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Original Article

Advancements in physical therapists' assessment using physical agents: A focus on online objective structured clinical examination

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ABSTRACT

The Online Objective Structured Clinical Examination (O-OSCE) is a novel tool in health education, offering secure clinical scenarios for skill development and clinical reasoning. To describe the design, implementation, and student satisfaction of an O-OSCE designed to assess clinical skills in physical therapists regarding the application of physical agents. Twenty-four students (17 males,7 females; average age 33±4) from the Physiological Foundations and Intervention with Physical Agents program at Universidad Andrés Bello participated. The program, comprising six courses, aims to train physical therapists or final-year students in advanced clinical skills related to physical agents. The O-OSCE featured nine stations: analgesia (S1), muscle relaxation (S2), tissue repair (chronic stage) (S3), tissue repair (acute stage) (S4), muscle strengthening (S5), phototherapy dosing (S6), interpreting electrotherapy parameters (S7), analyzing physical agents' application (S8), and rest stations (S9, S10). Experts validated stations for clarity, relevance, and pertinence using a Likert scale. The expert validation revealed strong consensus across clarity, relevance, and pertinence for most stations, particularly highlighting analgesia (S1) and electrotherapy (S7). Stations focusing on analgesia (S1), muscle relaxation (S2), and chronic tissue repair (S3) achieved scores exceeding 70%, indicative of passing. Conversely, stations such as phototherapy dosing (S6) and analysis of physical agents' applications (S8) obtained lower scores. Students overwhelmingly endorsed the O-OSCE's organization, station alignment, and educational utility. The O-OSCE enhances physical therapy education, offering a safe environment for practice. Student satisfaction underscores its value, suggesting integration into training programs for improved clinical readiness. Further research is needed to explore its impact.

Keywords: Clinical competence, Education, Health, Educational measurement, Physical therapy specialty, Telemedicine

Introduction

The COVID-19 pandemic brought significant changes to education, leading institutions, and healthcare professionals to reassess their training approaches [1]. Tele-education crucially emerged to ensure learning continuity and professional growth during this period. Social distancing and mobility restrictions accelerated the importance of information and communication technologies (ICTs), making them essential for distributing educational content and conducting virtual evaluations [2]. Educators also adapted by undergoing ICT training to facilitate the shift to online teaching methods [2, 3].

These changes had a notable impact on assessment strategies in healthcare education, particularly in training programs emphasizing clinical skill development [4]. The shift to online platforms led educators to adapt teaching and evaluation methods, focusing on case studies, digital resources like

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textbooks and educational videos, interactive assessments, virtual interviews, and teleconsultations [2, 4, 5]. The main goal was to maintain high standards for developing and evaluating clinical skills, even outside of traditional clinical settings [1]. As a result, integrating ICTs into assessment practices became crucial for effectively evaluating and improving the clinical competence of students and healthcare professionals [3, 6].

Changes in healthcare education evaluation strategies through ICTs have proven valuable in the post-pandemic era. Virtual simulations and teleconsultations provide flexible learning and improve the practical use of clinical knowledge [7]. The online objective structured clinical examination (O-OSCE) illustrates how ICTs have transformed assessment in health education [8]. The integration of videoconferencing platforms into O-OSCEs improves accessibility and inclusivity in medical education. It allows for refining essential competencies for virtual consultations, vital for future virtual clinics, while streamlining setup procedures compared to traditional in-person instruction. This transformative approach signifies a shift towards more efficient and practical medical training methodologies [9].

The O-OSCE differs from the traditional OSCE by being conducted remotely through online platforms, eliminating geographical and time constraints [9-11]. This advanced modality for assessing clinical skills using online technology allows participants to interact with virtual patients and perform clinical tasks in a controlled environment, thereby providing instant feedback and opportunities for effective skill enhancement. The O-OSCE's versatility and adaptability to various medical specialties facilitate continuous assessment and professional development in the healthcare field. Students can participate from anywhere with internet access [9, 10]. Despite its virtual nature, the O-OSCE maintains the same rigorous standards and fairness in evaluation as the traditional OSCE, ensuring all students encounter identical clinical scenarios [12]. Its ability to simulate diverse clinical situations provides a safe yet realistic environment for students to improve their clinical skills, leading to enhanced learning outcomes and optimized resource allocation while minimizing logistical challenges [9, 12].

Physical agents play a vital role in the education and training of physical therapists, necessitating profound comprehension and adept utilization for optimal rehabilitation outcomes [13]. These therapeutic modalities encompass diverse forms of energy such as heat, cold, water, sound, electromagnetic radiation, and electrical currents, each serving distinct purposes in addressing inflammation, fostering tissue healing, and managing pain [13, 14]. Physical therapists must exhibit a nuanced understanding of the biophysics, indications, contraindications, and application methodologies associated with these agents [13, 15]. Proficiency in these competencies is pivotal to their clinical prowess and can be effectively assessed through an O-OSCE [9, 10]. The O-OSCE may be used to test physical therapists' clinical reasoning skills, ability to analyze the effects of physical agents, ability to make dosing recommendations, and ability to teach patients. This evaluation method aims to measure therapists' proficiency in the effective and safe application of physical agents in the context of rehabilitation practice [9, 10].

Considering that the O-OSCE is an established resource in education and is increasingly regarded as an effective and safe option in the educational assessment of healthcare professionals in training, this study aims to describe the design, implementation, and student satisfaction of an O-OSCE specifically aimed at evaluating the clinical skills of physical therapists when applying physical agents.

Materials and Methods

Design

Non-experimental, cross-sectional descriptive study.

Participants

The study included 24 students (17 males, 7 females; average age 33 ± 4) enrolled in the continuing education program on Physiological Foundations and Intervention with Physical Agents in Physical Therapy cohort 2023 at Universidad Andrés Bello [16]. Physical therapists from all specialties, who utilize physical agents in clinical practice or seek to enhance their knowledge in the field, can benefit from this program's advanced theoretical-practical approach.The program is semi-presential, consisting of six courses with a total of 180 pedagogical hours, regularly delivered on a semester basis. Its objective is to train physical therapists with advanced knowledge and skills in physical agents, capable of planning and implementing interventions based on different health conditions affecting individuals across various professional contexts.

The program includes the following learning outcomes (LOs): 1) Assess the biophysical, physiological, and therapeutic effects of electrical, mechanical, and electromagnetic physical agents in both classic and new technologies; 2) Evaluate different modalities of physical agents, classic and new, for their therapeutic effects in diverse clinical contexts to address deficiencies and functional problems in various health conditions and professional settings, and 3) Apply interventions with physical agents judiciously to address deficits and functional problems in users' health conditions, considering relevance and context in the use of electrical, mechanical, and electromagnetic agents [13, 15].

The program consists of three evaluations: summative assessments for each course (60%), presentation and defense of a scientific article (10%), and the O-OSCE (30%), providing a comprehensive evaluation of the entire program content.

Selection criteria

Participants were selected based on the following criteria: students enrolled in the program during the year 2023, and those who provided written consent for the use of scores obtained in the O-OSCE equivalent to the program's final exam. Students

who did not take the assessment or did not sign the consent were excluded from the analysis.

Instrument: O-OSCE

The O-OSCE methodology was introduced to students at the start of the program as an assessment strategy aligned with the program's learning outcomes (LOs). It was designed in accordance with these LOs, following a structured process: design; expert validation of the stations; pilot testing; implementation of the O-OSCE; and student satisfaction. The program director designed the O-OSCE in accordance with the LOs listed for the program and the institutional educational model (student-centered). Training for the O-OSCE was conducted in each course of the program through case analysis, intervention plan construction, analysis of application videos and dosimetry, virtual interviews, and simulated telerehabilitation. Four physical therapists, experts in physical agents outside of the program, assessed the validity of the O-OSCE using three criteria for each station: clarity, relevance, and pertinence. Ratings were given using a Likert scale ranging from 1 to 5, with categories including strongly disagree (i), disagree (ii), neither agree nor disagree (iii), agree (iv), and strongly agree (v). The O-OSCE implementation was evaluated by students using key questions that looked at how the O-OSCE was organized, how well the stations matched the level of knowledge, how useful the O-OSCE was for training, how people thought training could be improved through similar assessments, and how important it was to test clinical skills. The same Likert scale criteria described earlier were utilized for these evaluations.

The stations were designed to replicate common clinical problems in physical therapy, focusing on musculoskeletal, neurological, and dermatofunctional areas. Each station had an access link leading to a designated room. The O-OSCE consisted of nine stations to test the course's learning outcomes: three standard patients (S1: pain relief; S2: muscle relaxation; S3: tissue repair (chronic stage); three virtual patients (S4: tissue repair (acute stage); S5: muscle relaxation; S6: muscle strengthening; S7: phototherapy dosing); and two mailboxes (S8: interpreting electrotherapy parameters; S9: analyzing the application of physical agents). Two rest stations (S10 and S11) were included as a waiting room with recreational videos. The clinical interviews were conducted through the Collaborate Ultra platform by Blackboard. The evaluators were the professors of the program, and each station was assessed using a checklist.

According to institutional evaluation policies and course-defined criteria, a learning outcome was considered successful if it achieved a score equal to or greater than 70% of the total score per station (approval score).

A pilot was conducted prior to running the O-OSCE to refine timing details, checklists, train evaluators, and review station elements. Each station had a duration of 10 minutes (1 minute for instructions and 9 minutes for station development), resulting in a total exam duration of 110 minutes (nine stations plus two rest stations). The cohort was divided into 3 groups (8 participants per group) to conduct the exam. Prior to the administration of the O-OSCE, students provided written consent for the utilization of their scores.

Statistical analysis

The statistical analysis was conducted using SPSS version 26. The Shapiro-Wilk test was employed to assess the normality of scores per station (observed performance) [17]. The results of student performance (O-OSCE scores) and student satisfaction with the exam were presented using descriptive statistics, including measures of central tendency such as means and medians, along with corresponding measures of dispersion such as standard deviations or quartiles. The Content validity, evaluated by four expert physical therapists, was assessed using the Fleiss' kappa statistic, with agreement strength classified according to the Landis and Koch classification [18].

Results and Discussion

According to the selection criteria, two students (2 men) were excluded due to absence reasons, resulting in a final sample of 24 participants, comprising 17 males and 7 females, with an average age of 33 years (SD ±4).

The agreement among evaluators for the stations of the O-OSCE was assessed in terms of clarity, relevance, and pertinence **(Table 1)**. The results reveal a variety of agreements for each criterion at the individual stations. A substantial agreement is observed in the relevance and pertinence categories (kappa ≥ 0.6), with some exceptions to agreements. The stations with the best agreements in clarity were S2 (muscle relaxation), S8 (electrotherapy parameter interpretation), and S9 (physical agent application analysis), all with kappa ≥ 0.6. On the other hand, the stations that showed moderate to low agreements, especially in the clarity category (kappa 0.2 and 0.59), were S1 (analgesia), S3 (tissue repair—chronic stage), S4 (tissue repair—acute stage), S5 (muscle flexibility), and S6 (muscle strengthening). These results suggest that, while evaluators largely agree on the relevance and pertinence of the stations, clarity might be an area that varies more in terms of agreement.

Table 1. The agreement obtained for the expert validation applied to each station of O-OSCE.

Criteria	S1	P-value†	S2	P-value†	S3	P-value†	S4	P-value†	S5	P-value†	S6	P-value†	S7	P-value†	S8	P-value†	S9	P-value†
Clarity	0.21**	< 0.05	0.44	< 0.05	0.78*	< 0.05	0.65*	< 0.05	0.64*	< 0.05	0.66*	< 0.05	0.64*	< 0.05	0.78*	< 0.05	0.78*	< 0.05
Relevance	0.42**		0.64*		0.46**		0.73*		0.42**		0.78*		0.74*		0.71*		0.46**	

Pertinence	0.61*	0.79*	0.78*	0.64*	0.74*	0.60*	0.64*	0.62*	0.74*

†p-value for the hypothesis test of agreement: H0 = there is no agreement among the raters beyond what is expected by chance; H1 = there is significant agreement among the raters. The level of agreement was analyzed with Fleiss kappa statistic.*Substantial agreement; **moderate or low agreement

After analyzing the agreement, criteria for stations with moderate or low concordance were refined, particularly focusing on clarity. Ambiguous criteria related to clarity were identified and subsequently removed from stations S1 (analgesia) and S2 (muscle relaxation). **Table 2** presents the improved O-OSCE following expert validation, highlighting the modifications to enhance station clarity and consistency. **Table 3** presents an example of the navigation route set up for each student in a group of eight students. **Figure 1** presents the O-OSCE, depicting student interactions with standardized patients in simulated clinical scenarios. This visual representation showcases the diverse stations and practical application of physical therapy skills in a virtual environment, enhancing students' learning outcomes.

Table 2. Physical agents' virtual O-OSCE stations and the clinical skills evaluated.

Station	Station Name	LO*	Station Aim	Modality	Instrument	Criteria	Score	Passing Score	Connection Link
S1	**Analgesia**	LO1 LO2 LO3	Conduct a clinical interview and propose a physical agent-based intervention for the condition	Standardized patient	Checklist	1. Keep the camera turned on. 2. Introduces himself as a responsible physical therapist. 3. Complement the interview with background information. 4. Gather information to determine the reason for consultation. 5. Choose the appropriate physical agent for the condition. 6. Explains physical agent procedure and dosing. 7. Describes indications and effects of physical agents. 8. Incorporates contraindications and asks relevant questions. 9. Educate users on post-intervention care. 10. Say goodbye to the user.	0 - 15	12	https://forms.office.com/r/whjRi2t9aS
S2	**Muscle relaxation**	LO1 LO2 LO3	Conduct a clinical interview and provide explanations about the procedures involving the listed physical agents in the medical order.	Standardized patient	Checklist	1. Keep the camera turned on. 2. Introduces himself as a responsible physical therapist. 3. Complement the interview with background information. 4. Gather information to determine the reason for consultation. 5. Choose the appropriate physical agent for the condition. 6. Explains physical agent procedure and dosing. 7. Describes indications and effects of physical agents. 8. Incorporates contraindications and asks relevant questions. 9. Educate users on post-intervention care. 10. Say goodbye to the user.	0 - 15	12	https://forms.office.com/r/TwDPqeNW8K
S3	**Tissue repair (chronic stage)**	LO1 LO2 LO3	Conduct a clinical interview, explaining the procedures involving the physical agents listed in the medical order.	Standardized patient	Checklist	1. Keep the camera on. 2. Introduces himself as a responsible physical therapist. 3. Complements the interview with background. 4. Gather information for the reason of consultation. 5. Choose an appropriate physical agent. 6. Explains physical agent procedure and dosing. 7. Describes indications and effects. 8. Ask contraindication questions. 9. Educate on post-intervention care. 10. Says goodbye.	0 - 15	12	https://forms.office.com/r/XKJqKtU0CZ
S4	**Tissue repair (acute stage)**	LO1 LO2 LO3	Prescribe and dose the most appropriate physical agent to facilitate tissue repair for the presented health condition.	Virtual patient	SAQs**	1. Specify the tissue repair stage. 2. Set a specific resolution goal. 3. Describes the chosen physical agent. 4. Identifies an energy transfer mechanism. 5. Specify the desired physiological effect. 6. Dose a physical agent with parameters. 7. List two contraindications.	0 - 10	7	https://forms.office.com/r/v2tg0TS54P

S5	**Muscle flexibility**	LO1 LO2 LO3	Prescribe and dose the most appropriate physical agent to facilitate tissue repair for the presented health condition.	Virtual patient	SAQs**	1. Specify the tissue repair stage. 2. Set a specific resolution goal. 3. Describes the chosen physical agent. 4. Identifies an energy transfer mechanism. 5. Specify the desired physiological effect. 6. Dose a physical agent with parameters. 7. List two contraindications.	0 - 10	7	https://forms.office.com/r/LeuyKVzgnc
S6	**Muscle strengthening**	LO1 LO2 LO3	Prescribe and dose the most appropriate physical agent to facilitate tissue repair for the presented health condition.	Virtual patient	SAQs**	1. Specify the tissue repair stage. 2. Set a specific resolution goal. 3. Describes the chosen physical agent. 4. Identifies an energy transfer mechanism. 5. Specify the desired physiological effect. 6. Dose a physical agent with parameters. 7. List two contraindications.	0 - 10	7	https://forms.office.com/r/Z2dN4LPmJx
S7	**Phototherapy dosification**	LO1 LO2	Dose the low-level laser therapy or light-emitting diode therapy according to the clinical context described.	Mailbox	SAQs**	1. Electromagnetic spectrum region. 2. Average emission power. 3. Irradiance for application. 4. Energy density for treatment. 5. Total treatment time. 6. Calculate the average power for distance change.	0 - 6	4	https://forms.office.com/r/jeTtCXNJwP
S8	**Electrotherapy parameters interpretation**	LO1 LO2	Recognize the parameters, physiological effects, and therapeutic effects of various electrotherapy modalities.	Mailbox	SAQs**	1. Recognize the characteristics of physical agent modalities. 2. Understand the parameters of physical agent modalities. 3. Determine the physiological and therapeutic effects of various electrotherapy modalities.	0 -16	11	https://forms.office.com/r/66ZLnJ2KYC
S9	**Physical agent application analysis**	LO1 LO3	Recognize and correct or incorrect applications when applying physical agents.	Mailbox	SAQs**	1. Identify the correct and incorrect applications for nine physical agent applications	0 - 18	13	https://forms.office.com/r/k5FHc5Ku7M
S10	**Rest station**	/	/	/	/	/	/	/	https://forms.office.com/r/4u9TAPgyLK
S11	**Rest station**	/	/	/	/	/	/	/	https://forms.office.com/r/aavb7xJBPM

Abbreviatures: Learning outcomes* Short answer questions**

Figure 1. Student interactions with Standardized Patients in Simulated Clinical Scenarios.

Table 3. Example of the online navigation route of a group in the O-OSCE.

Group 1		Rout 1	Rout 2	Rout 3	Rout 4	Rout 5	Rout 6	Rout 7	Rout 8
Rotation	**Hour**	**Student 1**	**Student 2**	**Student 3**	**Student 4**	**Student 5**	**Student 6**	**Student 7**	**Student 8**
ROTATION 1	**10:00 - 10:10**	https://forms.office.com/r/whjRi2t9aS	https://forms.office.com/r/LeuyKVzgnc	https://forms.office.com/r/jeTtCXNJwP	https://forms.office.com/r/k5FHc5Ku7M	https://forms.office.com/r/4u9TAPgyLK	https://forms.office.com/r/66ZLnJ2KYC	https://forms.office.com/r/jeTtCXNJwP	https://forms.office.com/r/k5FHc5Ku7M
ROTATION 2	**10:11 - 10:21**	https://forms.office.com/r/TwDPqeNW8K	https://forms.office.com/r/whjRi2t9aS	https://forms.office.com/r/aavb7xJBPM	https://forms.office.com/r/jeTtCXNJwP	https://forms.office.com/r/66ZLnJ2KYC	https://forms.office.com/r/k5FHc5Ku7M	https://forms.office.com/r/aavb7xJBPM	https://forms.office.com/r/4u9TAPgyLK
ROTATION 3	**10:22-10:32**	https://forms.office.com/r/k5FHc5Ku7M	https://forms.office.com/r/TwDPqeNW8K	https://forms.office.com/r/whjRi2t9aS	https://forms.office.com/r/LeuyKVzgnc	https://forms.office.com/r/jeTtCXNJwP	https://forms.office.com/r/aavb7xJBPM	https://forms.office.com/r/4u9TAPgyLK	https://forms.office.com/r/XKJqKtU0CZ
ROTATION 4	**10:33-10:43**	https://forms.office.com/r/4u9TAPgyLK	https://forms.office.com/r/k5FHc5Ku7M	https://forms.office.com/r/TwDPqeNW8K	https://forms.office.com/r/whjRi2t9aS	https://forms.office.com/r/v2tg0TS54P	https://forms.office.com/r/LeuyKVzgnc	https://forms.office.com/r/XKJqKtU0CZ	https://forms.office.com/r/Z2dN4LPmJx
ROTATION 5	**10:44-10:54**	https://forms.office.com/r/Z2dN4LPmJx	https://forms.office.com/r/4u9TAPgyLK	https://forms.office.com/r/66ZLnJ2KYC	https://forms.office.com/r/TwDPqeNW8K	https://forms.office.com/r/whjRi2t9aS	https://forms.office.com/r/XKJqKtU0CZ	https://forms.office.com/r/LeuyKVzgnc	https://forms.office.com/r/jeTtCXNJwP
ROTATION 6	**10:55-11:05**	https://forms.office.com/r/LeuyKVzgnc	https://forms.office.com/r/aavb7xJBPM	https://forms.office.com/r/k5FHc5Ku7M	https://forms.office.com/r/Z2dN4LPmJx	https://forms.office.com/r/TwDPqeNW8K	https://forms.office.com/r/whjRi2t9aS	https://forms.office.com/r/v2tg0TS54P	https://forms.office.com/r/66ZLnJ2KYC
ROTATION 7	**11:06-11:16**	https://forms.office.com/r/aavb7xJBPM	https://forms.office.com/r/66ZLnJ2KYC	https://forms.office.com/r/Z2dN4LPmJx	https://forms.office.com/r/v2tg0TS54P	https://forms.office.com/r/XKJqKtU0CZ	https://forms.office.com/r/TwDPqeNW8K	https://forms.office.com/r/whjRi2t9aS	https://forms.office.com/r/v2tg0TS54P
ROTATION 8	**11:17-11:28**	https://forms.office.com/r/jeTtCXNJwP	https://forms.office.com/r/Z2dN4LPmJx	https://forms.office.com/r/v2tg0TS54P	https://forms.office.com/r/XKJqKtU0CZ	https://forms.office.com/r/LeuyKVzgnc	https://forms.office.com/r/v2tg0TS54P	https://forms.office.com/r/TwDPqeNW8K	https://forms.office.com/r/whjRi2t9aS
ROTATION 9	**11:29-11:39**	https://forms.office.com/r/66ZLnJ2KYC	https://forms.office.com/r/v2tg0TS54P	https://forms.office.com/r/XKJqKtU0CZ	https://forms.office.com/r/aavb7xJBPM	https://forms.office.com/r/aavb7xJBPM	https://forms.office.com/r/jeTtCXNJwP	https://forms.office.com/r/Z2dN4LPmJx	https://forms.office.com/r/TwDPqeNW8K
ROTATION 10	**11:40-11:50**	https://forms.office.com/r/v2tg0TS54P	https://forms.office.com/r/XKJqKtU0CZ	https://forms.office.com/r/4u9TAPgyLK	https://forms.office.com/r/66ZLnJ2KYC	https://forms.office.com/r/Z2dN4LPmJx	https://forms.office.com/r/4u9TAPgyLK	https://forms.office.com/r/k5FHc5Ku7M	https://forms.office.com/r/LeuyKVzgnc
ROTATION 11	**11:51-12:01**	https://forms.office.com/r/XKJqKtU0CZ	https://forms.office.com/r/jeTtCXNJwP	https://forms.office.com/r/LeuyKVzgnc	https://forms.office.com/r/4u9TAPgyLK	https://forms.office.com/r/k5FHc5Ku7M	https://forms.office.com/r/Z2dN4LPmJx	https://forms.office.com/r/66ZLnJ2KYC	https://forms.office.com/r/aavb7xJBPM

Table 4 shows the results of the O-OSCE. The score distribution per station reveals that several stations displayed non-normal distributions ($p < 0.05$). In the analysis of O-OSCE performance, it is evident that the stations with the highest average scores were S1 (analgesia) with an average of 13.5 and a median of 13, closely followed by S2 (muscle relaxation) with an average of 13.3 and a median of 14. Additionally, S3 (chronic stage tissue repair) demonstrated notable results with an average of 11.2 and a median of 12, alongside S9 (physical agent application analysis) with an average of 12.0 and a median of 12. These stations consistently performed above the passing score of 12.

Instead, stations with lower average scores were found. For example, S7 (phototherapy dosification) had an average score of 3.0 and a median score of 3. S4 (acute stage tissue repair) and S5 (muscle flexibility) had average scores of 7.7 and 7.8, respectively, and median scores of 8 and 9. These stations displayed performance below the passing score. Noteworthy is the performance of stations S8 (electrotherapy parameter interpretation) and S6 (muscle strengthening), which achieved average scores of 8.5 and 7.2, respectively, with a median of 8 for S8.

Table 4. Physical agents O-OSCE scores (n = 24)

Station	Station Name	Score	Distribution*	Mean ± SD	Median	(P_{25} - P_{75})	Minimum Score	Maximum Score	Passing Score
S1	**Analgesia**	0 - 15	NON-NORMAL	13.5 ± 1.4	13	(13-15)	11	15	12
S2	**Muscle relaxation**	0 - 15	NON-NORMAL	13.3 ± 2.3	14	(13-15)	8	15	12
S3	**Chronic stage tissue repair**	0 - 15	NORMAL	11.2 ± 1.7	12	(10-12)	7	15	12
S4	**Acute-stage tissue repair**	0 - 10	NON-NORMAL	7.7 ± 2.0	8	(6-10)	4	10	7
S5	**Muscle flexibility**	0 - 10	NON-NORMAL	7.8 ± 2.3	9	(6-10)	3	10	7
S6	**Muscle strengthening**	0 - 10	NORMAL	7.2 ± 1.5	7	(6-8)	5	10	7
S7	**Phototherapy dosification**	0 - 6	NON-NORMAL	3.0 ± 1.1	3	(2-4)	2	5	4
S8	**Electrotherapy parameters interpretation**	0 -16	NORMAL	8.5 ± 3.1	8	(6-10)	3	15	16
S9	**Physical agent application analysis**	0 - 18	NORMAL	12.0 ± 2.9	12	(9-14)	6	17	13

*Shapiro-Wilk test: non-normal ($p < 0.05$)

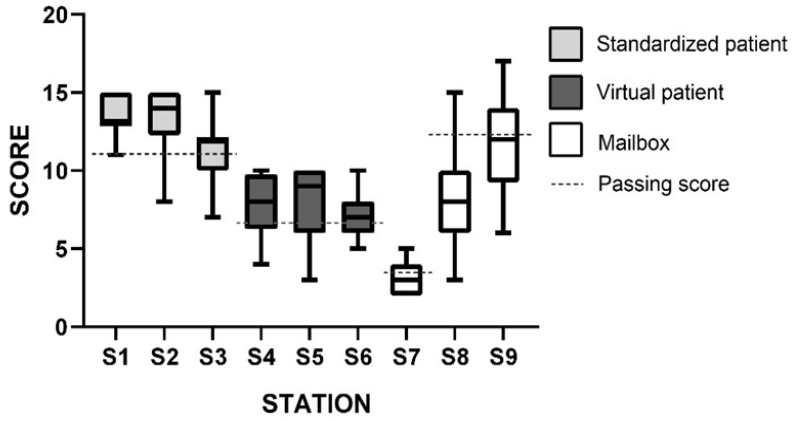

Figure 2. O-OSCE scores by station

Figure 2 illustrates the results by station, depicting the medians and interquartile ranges alongside the established passing score. Evidently, the standardized patient stations (S1–S3) achieved the highest performance, notable for their consistent outcomes. Conversely, the station related to phototherapy dosing (S7) exhibited inferior performance, indicating areas for improvement and a potential need for further training in this specific modality.

Table 5 presents the analysis of student evaluations regarding O-OSCE implementation, yielding significant insights. The findings indicate a favorable perception of the O-OSCE organization, with 62.5% strongly agreeing and 16.7% agreeing that the O-OSCE organization was adequate. Moreover, 58.3% strongly agreed, and 33.3% agreed that the stations were appropriate for their level of knowledge. Concerning utility, 54.2% strongly agreed, and 25.0% agreed that the O-OSCE has been useful for their training. Additionally, a noteworthy proportion (54.2%) believed that carrying out similar tests improved their training, with 33.3% agreeing. Lastly, 75.0% emphasized the significance of taking tests that assess clinical skills, with 20.8% in agreement.

These findings illuminate the positive reception of the O-OSCE format among students, affirming its perceived efficacy in augmenting their training and preparedness for clinical settings.

Table 5. Absolute and relative frequencies regarding the students' physical agents O-OSCE satisfaction (n = 24).

Questions	Category 1 strongly disagree	Category 2 Disagree	Category 3 Neither agree nor disagree	Category 4 Agree	Category 5 Strongly agree
Q1. The O-OSCE organization was adequate.	n = 0 0%	n = 0 0%	n = 5 20.8%	n = 4 16.7%	n = 15 62.5%
Q2. The stations were appropriate for my level of knowledge.	n = 0 0%	n = 0 0%	n = 2 8.3%	n = 8 33.3%	n = 14 58.3%
Q3. The O-OSCE has been useful for my training.	n = 0 0%	n = 1 4.2%	n = 4 16.7%	n = 6 25.0%	n = 13 54.2%
Q4. Carrying out similar tests improves my training.	n = 0 0%	n = 0 0%	n = 3 12.5%	n = 8 33.3%	n = 13 54.2%
Q5. Taking tests that assess clinical skills is important.	n = 0 0%	n = 0 0%	n = 1 4.2%	n = 5 20.8%	n = 18 75.0%

The study aimed to describe an O-OSCE that was designed to evaluate physical therapists' clinical skills in reasoning, justifying, recommending, and educating on the use of specific physical agents for purposes such as analgesia, strengthening and repair of tissue, and dosing. It explored the O-OSCE's relevance in physical therapy education, emphasizing its potential to comprehensively assess students' abilities in using and advocating for mechanical, electrical, and electromagnetic agents for these therapeutic objectives. The findings revealed a positive student perception of this assessment modality. Additionally, the analysis of station scores identified both strengths and areas for potential improvement in student performance. These findings underscored the utility of the O-OSCE in physical therapy education, emphasizing the importance of ongoing adaptation to enhance student learning and clinical readiness.

Enhancing physical therapy training with the O-OSCE

The versatility of the O-OSCE extends its applicability to various training programs, making it an invaluable asset in the education of future physical therapists [9, 19]. Its adaptable nature allows for the creation of diverse stations covering practical skills such as the application of physical agents, as well as stations focused on critical thinking, patient interviewing, and clinical decision-making [9, 10, 20]. This adaptability ensures that the O-OSCE can be customized to meet the specific learning objectives and competencies of different physical therapy curricula [21]. By integrating these practical, reasoning-based, and interview-focused stations, the O-OSCE becomes an integral component of a comprehensive training program, equipping students with a well-rounded preparation for the complexities of clinical practice [20, 21].

The O-OSCE in physical therapy education stands out for providing a safe and varied environment for clinical practices and offering flexibility and precise feedback [21]. It is accessible and adaptable to a range of skills, such as intervention, examination, and clinical reasoning, effectively preparing students for contemporary clinical practice. This not only fortifies them for scenarios like telerehabilitation but also enhances their confidence in treatment prescriptions and clinical interviews.

Content validity

Expert validation, a cornerstone of content validation, is pivotal in guaranteeing the quality and applicability of assessment instruments such as O-OSCE within physical therapy [22]. This validation type offers a meticulous evaluation by professionals possessing profound subject-matter expertise. In the development phase of the O-OSCE, a team of seasoned physical therapy educators rigorously scrutinized each station [22, 23]. Their assessments encompassed the clarity of instructions, the relevance of clinical scenarios, appropriateness of assessment criteria, and fidelity to the principles of physical therapy education. The invaluable insights gleaned from these experts honed the O-OSCE to authentically mirror the indispensable skills and knowledge requisite for adept practice in physical therapy. As a result, expert validation elevates the instrument's credibility, pertinence, and efficacy, cementing its status as a robust tool for the training and evaluation of upcoming physical therapists.

O-OSCE in physical agents

O-OSCE, designed for physical agents, presents a secure and controlled setting for clinical practice, effectively simulating a diverse array of clinical scenarios and modalities of physical agents [14]. This O-OSCE ensures a standardized and objective evaluation of students' competencies, facilitating precise and constructive feedback. Moreover, its online accessibility streamlines scheduling and student engagement, making it a flexible and efficient resource for physical therapy education.

This pioneering O-OSCE, to the best of our knowledge, represents the first of its kind in the realm of physical therapy education, marking a significant advancement in the virtual

assessment of physical agent modalities. Serving as a trailblazing initiative in this field, it utilizes virtual simulation to assess and train physical therapists in the application of mechanical, electrical, and electromagnetic agents [13-15]. This innovative approach not only meets the evolving needs of healthcare education but also sets a precedent for future developments in virtual assessment methodologies within the domain of physical therapy.

In the context of our study, the O-OSCE emerges as a pivotal instrument for several compelling reasons. Simulating precise scenarios of mechanical, electrical, and electromagnetic agent applications, provides students with a platform to cultivate reasoning and dosing skills in a risk-free environment, fostering effective and secure practical learning crucial for aspiring physical therapists. Furthermore, the O-OSCE ensures equitable evaluation of performance by delivering a standardized and objective test of dosing, application, and analysis skills related to these agents. Its adaptability to diverse modalities of physical agents enhances its relevance and applicability in the field of physical therapy, where both reasoning and technical expertise are paramount.

Integrating this O-OSCE into physical therapy training enhances students' proficiency in managing physical agents and facilitates the assessment of critical skills such as clinical decision-making, patient communication, and the integration of theoretical knowledge with clinical practice [21]. This multifaceted approach underscores the O-OSCE's role as an essential component in comprehensive physical therapy education, equipping students with the skills and knowledge necessary for success in clinical practice.

O-OSCE satisfaction

The findings of student satisfaction with the O-OSCE implementation reveal a favorable reception of this evaluation method [24-26]. A significant number of students either agreed or strongly agreed with the organization of the O-OSCE, the alignment of stations with their knowledge levels, and its educational utility, highlighting their favorable perception of this tool. These findings suggest that the O-OSCE not only met students' expectations but also made a substantial contribution to their clinical readiness and training. Moreover, the evident preference for this evaluation approach, as demonstrated by most students, supports the idea that the O-OSCE could be a valuable and well-received option in physical therapy training programs. These results underscore the significance of considering students' opinions and perceptions in the design and development of assessment methods to ensure their effectiveness and relevance in clinical learning.

Students' preference for the O-OSCE may be due to its interactive and practical nature, which allows them to actively apply theoretical knowledge in simulated clinical scenarios, thereby improving material retention. Additionally, a safe learning environment allows students to make errors without compromising real patient safety [9, 10]. The modernity and technological relevance of the O-OSCE also enhance its appeal, fostering student engagement and participation. These aspects elucidate why this assessment method might be favored over traditional approaches.

Notably, contemporary students are digital natives, having been immersed in digital technology since early ages [26]. This familiarity with digital tools can influence their preference for educational methods like the O-OSCE, which utilizes technology to offer a more interactive and engaging learning experience. When designing assessment techniques, educators should take this into account, as the integration of technology has the potential to boost student motivation and involvement in the learning process.

Limitations

This research is noteworthy as, to our knowledge, it marks the first instance of O-OSCE implementation in physical therapy within the realm of physical agents. Additionally, we value the students' satisfaction, as they demonstrated a positive acceptance of the tool. In terms of the study limitations, several key considerations must be considered. The singular focus on a physical therapy training program restricts the generalizability of the findings to other educational contexts. The relatively small sample size of participating students may impact the representativeness of the results, and the lack of direct comparison with other evaluation methods limits a comprehensive understanding of the O-OSCE's effectiveness. Furthermore, the fact that the O-OSCE doesn't include a practical part for using therapeutic techniques directly shows that this method needs to be complemented with tests that focus on students' practical skills. These limitations highlight the need for further research to gain a more comprehensive understanding of the complete impact of the O-OSCE on physical therapist education.

Conclusion

The O-OSCE emerges as a valuable and effective tool in physical therapy education, providing a safe and controlled environment for simulated clinical practice. The positive student satisfaction results support their favorable perception of the O-OSCE, highlighting its utility and relevance in the educational process. Even though some problems have been pointed out, like the fact that there isn't a direct practical component, the O-OSCE is a big step forward in standardizing how clinical skills are evaluated and encouraging critical thinking in simulated settings. Its integration into physical therapy training programs is suggested to enhance student readiness for the challenges of modern clinical practice, prompting further research to address practical aspects and continue exploring its impact on the professional development of physical therapists.

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