Orginal Article

Assessing online master class effectiveness as a teaching resource for physical agents in physical therapy education

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ABSTRACT

The COVID-19 pandemic accelerated digital learning, with online masterclasses (OMCs) replacing face-to-face education. OMCs can improve accessibility, engagement, and expert exposure, resulting in improved educational quality and reach, especially for healthcare professionals. To assess the effectiveness of an OMC session in educating physical therapy students on physical agents. This non-controlled clinical trial involved 135 seventh-semester physical therapy students (mean age 21.8 ± 1.1 years) at Universidad Andrés Bello in the Physical Agents course. The OMC employed an international instructor to teach superficial thermotherapy. Learning outcomes were assessed by comparing pre-and post-OMC evaluation scores, with a passing score of 70%. Student satisfaction with the OMC was evaluated in three dimensions: teacher quality, technical support, and overall satisfaction. The Wilcoxon signed-rank test assessed differences between the evaluations. The Physical Agents course analyzed 135 students (67 males and 68 females) after excluding 26 who did not meet the selection criteria. Evaluations before and after the OMC showed significant improvement, with scores increasing from 8.0 to 12.4 on average. The Wilcoxon signed-rank test indicated an 87.4% overall improvement, notably higher in males (95.5%) than females (79.5%). The satisfaction survey, completed by 101 students (62.73% response rate), reported high satisfaction (mean score 4.48 out of 5). Instructor availability for Zoom platform queries resulted in a 93% acceptance rate. The survey demonstrated high internal consistency, with a Cronbach's alpha of 0.965. The OMC enhances healthcare education by offering accessibility, engagement, and expert exposure, complementing traditional methods, and supporting blended learning formats.

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

Introduction

For an extended period, the traditional face-to-face format has remained the predominant modality in the educational realm, constraining access to learning, particularly for individuals burdened with occupational or familial responsibilities [1].

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During the COVID-19 pandemic, there was a swift global transition to online learning, including medical education, despite the historically limited use of distance education as a supplement to face-to-face teaching [1, 2]. This public health emergency required the rapid adoption of "emergency remote teaching," reflecting the urgency to maintain educational continuity without interruptions [2, 3]. Several education institutions implemented flexible models, such as HyFlex, allowing students to choose between online or in-person attendance based on their preferences [4]. Educators had to swiftly adjust their teaching strategies to ensure the feasibility and effectiveness of these new learning environments, adapting to fluctuating infection rates [3, 5]. This transformation prompted reflections on its long-term implications and the future of medical education in the post-COVID era [1, 4]. While some advocated for an immediate return to physical classrooms, others viewed the forced shift to online education as an opportunity to rejuvenate educational methods for training healthcare professionals [1].

The transition from in-person to online learning during the COVID-19 pandemic posed significant challenges for healthcare students but also offered various advantages [6]. These include the flexibility to access educational content from any location at any time, the use of interactive and multimedia tools to enhance learning, and the ability to quickly adapt to the changing needs of students and the global health environment [1, 2]. This new educational paradigm not only proved effective during crises but also opened new avenues to improve the quality and accessibility of medical education in the future [1, 7].

A masterclass is an academic forum in which a distinguished expert imparts advanced knowledge on a specific topic, attracting a targeted audience interested in the in-depth exploration of disciplinary themes through detailed discussions and analysis [8]. Masterclasses traditionally enhance knowledge and practical skills in physical settings under expert guidance. However, these sessions have evolved towards online formats in recent times, greatly enhancing their accessibility and outreach, particularly in the context of the pandemic and the advancement of online learning [3, 7]. Online masterclass (OMC) offers a dynamic and effective educational option suitable for both beginners seeking expertise in specific fields and seasoned professionals aiming to refine and update their knowledge in an interactive and collaborative environment [9-11]. In contrast to conventional online courses focused on digital resources and self-directed learning, masterclasses provide an interactive experience. Participants engage directly with renowned professionals who share extensive experience and specialized knowledge through structured sessions [12]. This approach creates a focused learning environment conducive to acquiring in-depth insights effectively [11].

The concise and targeted nature of OMCs, often of short duration, promotes focused learning [13]. These sessions encourage active participation with opportunities for questioning, deep dives into topics, and immediate feedback [10, 12]. Moreover, they facilitate networking among participants and experts in their respective fields.

In the realm of physical therapy, physical agents encompass therapeutic modalities that utilize physical energy, such as heat, cold, electrical stimulation, ultrasound, and electromagnetic radiation [14, 15]. These techniques are crucial for effectively addressing a wide range of musculoskeletal and neurological conditions. Mastering these modalities entails not only applying treatments to alleviate pain and promote physical recovery but also tailoring therapeutic approaches to meet the individual needs of each patient, necessitating a deep understanding of their mechanisms of action and the most appropriate clinical conditions [15, 16]. Physical agent training not only equips physical therapists with essential practical skills but also empowers them to make informed clinical decisions based on available scientific evidence [16, 17].

In a hypothetical scenario, OMCs would emerge as innovative resources in the undergraduate training of physical therapists. This educational approach would allow for in-depth exploration of the specific mechanisms of action associated with each technique, establishing a robust foundation for their effective application across diverse clinical conditions. Furthermore, by enabling flexible and accessible learning, OMCs would facilitate interactive engagement and active participation of students with experts, thereby promoting a comprehensive and practical understanding of therapeutic methods employed in physical therapy practice. Hence, the primary aim of this study was to assess the effectiveness of an OMC session as an educational tool in the education of physical therapy students on physical agents, evaluating both the attainment of learning outcomes (LO) and satisfaction with the masterclass.

Materials and Methods

Design

This experimental, non-controlled study focused on physical therapy students in their seventh semester of the Physical Therapy Program at the Universidad Andrés Bello, Chile. As part of the intervention, an international expert in physical agents delivered an OMC. Student scores from a baseline evaluation (evaluation 1) conducted before the OMCs were compared to scores from a post-class evaluation (evaluation 2). Relevant outcomes centered on the achievement of LO, evaluated through passing scores obtained after the OMCs in evaluation 2, and student satisfaction with the OMCs. Satisfaction with the OMC was measured using an adapted version of the instrument proposed by Jiménez-Bucarey *et al*. [18].

Ethical considerations

The study received approval from the Ethics Committee of the Faculty of Rehabilitation Sciences at Andrés Bello University, following the principles outlined in the Helsinki Declaration (approval number 0672024, May 1, 2024) [19]. Informed consent was obtained from all participants.

Participants

The study included 135 students (67 men, 68 women; average age 21.8 ± 1.1) from the seventh semester of the Physical Agents course in the Physical Therapy program at Universidad Andrés Bello. This course covers the physical and physiological bases of various non-ionizing physical agents, including electrical, mechanical, electromagnetic, and thermal agents. It encompasses three learning outcomes (LOs): (LO1) Examine the physical and physiological effects of the application of non-ionizing physical agents; (LO2) Evaluate different modalities of non-ionizing physical agents according to the intended therapeutic effect in various professional contexts, addressing deficiencies and functional problems in users caused by different health conditions; (LO3) assess the deficiencies and functional problems arising from users' health conditions, as well as the relevance and context of intervention through non-ionizing physical agents.

The course is organized into four assessments: two workshops (25% each), clinical case analysis (20%), and a practical evaluation (30%) in the form of an Objective Structured Practical Examination (OSPE). Each workshop comprises three summative evaluations, consisting of multiple-choice questionnaires, short-answer responses, and the interpretation of images or videos of physical agent applications.

Selection criteria

Participants were selected based on the following criteria: enrolled students in the Physical Agents course during the year 2024 who completed both the pre-master class and post-master class evaluations and provided written consent for the use of their evaluation scores. The analysis excluded students who either did not attend the master class or did not complete both the pre-master class evaluation 1 and post-master class evaluation 2. The attendance of students was recorded on the day the master class was conducted.

Online masterclass

The course coordinator scheduled an OMC featuring a distinguished international professor from the Physical Therapy program at the Federal University of São Carlos, globally recognized for academic contributions and expertise in physical agents. The international professor developed the content for Unit 3 of the Physical Agents course, focusing on the fundamental application of thermal agents in clinical practice and evidence-based approaches. Three preparatory meetings were convened to synchronize the OMC content and formulate questions for Evaluation 1 (pre-OMC) and Evaluation 2 (post-OMC). The OMS comprehensively addressed the physiological and physical underpinnings, therapeutic effects, and empirical evidence of various thermotherapy and cryotherapy modalities. Before its delivery, the masterclass underwent meticulous review and approval by the course coordinator. The course coordinator has scheduled OMC for the Zoom platform on June 7, 2024, at 18:00 hours. It was stipulated that the online masterclass (OMC) would be recorded to facilitate the provision of study materials to students. **Table 1** provides specific details about the masterclass content, OMC objectives, LOs, and OMC teaching resources.

Table 1. Structure and contents of the physical Agent online masterclass

Blocks	Schedule	Program detail	Contents	Class objective	LO*	Teaching resource
Block 1	18:00 - 19:15	Unit 3	(A) Physical Bases of Heat (B) Physiological Effects of Heat (C) Therapeutic Effects of Heat (D) Resources for Superficial Thermotherapy in Physical Therapy (E) Scientific Evidence of Superficial Thermotherapy (F) Demonstrative Videos	Understand the physical and physiological bases of heat and cold, as well as their therapeutic effects, and become familiar with the resources and scientific evidence related to superficial thermotherapy and cryotherapy in physical therapy practice.	LO1 LO2	1. Microsoft PowerPoint® presentation 2. Images 3. Interactive videos 4. Reviews of scientific articles
	19:15 - 19:30		Discussion and round of questions			
Block 2	19:30 a 20:15		(A) Physical Bases of Cold (B) Physiological Effects of Cold (C) Therapeutic Effects of Cold (D) Resources for Cryotherapy in Physical Therapy (E) Scientific Evidence of Cryotherapy (F) Demonstrative Videos			
	20:15 a 20:30		Discussion and round of questions			

*LO: course learning outcome

Evaluations

Two evaluations were constructed based on the thematic contents of Unit 3 of the Physical Agents course, focusing on thermal physical agent modalities (superficial thermotherapy and cryotherapy). Evaluation 1 was administered before the masterclass to assess students' baseline knowledge, while evaluation 2 took place one week thereafter. Each evaluation comprised 18 multiple-choice questions, each worth one point, with a maximum score of 18 points. The passing score for each evaluation was set at a 70% academic requirement, equivalent to 12points. Evaluations were conducted online via the Microsoft Office 365® platform, one week before and one week after the masterclass during in-person classes. Workshop 2 incorporated evaluation 2 in addition to two other summative evaluations conducted during the semester.

Students satisfaction

Satisfaction with the OMC was evaluated using an adapted version of the questionnaire proposed by Jiménez-Bucarey *et al.* [18], which comprehensively assesses service quality, teacher performance, technical system effectiveness, and student satisfaction in the context of online classes and teaching platforms. The original questionnaire consists of 13 items rated on a four-category Likert scale, categorized into service quality (SQ), teaching quality (TQ), technical system quality (TSQ), and student satisfaction (SS). Validated at Andrés Bello University with a population of 1,430 students, the questionnaire demonstrated excellent reliability (internal consistency) and convergent validity (Cronbach's alpha: SQ = 0.746; TQ = 0.752; TSQ = 0.727; SS = 0.771) (convergent validity: SQ = 0.668; TQ = 0.664; TSQ = 0.549; SS = 0.686). For this study, dimensions TQ, TSQ, and SS were utilized and adapted for the OMC context, while SQ was excluded as it pertains to services provided by online course administration platforms rather than specific activities. **Table 2** displays the satisfaction survey that the students completed after evaluation 2. The survey was uploaded to the online course platform and voluntarily completed by the students.

Table 2. Satisfaction survey to assess the online masterclass

Dimensions	N° Question	Items
Teaching quality (TQ)	1	TQ1. This online format enables my participation.
	2	TQ2. The online learning assessment strategy has proven to be appropriate.
	3	TQ3. The online format facilitates effective learning.
Technical system quality (TSQ)	4	TSQ1. Support has been provided through links for connecting to the platform (Zoom) and for reviewing materials via recordings.
	5	TSQ2. The interface of the online learning platform (Zoom) is considered suitable for its ease of use.
	6	TSQ3. The session conducted by the instructor remained consistently stable, without experiencing interruptions or connectivity issues.
	7	TSQ4. The instructors are available and respond to queries about the functionality of the Zoom platform during the online masterclass.
Student satisfaction (SS)	8	SS1. The online master class with an international expert represents an improvement in the subject's learning methodologies.
	9	SS2. The instructor effectively manages the activity's implementation (availability of activity information, connection links, and recording).
	10	SS3. The instructor effectively explains the content on the Zoom platform.

Statistical analysis

The descriptive analysis of the data was conducted as follows: categorical variables were summarized using relative and absolute frequencies, while continuous variables were summarized using measures of central tendency and dispersion. Specifically, for the scores obtained from the evaluations (pre and post-masterclass), the data were summarized using measures of central tendency (means and medians), measures of dispersion (standard deviations, minimum and maximum values), and percentiles (25th and 75th percentiles). The distribution of the data was assessed with the Shapiro-Wilk test [20]. Bivariate analysis was performed using the Wilcoxon matched-pairs signed rank test to determine differences between the pre-and post-masterclass evaluation scores due to the non-normality of the score distribution [21]. To determine the internal consistency (reliability) of the satisfaction survey, Cronbach's alpha statistic was calculated, grouping the items both overall and by dimension (TQ, TSQ, and SS) [22]. All statistical analyses were conducted using SPSS version 26.0 (Software for Sociologists: Statistical Analysis on the IBM PC). The significance level for all statistical tests was set at $p < 0.05$.

Results and Discussion

Online masterclass

The OMC was scheduled for June 7, 2024, at 18:00. The course instructors promoted the activity to the students four weeks prior. The course instructors also extended invitations to graduates, postgraduate students, and faculty to participate in the masterclass. The OMC was conducted via the Zoom® platform and moderated by the coordinator of the Physical Agents course. A total of 245 individuals attended, comprising 165 physical therapy students from the Physical Agents course and 80 participants from the public, including alumni, faculty, teachers, and postgraduate students. The OMC was structured into two 90-minute sessions (blocks), one on thermotherapy and the other on cryotherapy, each followed by a question-and-answer period **(Table 1)**. The recording of the masterclass was made available to students for subsequent review and to prepare for Evaluation 2, along with the material used during the presentation. Evaluation 2 was conducted one week after the OMC to give students time to prepare evaluation 2. **Figure 1** illustrates engagement and participation in the OMC.

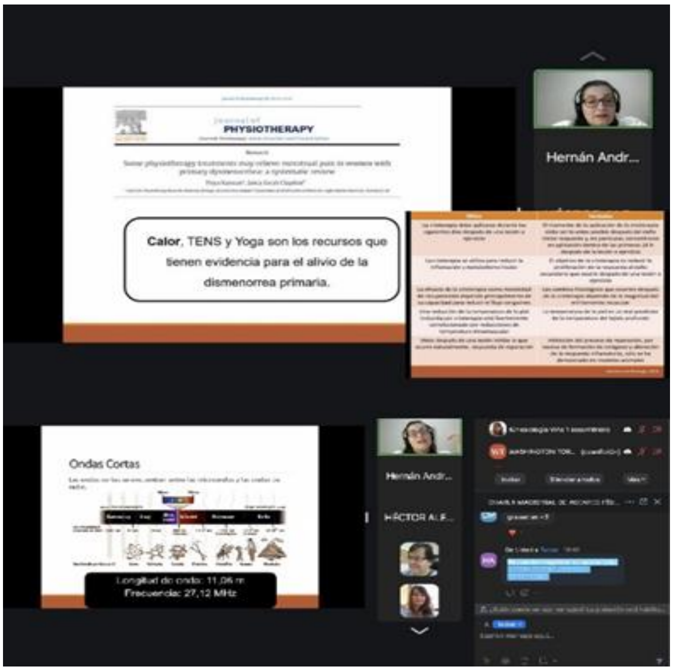


Figure 1. Physical agent's online masterclass

Online masterclass

The 2024 Physical Agents course enrolled a total of 161 students (81 males and 80 females). The selection criteria excluded 26 students from the analysis due to incomplete assessments: evaluation 1 (n = 16), evaluation 2 (n = 9), or both evaluations (n = 1). Health-related issues were the primary reasons for absence. Thus, the final sample comprised 135 students (67 males and 68 females, average age of 21.8 ± 1.1). The flow diagram depicted in **Figure 2** outlines the sequential progression of participants through the study, beginning with initial screening and enrollment and culminating in the final analysis phase.

Table 3 presents the results obtained for evaluations 1 and 2, conducted before and after the OMC. Statistical analysis using the Shapiro-Wilk test revealed a non-normal distribution for the scores in both evaluations ($p < 0.05$). The average score for evaluation 1 was 8.0 (± 3.2) and for evaluation 2 was 12.4 (± 2.6), with medians of 8 and 12, respectively. For evaluation 1, the 75th percentile score was 10 points, indicating that 75% of the students scored below the passing mark. Furthermore, males had lower scores at the 75th percentile compared to females, suggesting better performance by females in the second evaluation.

Conversely, for evaluation 2, a score of 12 at the 25th percentile indicated that 75% of the students in the Physical Agents course met or exceeded the passing score (12 points). Additionally, males had higher 25th percentile scores (12 points) compared to females (10 points), suggesting that fewer males fell below the passing score. The Wilcoxon signed-rank test showed a statistically significant improvement between evaluations 1 and 2, with 118 positive ranks, 11 negative ranks, and 6 ties, reflecting an 87.4% improvement in the cohort. The number of positive ranks was higher for males than females (64 versus 54), indicating a 95.5% increase in scores for males and a 79.5% increase for females. Additionally, the number of ties was higher among females, with a total of 5. **Figure 3** illustrates the results obtained before and after the OMC for the entire cohort, disaggregated by gender.

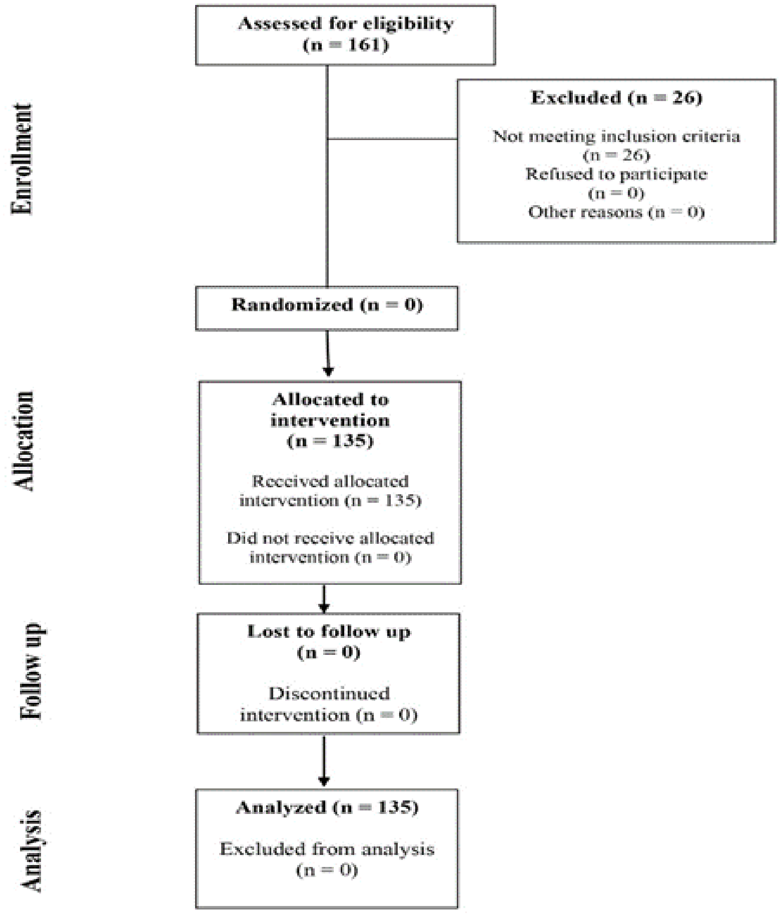
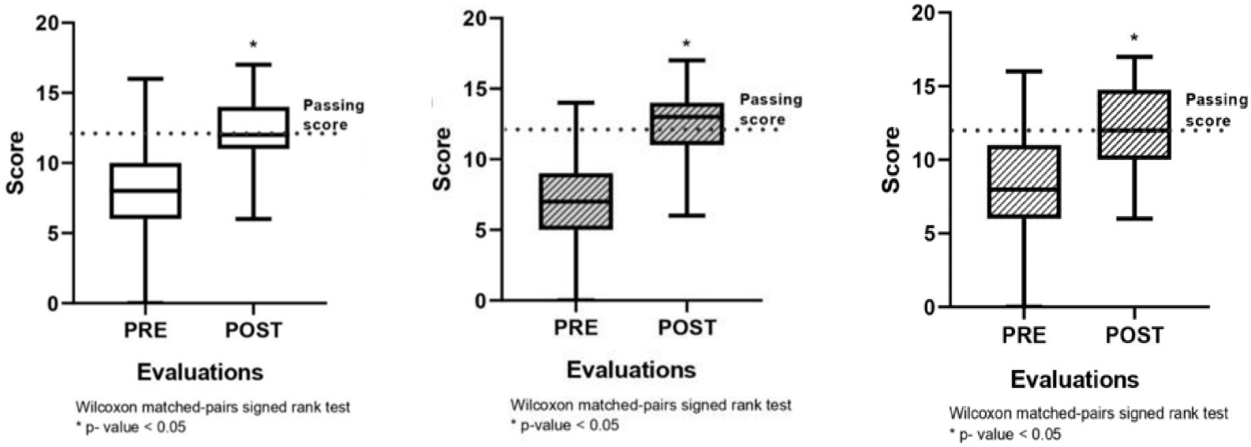


Figure 2. Study flowchart

Table 3. Evaluation results before and after the online masterclass

Evaluations	Sample	Analysed	Total score	Passing score	Distribution	Mean (± SD)	CI of the mean (95%)	Median	Minimum	25% percentile	75% percentile	Maximum	Median differences†	Rank sum†	Positive ranks†	Negative ranks†	Ties
Evaluation 1 (Before the OMC)			18	12	no-normal* p = 0.0247	8.0 (± 3.2) ♂ = 7.62 (± 2.8) ♀ = 8.34 (± 3.4)	7.4,8.5 ♂ = 6.9,8.3 ♀ = 7.5,9.1	8 ♂ = 7 ♀ = 8	0 ♂ = 0 ♀ = 0	6 ♂ = 5 ♀ = 6	10 ♂ = 9 ♀ = 10	6 ♂ = 14 ♀ = 14		265			
	161	n = 135 ♂ = 67 ♀ = 68											< 0.01* ♂: p < 0.01* ♀: p < 0.01*		118 ♂ = 64 ♀ = 54	11 ♂ = 2 ♀ = 9	6 ♂ = 1 ♀ = 5
Evaluation 2 (After the OMC)			18	12	no-normal* p = 0.0042	12.4 (± 2.6) ♂ = 12.57 (± 2.5) ♀ = 12.16 (± 2.8)	11.9,12.8 ♂ = 12.0,13.1 ♀ = 11.5,12.8	12 ♂ = 13 ♀ = 12	6 ♂ = 6 ♀ = 6	12 ♂ = 12 ♀ = 10	14 ♂ = 14 ♀ = 14.7	17 ♂ = 17 ♀ = 17		8120			

Abbreviations: ♂, men; ♀, women; CI, Confidence interval; OMC, online masterclass. P-value < 0.05*
Wilcoxon matched pairs signed rank test†



a) Cohort score b) Men scores c) Women scores

Figure 3. Differences in scores between Evaluation 1 and Evaluation 2 across the entire cohort (a), were disaggregated by males (b) and females (c).

Satisfaction with the OMC

One week after the OMC, the cohort received the satisfaction survey and had three days to complete it on the course platform. Participation in the survey was voluntary and anonymous to avoid biasing the results. A total of 101 surveys were obtained from 161 students, yielding a response rate of 62.73% **(Table 4)**. Overall, the activity was well-received, with an average satisfaction score of 4.48 (± 0.92), indicating high satisfaction among the cohort. Grouping response categories into agreement levels revealed that student satisfaction was the domain with the highest acceptance, with acceptance rates of 90% for SS1, 91% for SS2, and 92% for SS3. The item with the highest acceptance was TS4, associated with "The instructors are available and respond to queries about the functionality of the Zoom platform during the online masterclass," achieving 93%. Conversely, the dimension with slightly lower acceptance was TQ, where TQ3, "The online format facilitates effective learning," showed an acceptance rate of 76.2% when combining the agreement and strong agreement categories and a non-acceptance rate of 10.8% when combining the disagreement and strong disagreement categories.

The internal consistency of the instrument was calculated with a Cronbach's alpha of 0.965, indicating very high reliability. The analysis of internal consistency by dimension yielded high reliability, with Alpha values of 0.912 for TQ, 0.948 for TSQ, and 0.946 for SS.

Table 4. Satisfaction survey to assess the online masterclass (n = 101)

Items	Strongly disagree n (%)	Disagree n (%)	Neither agree nor disagree n (%)	Agree n (%)	Strongly agree n (%)	Mean (± SD)	Mean CI (95%)	Survey reliability*	Reliability by dimension*
TQ1. This online format enables my participation.	3 (2.9%)	6 (5.9%)	4 (3.9%)	17 (16.8%)	71 (70.3%)	4.45 (± 1.02)	4.2,4.6	α = 0.965	α = 0.912
TQ2. The online learning assessment strategy has proven to be appropriate.	3 (2.9%)	1 (0.9%)	14 (13.9%)	20 (19.8%)	63 (62.4%)	4.37 (± 0.97)	4.2,4.6		
TQ3. The online format facilitates effective learning.	5 (4.9%)	6 (5.9%)	12 (11.8%)	21 (20.8%)	57 (56.4%)	4.17 (± 1.16)	3.9,4.4		
TSQ1. Support has been provided through links for connecting to the platform (Zoom) and for reviewing materials via recordings.	3 (2.9%)	0 (0%)	10 (9.9%)	11 (10.9%)	77 (76.2%)	4.57 ± (0.90)	4.5,4.8		α = 0.948
TSQ2. The interface of the online learning platform (Zoom) is considered suitable for its ease of use.	4 (2.9%)	0 (0%)	8 (7.9%)	21 (20.8%)	69 (68.3%)	4.51 (± 0.88)	4.4,4.8		
TSQ3. The session conducted by the instructor remained consistently stable, without experiencing interruptions or connectivity issues.	5 (2.9%)	0 (0%)	8 (7.9%)	21 (20.8%)	69 (68.3%)	4.51 (± 0.88)	4.3,4.7		
TSQ4. The instructors are available and respond to queries about the functionality of the Zoom platform during the online masterclass.	6 (2.9%)	0 (0%)	7 (6.9%)	17 (16.8%)	74 (73.3%)	4.57 (± 0.86)	4.4,4.7		

SS1. The online master class with an international expert represents an improvement in the subject's learning methodologies.	7 (2.9%)	1 (0.9%)	6 (5.9%)	21 (20.8%)	70 (69.3%)	4.52 (± 0.89)	4.3,4.7	
SS2. The instructor effectively manages the activity's implementation (availability of activity information, connection links, and recording).	8 (2.9%)	0 (0%)	5 (4.9%)	17 (16.8%)	76 (75.2%)	4.61 (± 0.84)	4.5,4.8	α = 0.946
SS3. The instructor effectively explains the content on the Zoom platform.	9 (2.9%)	0 (0%)	6 (5.9%)	15 (14.9%)	77 (76.2%)	4.61 (± 0.84)	4.5,4.8	

Abbreviations: CI, Confidence interval; OMC, online masterclass; TQ, Teaching quality; TSQ, Technical system quality; SS, Student satisfaction. *Reliability was evaluated with Cronbach's alpha statistic.

The objective of this study was to assess the effectiveness of an OMC session in educating physical therapy students on a unit of the Physical Agents course and to evaluate student satisfaction with this instructional strategy. The OMC enhances learning outcomes, as evidenced by improved student performance in post-OMC evaluations compared to their baseline knowledge from pre-OMC assessments. Notably, at least 75% of the cohort met or exceeded the passing score. The inclusion of an international expert added a valuable dimension to the learning experience, providing students with diverse perspectives and advanced knowledge in the field. Additionally, the OMC received high student satisfaction ratings, particularly in the areas of methodology, effective management, and clear explanations by the instructor. However, despite the overall high satisfaction, the dimensions of teaching quality—such as participation enabled, appropriate assessment, and effective learning—were slightly lower, although they still received a satisfactory average approval rating.

Masterclass and online masterclass

The masterclass, as a traditional teaching method, offers several significant advantages in the educational domain. Firstly, it facilitates the efficient transmission of knowledge, enabling instructors to present large volumes of information in an organized and coherent manner, which is essential for complex concepts [23, 24]. Additionally, its planned structure guarantees a logical and progressive approach to topics, thereby improving students' comprehension and retention. The instructor's expertise and authority, typically as a subject matter expert, not only legitimizes the content delivered but also inspires and motivates students. This method allows for the standardization of educational content, ensuring a homogeneous knowledge base among students [8, 23]. The flexibility in using educational resources, such as multimedia presentations and practical examples, enriches the masterclass and caters to various learning styles [25]. Although predominantly unidirectional, the masterclass format also provides opportunities for discussion and questions, promoting a deeper understanding of the material. Instructors can also model critical and analytical thinking by demonstrating how to approach and solve complex problems, which is critical for students' intellectual development [23, 24].

The transition from traditional face-to-face formats to online modalities has introduced both advantages and disadvantages, significantly impacting the educational experience [26]. OMC enhances accessibility and flexibility, allowing students to engage with course materials from any location and at any time, accommodating various schedules and learning paces [27, 28]. This modality also facilitates the integration of diverse digital resources, such as multimedia presentations and interactive simulations, thereby enriching the learning experience. Moreover, the scalability of OMC enables institutions to reach a broader audience, potentially reducing educational costs and expanding program availability [28]. Additionally, videoconferencing platforms such as Zoom, Microsoft Teams, and Google Meet, commonly used to deliver OMC, integrate various resources such as interactive whiteboards, polling systems, and interaction chats, which significantly enhance the student experience. These tools not only facilitate OMC delivery but also enable recording of their content, providing students with the opportunity to review and consult it later [29].

However, this OMC presents challenges, such as limited real-time interaction, especially with large audiences, which can reduce opportunities for spontaneous questions and discussions, hindering deeper understanding for some students. Technological barriers, including unequal access to reliable internet and advanced devices, can exacerbate the digital divide and disrupt learning. Furthermore, maintaining student engagement is more challenging in an online environment, where the lack of physical presence and potential home distractions can detract from attention and participation. Evaluating student performance and providing personalized feedback have also become more complex, as automated systems may not capture the nuances of understanding and effort. Furthermore, the home environment may lack the structured atmosphere of a classroom, potentially affecting student concentration and productivity. Balancing these factors is crucial for optimizing the effectiveness of online education.

OMC versus open massive course

The transition from traditional classroom settings to digital platforms has given rise to two distinct educational models: OMC and Massive Open Online Courses (MOOCs). Formal educational programs typically design OMCs for a specific number of enrolled students, offering real-time interaction with instructors through live sessions and direct communication [8]. These sessions offer in-depth exploration of subjects, allowing instructors to tailor content based on class feedback and progress, often including comprehensive assessments and personalized feedback. In contrast, MOOCs cater to a global audience with potentially thousands of participants, offering self-paced learning with pre-recorded lectures, standardized content, and automated or peer-reviewed assessments [11, 12]. While MOOCs enhance accessibility and democratize education by removing traditional barriers, they often lack the direct interaction and personalized attention found in OMCs. Furthermore, OMCs usually contribute to academic credits as part of a degree program, whereas MOOCs typically offer certificates of completion or badges, with academic credit being less common [10]. Furthermore, it is worth noting that in many large online lectures, the evaluation of learning outcomes may be limited, and at times, the pursuit of mass participation may serve economic interests. Despite these differences, both models play significant roles in expanding educational opportunities through digital platforms [25, 30].

Satisfaction survey validation

Survey validation is critical for ensuring the reliability and validity of the research data collected. It verifies that the instrument accurately measures what it intends to assess, thereby yielding precise and dependable results. This process not only bolsters the credibility of the findings but also ensures robust conclusions applicable to the study context. Internal consistency analysis is one method for validating an instrument [31]. This method evaluates the coherence of responses to different items that measure the same construct, ensuring that the items reliably reflect the concept under study. Internal consistency is crucial, as it ensures that the instrument produces consistent and accurate results, thereby enhancing the reliability of the conclusions drawn from the collected data.

While the primary focus of this study was not survey validation, a validation process was necessary due to the instrument's adaptation for assessing satisfaction with the OMC. The survey, which the authors adapted from Jiménez-Bucarey *et al*.'s original design to evaluate service quality, teaching quality, technical system effectiveness, and student satisfaction in online teaching environments, demonstrated high internal consistency [18]. The adaptation ensured that the instrument's technical and content aspects were suitable for measuring satisfaction, specifically within the OMC context.

Instructor competencies to administer OMC

In the context of OMCs, instructors require specific competencies that span critical areas. Firstly, proficiency in advanced educational technologies, including virtual teaching platforms and interactive tools, is essential for effectively facilitating online instruction and engagement [32, 33]. Pedagogical skills adapted to the digital environment are pivotal, enabling instructors to deliver content clearly and cohesively while employing interactive methods such as online discussions, real-time questioning, and collaborative activities [34]. Effective management of online interaction and communication is crucial to cultivating a participative learning atmosphere and promoting knowledge exchange among students [32]. Furthermore, instructors must demonstrate adaptability and flexibility to tailor content and teaching strategies to meet the unique dynamics of online environments, thereby ensuring meaningful learning experiences and optimizing educational outcomes in virtual settings [33, 34].

Study limitations

While the findings indicate favorable outcomes in recognizing the potential of OMC, the authors acknowledge several limitations that warrant consideration. Primarily, variations in educational contexts, student levels, and subject matter may constrain the generalizability of these findings, potentially limiting their applicability across diverse educational settings. Methodological limitations, such as study design and duration of follow-up, could introduce biases or constraints that might influence the interpretation of results. Furthermore, comparisons with alternative teaching methods, such as active learning or problem-based instruction, as well as traditional face-to-face lectures, are essential to provide a broader context for assessing the relative effectiveness of online lectures. Additionally, the choice of evaluation criteria, whether standardized tests, satisfaction surveys, or performance assessments, may not comprehensively capture all dimensions of how online lectures impact student learning and satisfaction. Addressing these considerations is crucial for a comprehensive understanding of the implications of online lectures in educational contexts.

Conclusion

The OMC serves as a valuable educational resource for training healthcare professionals, offering advantages such as enhanced accessibility, interactive engagement, and exposure to global expertise. By leveraging technological capabilities, it complements traditional teaching methods, fostering flexible and dynamic learning environments through digital resources. Unlike massive open online courses, the OMC specifically caters to academic and curricular objectives in healthcare education. The authors recommend integrating OMCs into blended learning formats that include face-to-face interactions, despite their limitations. Future research should prioritize comparative studies to assess the effectiveness of OMCs relative to other teaching strategies. Additionally, validating the student satisfaction survey with the OMC emphasizes its relevance for future implementation.

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