Original Article

Validating an objective structured clinical examination to enhance assessment of clinical skills in physical therapy students

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ABSTRACT

The validation of evaluation instruments such as the Objective Structured Clinical Examination (OSCE) in healthcare education is crucial for precise clinical skills assessments, which are requisites for professional practice. This study aims to validate an OSCE designed specifically for physical therapy students enrolled in the electrophysical agents course. A non-experimental cross-sectional study included 167 fourth-year students (86 men,79 women, average age 21 years ±1.3) at Andres Bello University. The OSCE, comprising five stations (S1-S5) assessing electrophysical agent applications, constituted 30% of the course grade. Stations evaluated generic skills, clinical reasoning, and practical abilities with checklists. Statistical Analysis KR-20 for internal consistency and exploratory factor analysis for construct validity, with the removal of criteria with low correlations and high eigenvalues to refine the instrument.
Descriptive statistics indicated a non-normal score distribution ($p<0.01$) across stations. Notably, stations S1 (connective tissue flexibility) and S5 (equipment installation) exhibited notable performance. The KR-20 statistic showed that most stations had high (S2-S4) or very high (S1, S2) reliability. Analysis by domain revealed low internal consistency (<0.4) for generic and practical skills, specifically for S3 (drainage), S4 (strengthening), and S5 (equipment installation). Factor analysis identified underlying latent variables, particularly in S2, S3, and S4. Refinement led to the removal of 6,7, and 3 criteria from S1, S2-S4, and S5, respectively, resulting in improved reliability and construct validity in the instrument. The enhancements in validity and internal consistency, justifying the removal of the generic domain.

Keywords: Objective structured clinical examination (OSCE), Physical therapy, Education, Professional, Clinical competence, Validation studies as topic

Introduction

The validation of instruments stands as a cornerstone of multidisciplinary research and evaluation [1]. This meticulous process involves stages and tests aimed at confirming the instrument's coherence and precision in measuring the evaluated phenomenon, accounting for its cultural and linguistic relevance and applicability across diverse contexts and populations [1, 2]. Both validity and reliability are indispensable pillars in this endeavor, significantly enhancing the quality and credibility of the obtained results [2].

Instrument validity is paramount for ensuring accurate measurements of theoretical constructs [3]. Along with content and criterion validity, construct validity is an important method that looks at how instrument scores relate to variables that are thought to be related to the construct [4]. Methods such as factor analysis and correlation matrices play a pivotal role in establishing construct validity, thereby bolstering the instrument's robustness [5, 6]. Meanwhile, instrument reliability focuses on the consistency and stability of the obtained results, assessing the coherence of responses among the instrument's different items.

Access this article online	
Website: www.japer.in	**E-ISSN:** 2249-3379

How to cite this article: Mirand LG, Amigo TR, Ortiz HADLB. Validating an objective structured clinical examination to enhance assessment of clinical skills in physical therapy students. J Adv Pharm Educ Res. 2024;14(2):16-26. https://doi.org/10.51847/c2DlK9b9pQ

In addition to traditional coefficients like Cronbach's alpha or Kuder-Richardson (KR20), alternative statistical methods like the intra-class correlation coefficient and Pearson's correlation coefficient can further evaluate reliability [3, 4].

Objective-structured clinical examination (OSCE) has emerged as an indispensable tool for assessing clinical aptitude within a controlled environment for health students. OSCE simulates genuine clinical scenarios, comprising a series of stations tailored to mimic authentic encounters in healthcare [7]. Unlike conventional evaluation methods, OSCE adopts a structured approach, delineating specific skills for assessment, including diagnosis, communication, clinical decision-making, and teamwork. A primary advantage of OSCE lies in its capacity to deliver standardized and objective evaluations [7, 8]. Each station is meticulously crafted with defined assessment criteria, facilitating consistent measurement of students' competencies across diverse clinical contexts [8].

OSCE offers distinct advantages over traditional written or oral examinations, enabling the appraisal of practical clinical proficiencies within a controlled milieu and mitigating reliance on subjective judgments [7, 9, 10]. Additionally, they afford students invaluable feedback, fostering targeted enhancements in performance. Through the replication of real-life clinical scenarios, OSCE aims to provide students with the necessary skills and confidence to effectively navigate upcoming medical challenges [9, 11]. This approach ultimately enhances their overall competence in clinical practice.

In healthcare education, validating assessment instruments is essential to accurately measuring the clinical skills requisite for professional practice [1, 2, 12]. This not only bolsters the credibility of the obtained results but also establishes a robust basis for impartial and objective student evaluation [1, 4]. The validation of the OSCE represents an ongoing endeavor to refine assessment protocols in healthcare education [5, 13]. It guarantees the reliability and validity of this assessment approach in health education training, facilitating continual enhancements to align with evolving standards and student requirements [13].

Electrophysical agents represent a fundamental clinical skill in the training of physical therapists and are widely integrated into graduation profiles and curricula [14, 15]. Physical therapists leverage their specialized expertise to meticulously select and administer these therapeutic modalities for purposes such as analgesia, healing, strengthening, and edema management, tailoring interventions to meet the individual needs of each patient [15, 16]. Therefore, their application entails solid clinical reasoning, a deep understanding of potential adverse effects, and refined practical skills to ensure effective and safe outcomes for patients [9, 16, 17].

Evaluations such as the OSCE are relevant tools for evaluating intervention skills, such as the use of electrophysical agents, in physical therapy students [7, 9]. This type of rigorous evaluation ensures that aspiring physical therapists are prepared to deliver effective and safe treatments to their patients in clinical practice. Improving the quality of assessments for health students, especially the OSCE, is crucial as it enhances the reliability of evaluations, thereby contributing to the development of competent professionals. Therefore, this study aims to validate an OSCE designed for physical therapy students within the electrophysical agent course, highlighting its pivotal role in accurately assessing students' clinical skills.

Materials and Methods

Design

Non-experimental, cross-sectional descriptive study. Exploratory factor analyses were adopted to examine the latent domains underlying various indicators assessed.

Participants and context

The OSCE was implemented with 167 fourth-year physical therapy students at Andrés Bello University in 2023. This cohort consisted of 86 males and 79 females, with an average age of 21 years (SD $\pm$1.3), all enrolled in the electrophysical agents course. This course emphasizes the application of electrophysical agents, recognized for their effectiveness in addressing various musculoskeletal, neurological, and cardiopulmonary conditions [15, 18]. This course is a key part of the required curriculum for the seventh semester, spanning 116 semester hours. It consists of 2.5 hours of in-person instruction and 5 hours of independent study per week, contributing to a total of 5 academic credits (ECTS). During this course, students enhance their ability to thoughtfully apply and assess non-ionizing physical resources across a range of clinical settings, addressing the requirements and challenges presented by individuals with diverse health conditions. The course consists of three evaluations: summative assessments (50%), clinical case construction (20%), and the OSCE (30%), providing a comprehensive evaluation of the entire course content.

Selection criteria

The sample for this study consisted of fourth-year physical therapy students. Were included physical Therapy students from Andrés Bello University who fully completed the physical agents course. Exclusion criteria encompassed students who did not provide written consent for the use of their results, as well as those who formally withdrew from the course or students who did not complete all the stations of the OSCE.

Instruments: OSCE

The OSCE was developed by course instructors, considering the learning outcomes of the course program, which encompassed: (i) analyzing the physical and physiological effects of electrophysical agents; (ii) evaluating different modalities in various professional contexts; and (iii) identifying functional deficiencies in users due to health conditions. The instrument underwent validation by experts in the field (face validity), unaffiliated with the course. OSCE was employed as the final evaluation of the course. OSCE includes five stations with standardized patients, each focused on the application of different electrophysical agent resources for various therapeutic purposes—S1: connective tissue flexibility, S2: analgesia, S3: drainage, S4: muscle strengthening, and S5: equipment installation. Each station was constructed with specific criteria associated with three dimensions: generic skills, clinical reasoning, and practical skills. Evaluation at each station was conducted using checklists. Trained observers, equipped with checklists, were assigned to each of the five stations to ensure adherence to established criteria. As per institutional evaluation policies and course-defined criteria, a learning outcome was deemed successful if a score equal to or greater than 70% of the total score per station (passing score) [9].

A pilot was conducted before running the OSCE to refine details of timing, checklists, train evaluators, and review station elements. Each station had an 8-minute duration (1 minute for instructions and 7 minutes for application), resulting in a total exam duration of 40 minutes (time for completing five stations). **Table 1** depicts the instrument in its original version.

Over three months, comprehensive learning was conducted on the biophysical fundamentals, physiological effects, and practical uses of electrophysical agents and resources. A special focus was given to transcutaneous electrical nerve stimulation (biphasic pulsed current), Russian currents, and therapeutic ultrasound. Practical exercises, resolution of clinical cases, and simulated peer stations were incorporated to prepare students for the OSCE.

Table 1. OSCE stations.

Station	Station name	Aim	Learning outcomes	Modality	Criteria	Score	Generic skills criteria	Clinical reasoning criteria	Practical skills criteria	Instrument
S1	Connective tissue flexibility	To apply US for loosening adhered or shortened connective tissue	LO1- LO3	SP	1. Greet and introduce yourself. 2. Conduct a brief interview for additional info. 3. Identify clinical problems from records and interviews. 4. Choose the appropriate intervention: US. 5. Explain the procedure to the user. 6. Ask key safety questions. 7. Position the user correctly. 8. Ensure hand hygiene before the procedure. 9. Skillfully operate equipment; quick setup. 10. Target treatment area: posterior shoulder. 11. Set treatment frequency. 12. Choose a duty cycle. 13. Select the appropriate head. 14. Adjust treatment time using the half-head rule. 15. Set power density. 16. Apply gel to the head first. 17. Keep your head moving during treatment. 18. Clean the treatment area and head afterward. 19. Tidy clinical area post-treatment. 20. Say goodbye and thank the user.	20	1,5 and 20	2,3,4,6,11-15	7-10,16-19	Checklist
S2	Analgesia	To demonstrate the application of BPS for analgesia	LO1- LO3	SP	1. Greet and introduce yourself. 2. Supplement case information with a brief interview. 3. Conduct a brief interview. 4. Identify a clinical problem. 5. Explain the procedure and pain relief mechanism. 6. Choose the BPC intervention 7. Ask two safety questions. 8. Position the user for joint rest. 9. Demonstrate equipment operation. 10. Set treatment parameters (frequency). 11. Set treatment parameters (pulse duration). 12. Ensure hand hygiene. 13. Apply electrodes. 14. Clean the treatment area. 15. Safely install electrodes. 16. Program treatment duration. 17. Assist the user post-application. 18. Clean clinical setting. 19. Say goodbye and thank the user.	19	1,5 and 19	2,3,4,6,9-11,13-15	7,8,12,16-18	Checklist

S3	Drainage	To demonstrate drainage by activating muscle pumps through EIMC	LO1- LO3	SP	1. Greet and introduce. 2. Conduct a brief interview. 3. Identify a clinical issue. 4. Choose the NMES intervention. 5. Explain the procedure. 6. Ask safety questions. 7. Position the user properly. 8. Demonstrate equipment. 9. Set the treatment frequency. 10. Adjust the stimulation intensity. 11. Design an NMES program. 12. Apply electrodes. 13. Clean the treatment area. 14. Ensure hand hygiene. 15. Secure the electrode installation. 16. Program treatment time. 17. Assist post-treatment. 18. Clean the treatment area. 19. Say goodbye and thank the user.	19	1,5 and 19	2,3,4,6,9-11,13,15	7,8,12,14,16-18	Checklist
S4	Muscle strengthening	Performing electrical muscle strengthening to enhance trophism	LO1- LO3	SP	1. Greet and introduce yourself. 2. Conduct a brief interview. 3. Identify a clinical problem. 4. Choose the NMES intervention. 5. Explain the procedure to the user. 6. Ask safety questions. 7. Position the user appropriately. 8. Demonstrate equipment operation. 9. Set the treatment frequency. 10. Adjust the stimulation intensity. 11. Design an NMES program. 12. Apply electrodes to weakened muscles. 13. Clean the treatment area. 14. Ensure hand hygiene. 15. Securely install electrodes. 16. Program treatment time. 17. Assist the user post-treatment. 18. Clean the treatment area. 19. Say goodbye and thank the user.	19	1,5 and 19	2,3,4,6,9-13,15	7,8,14,16-18	Checklist
S5	Equipment installation	To demonstrate a safe application of electrotherapy	LO1 and LO2	Dummy	1. Position the user for lower limb drainage. 2. Efficiently operate equipment. 3. Set treatment time for at least 15 minutes. 4. Clean the treatment area with alcohol. 5. Apply electrodes to the quadriceps or triceps surae. 6. Program treatment frequency appropriate for the goal. 7. Set pulse duration suitable for the therapeutic objective. 8. Ensure hand hygiene before application. 9. Ensure electrodes make uniform contact. 10. Ensure electrodes are adequately hydrated. 11. Secure electrodes without displacement. 12. Assist user post-application. 13. Clean clinical area post-application.	13	NA	5-7,9-11	1-4,8,12,13	Checklist

Abbreviatures: BPC, biphasic pulsed current; EIMC, electrically induced muscle contractions; EPA, electrophysical agent; NMES, neuromuscular electrical stimulation; SP, standardized patient; US, therapeutic ultrasound.

Statistical analysis

The station scores were recorded by one of the researchers (HDB) in a Microsoft Excel® sheet. The normality of the distribution for each station was assessed using the Shapiro-Wilk test [19]. The internal consistency of each dimension, station, and overall instrument was evaluated using the Kuder-Richardson (KR-20) statistic [20]. Reliability was further examined, categorizing it as very high (0.81–1.00), high (0.61-0.80), moderate (0.41-0.60), low (0.21-0.40), and very low (0.01-0.20) [20]. Items within each station that significantly compromised reliability were identified based on low correlations.

Exploratory factor analysis (EFA) was used to check the construct validity of the instrument and find factors that had nothing to do with the main goal of the station [21]. For EFA, an orthogonal model for factor rotation was performed using the varimax method. The Kaiser-Meyer-Olkin (KMO) test was applied as a statistical measure to evaluate the proportion of variance of each criterion per station and determine the suitability of the data for factor analysis [6]. KMO values greater than 0.6 were considered relevant to conduct the factorial analysis. Criteria per station with lower correlation scores in internal consistency assessment and those with higher eigenvalues representing the highest factorial load (eigenvalues) derived from the EFA were analyzed for elimination, contributing to the refinement of the instrument.

Results and Discussion

In the electrophysical agents course, 175 students were enrolled, of whom 167 met the study's criteria, with 8 excluded due to absence from the exam, resulting in a cohort participation rate of 95%. **Table 2** summarizes the descriptive statistics of student performance (scores) obtained for each station (S1-S5) and the reliability analysis using the KR-20 statistic for all stations and their respective dimensions (generic skills, clinical reasoning, practical skills), along with the criteria of each station showing the lowest correlations. Results indicate a non-normal distribution of observed performance for all stations with the Shapiro-Wilk test ($p < 0.01$). Notably, stations S1 (connective tissue flexibility) and S5 (equipment installation) exhibited superior performance (highest scores), with cohort mean and median scores equal to or exceeding the passing score. Overall, reliability by station and dimension per station was rated as high (S2, S3, and S4) or very high (S1 and S2), except for the generic skills dimension across all stations and the practical skills dimension specifically for stations S3 (Drainage), S4 (Muscle strengthening), and S5 (Equipment Installation), where low or very low internal consistency values (< 0.4) were observed. The average number of items with the lowest correlation per station was 5, with the maximum observed in station S4 and the minimum in station S5 due to its lack of generic domain content.

Table 2. Internal Consistency (KR20 statistic) for OSCE stations after EFA.

Descriptive statistics	S1		S2		S3		S4		S5	
Score distribution (n = 167)	Non-normal (p < 0.01)		Non-normal (p < 0.01)		Non-normal (p < 0.01)		Non-normal (p < 0.01)		Non-normal (p < 0.01)	
Mean score (±SD)	14.3 (±1.4)		10.9 (±2.0)		12.4 (±2.0)		12.3 (±1.8)		9.3 (±1.4)	
Median score (p_{25}-p_{75})	14 (13-15)		11 (9-12)		13 (11-14)		13 (11-14)		10 (8-10)	
Minimum score	10		5		6		6		5	
Maximum score	16		14		15		15		11	
Passing score (70%)	14		13		13		13		9	
Category	Results	Criteria with the lowest correlation	Results	Criteria with the lowest correlation	Results	Criteria with the lowest correlation	Results	Criteria with the lowest correlation	Results	Criteria with the lowest correlation
Criteria (n)	n = 20	n = 5	n = 19	n = 4	n = 19	n = 5	n = 19	n = 8	n = 13	n = 3
Generic skills reliability	0.27†	1,20	0.33†	1,19	0.02†	1,19	0.04†	1,19	NA	NA
Clinical reasoning reliability	0.83*	2,3	0.71**	2	0.61**	2,3	0.57	2,4,13	0.73**	NA
Practical skills reliability	0.83*	8	0.70**	14	0.39†	12	0.24†	14,17,18	0.37†	2,4,8
Station reliability	0.91*	1,2,3,8,20	0.77**	1,2,14,19	0.66**	1,2,3,12,19	0.63**	1,2,4,13,14,17-19	0.72**	2,4,8

NA, not apply; Very high reliability*; High reliability**; Low or very low reliability†

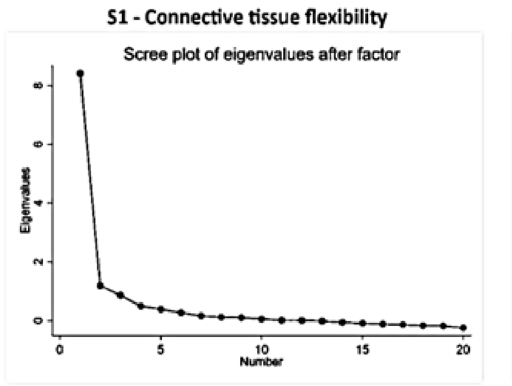
Table 3 illustrates the results of construct validity through EFA by station and dimensions per station. The KMO index for all stations was greater than 0.6, indicating the suitability of the factor analysis. Across all stations, the presence of more than one factor was observed, suggesting the existence of underlying variables. Stations S2, S3, and S4 exhibited the highest number of factors, consistent with the stations that showed more criteria with a higher factorial load. **Figure 1** presents the scree plots per station following EFA, indicating the presence of multiple factors in the original version of the instrument and suggesting the presence of latent variables (values greater than 1).

Table 3. Construct Validity of the OSCE with EFA.

Category	S1	S2	S3	S4	S5
Factor (n)	2	3	3	3	2
Generic skills: high factors loading by Eigenvalues* (criteria)	1,20	1,19	1,19	1,19	NA
Clinical reasoning: high factors loading by Eigenvalues* (criteria)	6	2,3,6,14	2,3,6	2,3,6	1,3,4,8
Practical skills: high factors loading by Eigenvalues* (criteria)	7,8	7,12,18	17,18	17,18	NA
High factors loading by Eigenvalues* (criteria)	1,6-8,20	1-3,6,7,12,14,19	1-3,6,17,18	1-3,6,17,19	1,3,4,8
KMO	0.90	0.73	0.60	0.64	0.68

Abbreviatures: EFA, exploratory factor analysis; KMO, Kaiser-Meyer-Olkin coefficient

Eigenvalues*: The amount of variance explained by a factor that contributes to the overall variance and that requires extraction.



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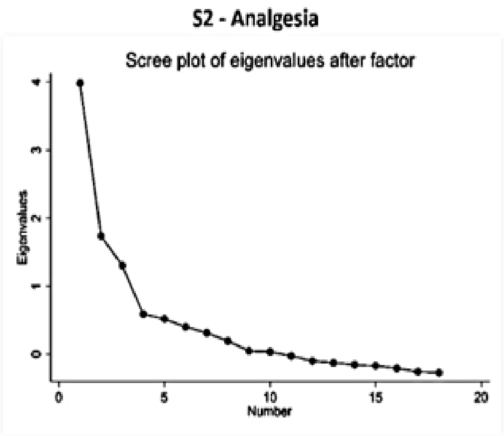

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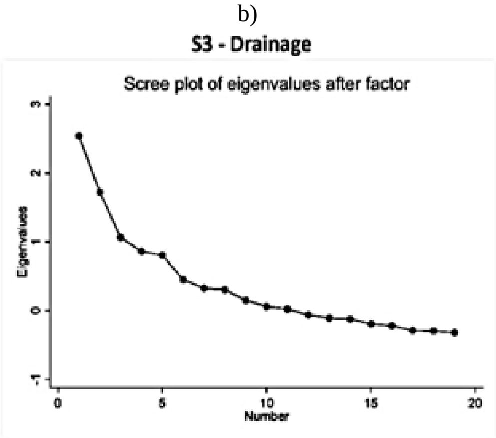

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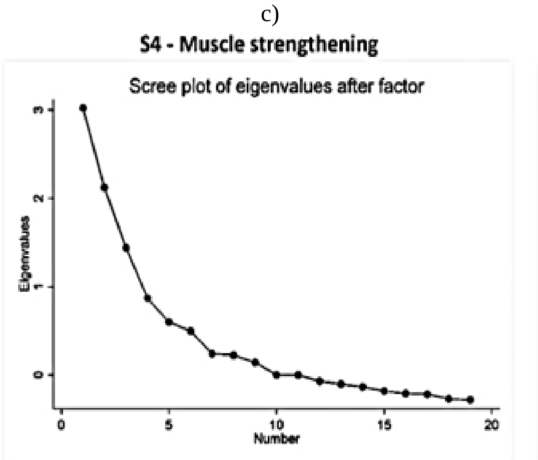

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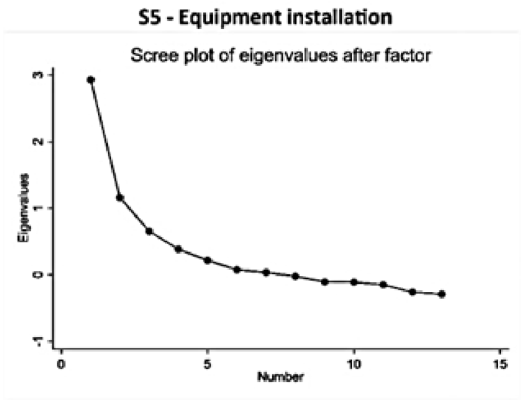

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Figure 1. Scree plots for EFA for the OSCE stations (S1–S5)

For each station, criteria with the lowest correlation obtained from the internal consistency analysis (KR20 statistic) and those with the highest factorial load were analyzed to assess their elimination and obtain refined OSCE stations. Six criteria were removed for S1, while seven criteria were eliminated for S2, S3, and S4, and three criteria for S5. It was decided to eliminate generic skills from all stations due to their high factorial load and low correlation, considering their high association with other underlying variables unrelated to the stations' objectives. **Table 4** shows the reliability analysis using KR20 for the refined stations after criteria with high factorial load and low reliability were taken out. In both clinical reasoning and practical skills, as well as across all stations, there is a clear improvement in internal consistency. This is especially clear in stations S2–S4, where values range from high to very high.

Table 4. Internal Consistency (KR20 statistic) for OSCE stations after EFA.

Category	S1	S2	S3	S4	S5
Criteria (n)	n = 14	n = 12	n = 12	n = 12	n = 10
Clinical reasoning reliability	0.86*	0.74**	0.69**	0.65**	0.73**
Practical skills reliability	0.85*	0.80**	0.64**	0.62**	0.37†
Station reliability	0.95*	0.79**	0.71**	0.68**	0.75**

Very high reliability*; High reliability**

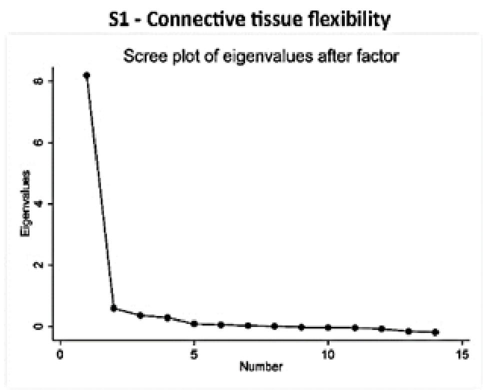
Table 5 presents the depured OSCE following the adjustment of criteria for post-reliability and construct validity validation. The criteria count per station was set at 14 for S1, 12 for S2-S3, and 10 for S5. Each station score was proportionally aligned with the corresponding number of criteria. Furthermore, **Figure 2** illustrates the scree plots per station before the removal of criteria with low reliability and high load factors, showing the presence of only one factor per station in the depured version of the instrument.

Table 5. OSCE was depured after EFA and internal consistency.

Station	Station name	Aim	LO*	Modality	Criteria	Score	Clinical reasoning criteria	Practical skills criteria	Instrument
S1	Connective tissue flexibility	To apply US for loosening adhered or shortened connective tissue	LO1- LO3	SP	1. Select US 2. Explain the US effect briefly. 3. Ask key safety questions. 4. Position the user correctly. 5. Program parameters in <1 minute. 6. Target the posterior shoulder. 7. Use the correct treatment frequency. 8. Choose the correct duty cycle. 9. Pick the correct ERA head. 10. Set the treatment time accurately. 11. Adjust the correct intensity. 12. Apply gel to the US applicator first. 13. Keep the head moving continuously. 14. Clean the treatment area and head post-application.	14	1-3,6-11	4,5,12-14	Checklist
S2	Analgesia	To demonstrate the application of BPS for analgesia	LO1- LO3	SP	1. Choose BPC for pain management. 2. Explain how BPC can alleviate pain. 3. Ask at least two safety questions to assess suitability. 4. Position the user correctly. 5. Set the correct treatment frequency. 6. Adjust the correct pulse width. 7. Select the correct level of intensity. 8. Apply electrodes to a large treatment area. 9. Secure electrodes for complete and safe contact. 10. Program treatment time for ≥15 minutes. 11. Uninstall equipment and assist the user post-treatment. 12. Clean the clinical area post-application.	12	1-3,5-7,10	4,8,9,11,12	Checklist
S3	Drainage	To demonstrate drainage by activating muscle pumps through EIMC	LO1- LO3	SP	1. Choose CBP for drainage. 2. Explain how muscle contraction stimulates circulation. 3. Ask at least two safety questions to assess suitability. 4. Position the user correctly. 5. Set the correct frequency. 6. Set a correct phase duration. 7. Select the correct intensity level. 8. Apply electrodes to muscles, aiding drainage. 9. Secure the electrodes with complete contact and hydration. 10. Program treatment time for at least 15 minutes. 11. Uninstall equipment and assist the user post-treatment. 12. Clean the clinical area post-application.	12	1-3,5-7,10	4,8,9,11,12	Checklist
S4	Muscle strengthening	Performing electrical muscle strengthening to enhance trophism	LO1- LO3	SP	1. Choose Russian currents (Kots) for strengthening. 2. Explain to the user how Russian currents (Kots) will help. 3. Ask at least two safety questions. 4. Position the user correctly. 5. Set the correct treatment frequency. 6. Select the correct level of intensity. 7. Design the correct training program with NMES. 8. Apply electrodes to weakened muscles. 9. Secure the electrodes with complete contact and hydration. 10. Program treatment time for 5–20 minutes. 11. Uninstall equipment and assist users post-treatment. 12. Clean the clinical area post-application.	12	1-3,5-7,10	4,8,9,11,12	Checklist

S5	Equipment installation	To demonstrate a safe application of electrotherapy	LO1 and LO2	Dummy	1. Position the user to facilitate drainage (antigravitational positioning). 2. Program a treatment time of at least 15 minutes. 3. Apply electrodes to the correct area. 4. Set the correct treatment frequency. 5. Program the correct pulse width. 6. Ensure complete and uniform contact between the electrodes. 7. Verify that the electrodes are adequately hydrated. 8. Secure the electrodes without detachment or displacement. 9. Uninstall the equipment and assist the user post-treatment. 10. Organize and clean the clinical area post-application.	10	1,2,4,5	3,6-10	Checklist

Abbreviatures: BPC, biphasic pulsed current; EIMC, electrically induced muscle contractions; EPA, electrophysical agent; LO, learning outcome; NMES, neuromuscular electrical stimulation; SP, standardized patient; US, therapeutic ultrasound.



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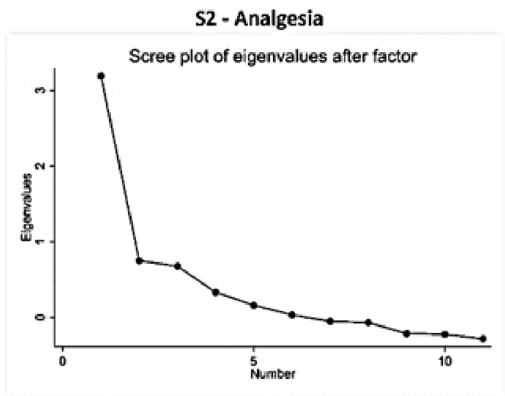

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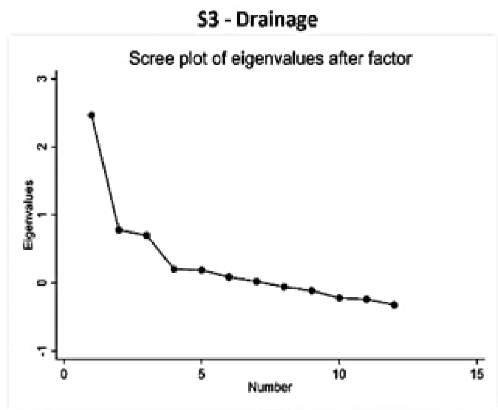

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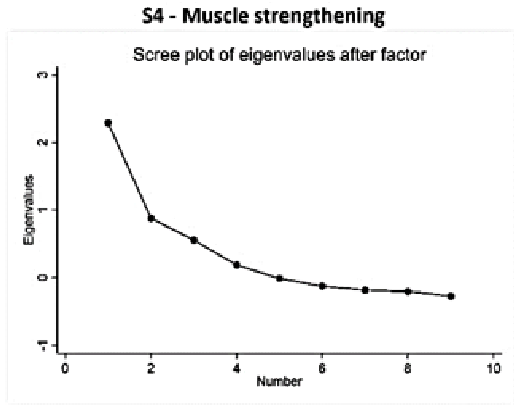

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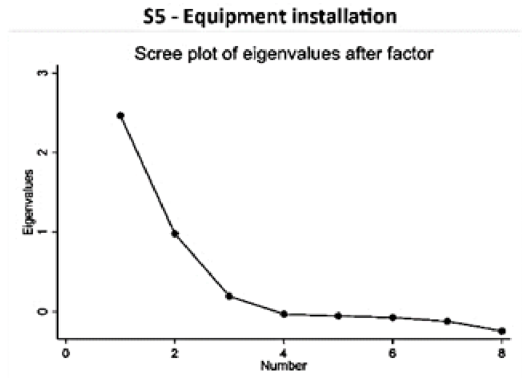

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Figure 2. Scree plots the result of the EFA for the OSCE stations (S1-S5) after departing criteria with high eigenvalue.

This study aimed to determine the reliability and construct validity of an OSCE administered to physical therapy students during the electrophysical agents course. This validation emphasizes the importance of establishing a high-quality assessment tool that effectively evaluates clinical skills in utilizing these resources, with results that exhibit consistency. The findings of the validation process demonstrate an enhancement in the instrument's reliability and validity following the refinement of criteria characterized by low reliability and greater factorial weight.

The validation of instruments, such as the OSCE, is an ongoing process that evolves alongside advancements in education and clinical practice [4]. The continual refinement of assessment instruments not only enhances the quality of the evaluation process but also strengthens educational practices by ensuring precise and reliable measurements [12]. By identifying areas for improvement and adjusting evaluation criteria, a closer alignment with learning objectives and required clinical competencies is achieved. This iterative approach to enhancement not only benefits students by providing a fair and meaningful assessment of their skills but also contributes to the advancement and excellence in healthcare professional training, as seen in the field of physical therapy.

Ensuring the reliability and validity of instruments ensures that the results accurately reflect the intended skills and competencies being measured [1, 2]. This holds relevance in the healthcare field, where patient safety and care greatly depend on the clinical competence of professionals [13]. The proper validation of the OSCE ensures that students are assessed fairly and that the results obtained are reliable for informing educational and evaluative decisions.

The internal consistency of OSCE, assessed through statistics such as Cronbach's alpha or KR-20, serves as a key indicator of the instrument's quality [20, 22]. High internal consistency suggests that the various criteria within the OSCE stations are consistently measuring the same clinical skill or competency [2]. This is crucial to ensuring that the scores obtained are reliable and consistent over time and across different student groups. Furthermore, strong internal consistency provides a solid foundation for interpreting results and making informed decisions regarding students' progression in their clinical training [1, 2].

Factor analysis of the OSCE is crucial for understanding the underlying structure of the assessed clinical skills by identifying latent variables within the instrument [6]. By pinpointing these latent factors contributing to the obtained scores, valuable insights into the specific dimensions of clinical skill measured by the OSCE can be gleaned. This allows educators to fine-tune the instrument for a more precise and comprehensive evaluation. Purging factors in the OSCE's factorial analysis is a critical step in ensuring the validity of students' clinical skill measurements. This process involves identifying and eliminating variables that do not significantly contribute to the instrument's underlying structure, which is essential for obtaining clear and reliable results. By purging factors, we can eliminate noise or interference that might distort result interpretation, focusing instead on aspects truly relevant to clinical skill evaluation and station objectives. One primary benefit of purging redundant or less relevant factors is the simplification of the instrument's structure, making it clearer and easier to interpret. A simpler and clearer structure enhances understanding of the assessed dimensions and their interrelationships, thereby improving the utility and applicability of the OSCE in evaluating students' clinical skills. Furthermore, purging factors in factorial analysis can enhance the OSCE's validity by ensuring that only truly relevant clinical skills are assessed, providing greater confidence that the obtained scores accurately reflect the intended clinical abilities to be measured [23].

During the refinement process of the OSCE, the decision was made to eliminate the generic domain encompassing cross-cutting skills for several fundamental reasons [22]. Firstly, this domain exhibited the lowest reliability as measured by the KR20 coefficient, indicating that the questions or items within this domain were not consistently correlated to measure a specific skill. This lack of cohesion in measurements could lead to unreliable and imprecise results, compromising the utility of the OSCE as an assessment tool. Furthermore, factorial analysis revealed that the generic domain contributed to other latent variables that were not the primary objectives of the OSCE stations. Since the stations were meant to test clinical reasoning and the use of electrophysical agents in certain situations, adding skills that aren't directly related to those tasks could have made the results less clear. By separating the cross-cutting skills and focusing on the specific objectives of each station, a more precise and focused evaluation of the essential clinical competencies for physiotherapy students in the electrophysical agents course is achieved.

It is noteworthy that, while generic skills are relevant and potentially crucial in clinical practice, their measurement can be more effectively conducted at a specific station designed for this purpose or in other evaluative instances within the educational program. This ensures that the OSCE stations are consistently aligned with the specific learning outcomes that students are required to acquire and demonstrate in the course. The removal of the generic skills not only enhanced the accuracy and validity of the OSCE but also facilitated the development of a more focused and meaningful instrument for the essential clinical skills in applying electrophysical agents among future physical therapy professionals.

It is imperative to acknowledge that the refinement and validation of the OSCE in this investigation contribute significantly to the broader realm of healthcare education and professional training. The iterative process of enhancing assessment instruments, exemplified by the OSCE, manifests a steadfast commitment to elevating educational standards and ensuring the thorough preparation of students for clinical practice [24]. Through the alignment of assessment criteria with the evolving exigencies of healthcare practice, educators can better equip students with the requisite skills and competencies essential for the delivery of safe and efficacious patient care [25]. The findings of this study underscore the criticality of perpetual evaluation and adaptation of assessment methodologies to meet the ever-changing demands of healthcare education. As the landscape of healthcare continues to evolve, so must the modalities through which we appraise and gauge clinical proficiency. The refinement of the OSCE, underpinned by rigorous validation procedures, not only augments its efficacy as an assessment tool but also establishes a precedent for continual advancement in healthcare education.

The authors acknowledge several limitations. One of these is the potential presence of unconscious biases among OSCE evaluators when scoring students, which could have influenced the observed results. Additionally, the decision to selectively eliminate the generic domain and certain criteria during the OSCE refinement process may have overlooked relevant aspects, thereby limiting the comprehensiveness of student evaluation. The specific focus on the electrophysical agent's course restricts the generalizability of findings to other areas of physical therapy. Finally, conducting a full OSCE requires a significant investment of time and resources, which could impact the implementation and replicability of the new instrument in other settings.

Conclusion

This study highlights a validated and refined OSCE's significance in assessing clinical skills for physical therapy students, revealing enhancements in validity and internal consistency, justifying the removal of the generic domain. The removal of the generic skills not only enhanced the reliability and validity of the OSCE but also facilitated the development of a more focused and meaningful instrument for the essential clinical skills in applying electrophysical agents among future physical therapy professionals. It is pertinent to highlight that, although generic skills hold relevance and are potentially crucial in clinical practice, their assessment could be more effectively executed at a designated station tailored for this purpose or within other evaluative contexts.

Acknowledgments: Exercise and Rehabilitation Sciences Institute and School of Physical Therapy, Universidad Andres Bello and Physical Activity Sciences Observatory, Playa Ancha University (OCAF-UPLA).

Conflict of interest: None

Financial support: None

Ethics statement: The study protocol and its ethical aspects were approved by the Department of Physical Therapy and Faculty of Rehabilitation Sciences of Andrés Bello University on April 5, 2023 (reference number 50423).

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