	8.64±1.13	8.29±1.75	0.373[a]
Different Ways of Learning	9.25±0.93	7.29±1.83	**<0.001**[a]
High Expectations	8.75±1.14	7.37±1.59	**<0.001**[a]
Total Score	69.5±6.08	61.0±9.08	**<0.001**[a]

Data are presented as mean ± standard deviation.
[a]Independent Samples T-Test
EPQ: Educational Practices Questionnaire

Significant differences were observed between the simulation and control groups in the Satisfaction and Self-Confidence subscales ($p=0.001$), as well as in the total score of the SSSCLS ($p<0.001$) (Table 3).

Table 3. Comparison of Student Satisfaction and Self-Confidence Scale Results in Learning

SSSCLS Subscales	Simulation Group (n=28)	Control Group (n=38)	p-value
Satisfaction	22.2±2.22	19.7±3.23	**0.001**[a]
Self-Confidence	29.2±3.64	25.3±4.60	**0.001**[a]
Total Score	51.4±5.38	45.03±7.16	**<0.001**[a]

Data are presented as mean ± standard deviation.
[a]Independent samples t-test
SSSCLS: Student Satisfaction and Self-Confidence in Learning Scale

A statistically significant difference in course achievement scores was observed between the simulation and control groups ($p=0.001$) (Table 4).

To assess the statistical power of the study findings, a post hoc power analysis was performed using G*Power 3.1 software. The analysis revealed a large effect size for the EPQ-Active Learning subscale (Cohen's $d = 0.89$). Based on a standard error rate of 0.05, the calculated statistical power of the study was 94.7%, indicating that the sample size was sufficient to detect significant effects.

Table 4. Comparison of Course Achievement Scores

	Simulation Group (n=28)	Control Group (n=38)	p
Course Achievement Grade	84.57±12.81	74.84±9.60	**0.001**[a]

Data are presented as mean ± standard deviation.
[a]Independent Samples T-Test

DISCUSSION

This study aimed to investigate the effects of simulation-based education in neurological physiotherapy and rehabilitation—a field that requires modelling, intensive practice, and repetition—on students' perceptions of educational quality, academic achievement, satisfaction, self-confidence, and motivation. Students who participated in simulation-based training demonstrated significantly higher scores in Active Learning, Different Ways of Learning, and High Expectations within educational practices, as well as greater satisfaction, self-confidence, and course achievement, compared to those who received traditional instruction.

Several factors may explain the more favorable outcomes observed in the simulation group, the most notable of which is the promotion of active learning. Simulation encourages students to move beyond passive listening and engage in learning by doing, providing a hands-on educational experience (13). Consistent with this, students in the simulation group in the present study achieved higher scores on the Active Learning subscale of the EPQ. Similarly, a previous study on simulation-based education in physiotherapy and rehabilitation reported that this training approach enhanced students' clinical decision-making skills (14).

Another factor contributing to the superior outcomes in the simulation group is the opportunity to make mistakes in a safe environment. This allows students to practice repeatedly, refine their skills, and progressively reduce the likelihood of errors with each iteration (15). In addition, simulation scenarios enhance student engagement and promote long-term retention of knowledge (16).

Our study also observed increased self-confidence and motivation among students in the simulation group. Hagan et al. investigated doctoral students in physiotherapy and rehabilitation, comparing an simulation group that participated in a single simulation session with a control group that received standard laboratory training. The study reported a significant increase in self-confidence scores in the experimental group following the simulation session; however, there was no significant difference in clinical performance observed between the groups. These findings suggest that low-technology simulation interventions, which can be implemented at relatively low cost, may positively influence self-confidence (17). Dale et al. examined 76 doctoral students undergoing training in blood pressure measurement. One group practiced using a low-fidelity task trainer manikin arm, while the other group used traditional training methods alone. No significant differences were observed between the groups in either self-confidence scores or measurement accuracy, indicating that both approaches were similarly effective and that simulation did not confer a distinct advantage in terms of performance or confidence (18).

In addition to the Self-Confidence subscale, the Satisfaction subscale of the SSSCLS was also examined in the present study. Consistent with our findings, previous studies in physiotherapy education have reported that simulation-based learning enhances both self-confidence and student satisfaction. Similarly, Sabus et al. reported that simulation-based education improved students' confidence and satisfaction with the learning experience (2). Dale et al. found that both low- and high-fidelity simulation approaches positively influenced students' satisfaction and perceived self-efficacy (18). These findings collectively suggest that simulation-based learning not only strengthens students' self-confidence but also enhances their overall satisfaction, highlighting the value of interactive and practical teaching methods in physiotherapy education.

In general, studies in this field are characterized by small sample sizes and predominantly employ experimental designs. Common outcome measures include pre- and post-test scores, clinical performance assessments, and self-confidence questionnaires (9, 18). The findings across studies are heterogeneous, with some reviews reporting no significant differences in skill acquisition between high- and low-fidelity simulation modalities (19). These observations suggest that training with basic manikins is often sufficient for educational purposes. Both the current literature and the findings of our study indicate that basic plastic manikins can serve as valuable educational tools in physiotherapy training, particularly when integrated with well-designed scenarios and appropriate instructional strategies.

Limitations

The limitations of the present study include the absence of an assessment of the long-term effects, as well as a lack of comparison between the different types of simulation. Future research should consider longitudinal study designs to evaluate the sustained impact of simulation-based training on learning outcomes. Additionally, it would be valuable for subsequent studies to compare the effectiveness of simulation techniques involving virtual reality applications with those using standardized patient scenarios.

CONCLUSION

In conclusion, the findings of this study specifically highlight the benefits of simulation-based education in the field of neurological rehabilitation. While the results indicate improvements in students' active learning, satisfaction, self-confidence, and academic performance, these outcomes are most directly applicable to neurological rehabilitation courses. Nevertheless, the positive effects observed suggest that simulation-based applications in other physiotherapy courses may also be valuable, providing a foundation for future research in diverse areas of physiotherapy education.

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