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RESEARCH ARTICLE

Impact of Online Teaching During the COVID-19 Era on Senior Physiotherapy Students' Clinical Self-efficacy at Fatima College of Health Sciences, UAE

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Abstract:

Introduction:

Entry-level physiotherapists function as autonomous healthcare practitioners within a complex healthcare system, requiring professional competence in the clinical domain. Physiotherapy (PT) educational programs typically emphasize onsite teaching and use summative assessments to evaluate students' achievement of program objectives and learning outcomes. However, possessing knowledge and skills does not guarantee efficacy or confidence in clinical practice. This study aimed to assess the impact of online teaching approaches (TAs) during the COVID-19 era on the physiotherapy self-efficacy (PSE) of senior FCHS physiotherapy students across three clinical areas: musculoskeletal (MSK), neurological (N), and cardiorespiratory (CR), and to explore the influence of academic factors on PSE scores.

Methods:

Researchers collected data for this cross-sectional study using a four-section questionnaire. One section specifically addressed the PSE. The study focused on three cohorts of pre-graduation senior PT students at Fatima College of Health Sciences (FCHS) who encountered a combination of onsite, online, and blended TAs due to COVID-19. Nonparametric statistical analysis was employed to analyze the data.

Results:

Of the seventeen participating students (68% participation rate, median age 22), the results indicate a statistically significant decrease in self-efficacy from MSK to N and CR clinical areas. The impact of online TAs on PSE varied by course specialty; TAs related to CR specialty courses significantly correlated with PSE scores, showing a preference for onsite TA to enhance self-efficacy over blended and online TAs. Furthermore, greater exposure to clinical cases and verbal encouragement from clinical educators were associated with higher self-efficacy. Physiological reactions, such as body pain, were also found to be influenced by the specific clinical area.

Conclusion:

The impact of online TAs, implemented during the COVID-19 pandemic, on the self-efficacy of senior PT students is dependent on the specialty of the courses. This impact was most significant in CR specialty courses. Moreover, other factors, such as the sufficiency of exposure to clinical cases and clinical educators' verbal encouragement, significantly contributed to students' self-efficacy.

Keywords: Clinical self-efficacy, Physiotherapy education, COVID-19, Online teaching in physiotherapy, Clinical competence, Student encouragement, Clinical exposure, Blended learning.

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1. INTRODUCTION

Physiotherapy (PT) is an autonomous healthcare profession, with entry-level physiotherapists functioning as independent practitioners [1, 2]. In clinical settings, they are required to adhere to best practice standards encompassing patient assessment, diagnosis/classification, planning, intervention, and outcome measurement [1, 2]. Additionally, physiotherapists are expected to exhibit self-determination, professionalism, and decision-making skills in the face of an ever-increasing body of knowledge [1]. Furthermore, the physiotherapists' role within a complex healthcare system necessitates professional competence in clinical settings [3, 4]. Therefore, PT educational programs must be designed to adequately prepare students to meet the demands of clinical practice [5].

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Moreover, PT programs need to evaluate students' progress toward achieving the program's learning outcomes and clinical education objectives [6]. Traditionally, PT programs have relied on summative assessments for this purpose [6]. Although summative assessments are effective in evaluating students' theoretical knowledge and psychomotor skills, their ability to demonstrate how instructional education prepares students for specific clinical practice areas is limited [6]. There is a clear distinction between possessing knowledge and skills and applying them effectively in difficult circumstances [7]. Personal achievement requires not only skills but also a strong belief in one's ability to use them effectively [7]. Therefore, individuals with the same knowledge and skills can exhibit a wide range of performance, from poor to exceptional, largely depending on their level of self-efficacy [7].

Self-efficacy emerges as a critical component in preparing students for clinical work, alongside the acquisition of skills and knowledge [5]. It is increasingly recognized as vital for the professional development of health profession students [3, 8, 9]. A self-efficacy assessment tool serves as a beneficial resource for educators to evaluate students' trust in their abilities to take care of patients and navigate the challenges encountered in acute care clinical settings [6]. Such a tool not only gauges students' mastery of skills related to their practice setting but also provides insight into their readiness to interact with various situations they may face during their clinical education experiences [6].

Self-efficacy is described as an individual's assessment of their abilities and belief in their capability to plan and carry out actions necessary to achieve specific levels of performance [10, 11]. In the context of educational research, self-efficacy pertains to a student's confidence in their ability to complete specific tasks [12], and it is recognized as a significant factor influencing academic achievement [13]. It is essential to differentiate between general and specific self-efficacy. General self-efficacy refers to a person's belief in their abilities regardless of the situation, meaning it is not tied to particular tasks or contexts [7]. In contrast, specific self-efficacy depends on the problem and can be shaped by factors such as training, motivation, and other internal or external influences [6]. In physiotherapy, self-efficacy is considered an independent predictor of student performance in clinical environments [14], and its assessment can serve as a potential outcome for educational interventions [15]. The measurement of self-efficacy aligns with Bandura's social cognitive theory [7], evaluating students' clinical education experiences based on their self-reported levels of confidence. This approach is widely used across various health professions, including physiotherapy, to estimate a student's potential performance [6]. To assess self-efficacy, individuals must have the opportunity for self-assessment or the ability to compare their performance against an evaluative standard [10].

The Physiotherapist Self-Efficacy (PSE) questionnaire is a specific tool designed to assess PT students' self-efficacy in three clinical areas: cardiorespiratory, musculoskeletal, and neurological [5]. It consists of 13 statements that reflect key criteria; students are evaluated during their acute care clinical placements [5]. These 13 statements are repeated for each of the three clinical areas. The PSE is a self-administered questionnaire where students use a five-point Likert scale to rate their confidence in performing the outlined clinical tasks [5]. This method of assessing self-efficacy becomes particularly relevant in the context of significant educational shifts that occurred because of COVID-19. In 2019, the whole world was subjected to the COVID-19 pandemic, leading the World Health Organization to announce a global outbreak in March 2020. This exceptional situation forced higher education institutions worldwide to leave the traditional onsite teaching approach (TA) and transfer to online and blended TAs [16]. The transition underscores the importance of understanding how such changes in teaching methodologies impact student self-efficacy, particularly in clinical settings, making tools like the PSE questionnaire valuable for gauging student confidence during these educational adaptations.

The PT program at FCHS, UAE, like PT programs worldwide, adopted online and blended teaching approaches during the COVID-19 outbreak from the second semester of the 2019-2020 academic year until the second semester of 2021-2022. While onsite teaching was preserved for clinical practice courses, theoretical and practical courses were shifted to distance learning. Post-pandemic, the program included three cohorts of students who had experienced varying degrees of online and/or blended teaching throughout their academic pathway. Consequently, the TA for the same course varied across semesters: onsite before the pandemic, online or blended during it, and returning to onsite afterward. This meant that, for a given course, some students were taught through onsite TA, others online, and yet others *via* blended TA. Despite the benefits of online teaching cannot be denied and were reported in many studies that included PT programs [17 - 19], a significant body of research has also expressed reservations about these advantages [16, 20 - 23].

Resolving this debate was deemed crucial. Therefore, the current study aimed to assess the impact of the online teaching approach on the clinical self-efficacy of senior FCHS physiotherapy students across three distinct clinical areas: musculoskeletal, neurological, and cardiorespiratory. As well as to study the influence of academic factors on the students' scores of self-efficacies. It is hypothesized that senior PT students will report higher clinical self-efficacy for onsite TA compared to blended and online TAs across all three studied clinical-specific areas.

2. METHODS

2.1. Study Design

This research adopts a cross-sectional design, using a survey method for data capture.

2.2. Setting

The study was conducted at the PT department, FCHS, Al Ain Campus, UAE.

2.3. Study Duration

The study was extended over one and a half academic years; it commenced in the Fall semester of the 2022-23

academic year and completed at the end of the Spring semester of the 2023-2024 academic year. This timeframe aligns with the graduation of the three cohorts of students who experienced online teaching during the COVID-19 pandemic.

2.4. Target Population

This study focused on three cohorts of pre-graduation senior PT students at FCHS, who were the primary target population. These cohorts were uniquely exposed to onsite, online and/or blended TAs implemented by FCHS during the COVID-19 pandemic. The overall target population comprised 29 students: 14 from the first cohort, 10 from the second, and 5 from the third cohort. Eligibility for inclusion was determined based on two criteria: 1) students who experienced online and/or blended TAs as part of their academic journey due to the COVID-19 pandemic, and 2) those who completed their program within the study's data collection timeframe.

2.5. Surveying Instrument

For data collection in this study, a questionnaire grounded in existing literature was developed and utilized. The questionnaire is structured into 4 distinct sections, as follows:

2.5.1. The First Section

It included a welcoming statement to participants and a participations' information sheet. In this sheet, the aim of the study and how the participants can respond are presented, as well as the researcher's contact information. In addition, the first section comprised a consent form which assures that the participation is voluntary, the participants' confidentially is guaranteed, and the collected data will be used only for this research purpose and will be executed after the publication of the study. It was also mentioned that completing the questionnaire would indicate consent to participate in the study.

2.5.2. The Second Section (Participant's Academic Background)

This section included 3 questions designed to gather information about the students' age, their academic year and semester of program entry, and their academic year and semester of program completion.

2.5.3. The Third Section (Participant's Academic Pathway)

The PT program curriculum at FCHS is a four-year curriculum that includes general requirement courses, college and department elective courses, PT courses as evidence-based practice and research projects, PT specialty courses, and clinical practice courses.

2.5.3.1. The PT Specialty Courses

Each specialty is a package of 3 courses: 1- Human Biosciences course, which introduces the students to the relevant anatomy and physiology, 2- Physiotherapy Theory (PTT) course that provides the students with the clinical picture of related diseases and disorders and discuss the underlying theories and concepts of physiotherapy assessment, treatment, and rehabilitation plan, 3- Physiotherapy Practical (PTP) course which is dedicated for providing the students with practical skills for different assessment and therapeutic interventions. Given their critical role in shaping students' clinical practice skills, the PTT and PTP courses from three specialties, musculoskeletal (MSK), neurology (adult and pediatric) (N), and cardiorespiratory (CR), were included in this study. Table **1** illustrates the 3 included specialties, their represented courses, and their relevant PSE clinical areas. A table within the questionnaire lists these specialties, their corresponding courses, and associated clinical areas as defined by the PSE. Participants were instructed to detail, for each course, the academic year and semester of enrolment and to identify the TA (onsite, blended, or online) applied.

2.5.3.2. The Clinical Practice (CP) Courses

The curriculum includes seven CP courses, providing students with opportunities to practice clinical skills at clinical sites. These courses are stratified into three progressive stages:

2.5.3.2.1. Novice Stage (CP1- CP2)

Students begin their clinical education by shadowing clinical educators at the site, primarily observing patient care.

2.5.3.2.2. Intermediate Stage (CP3- CP4- CP5)

At this level, students engage in hands-on practice under the close supervision of clinical educators, gradually building their clinical skills.

2.5.3.2.3. Advanced Stage (CP6- CP7)

In the final stage, students continue to practice under supervision but are granted increased autonomy to apply their skills. Faculty members assigned to CP courses within the PT program serve as clinical tutors, overseeing the students' practical learning experiences. Students were asked to specify, for each of the seven CP courses, the academic year and semester of their enrollment, as well as the TA (onsite, blended, or online) utilized.

The 3rd section of the questionnaire included a five-point scale designed to measure students' physiological reactions in terms of body pain and arousal during clinical practice. The scale ranges from 'always,' indicating that body pain or arousal is frequently experienced, to 'ever,' denoting an absence of body pain or arousal. Students were required to report their levels of body pain and arousal across the MSK, neurology N, and CR clinical areas.

Table 1. Physiotherapy academic program specialty, courses and their relevant physiotherapy self-efficacy clinical area included in the study.

Academic Program Specialty	Courses	Relevant Physiotherapy Self-efficacy Clinical Area
Musculoskeletal (MSK 1)	PTT1, PTP1,	Musculoskeletal (MSK)
Musculoskeletal (MSK 2)	PTT2, PTP2,	
Neurology (N3)	PTT3, PTP3,	Neurology (N)
Neurology (N4)	PTT4, PTP4,	
Cardiorespiratory (CR)	PTT5, PTP5,	Cardiorespiratory (CR)

Table 2. Physiotherapy self-efficacy questionnaire [5].

Item #	Wording of the Items	Your Perception about your Confidence to Perform the Described Task														
		Musculoskeletal Clinical Caseload/ Clinical Area					Neurology* Clinical Caseload/ Clinical Area					Cardiorespiratory Clinical Caseload/ Clinical Area				
		5	4	3	2	1	5	4	3	2	1	5	4	3	2	1
1-	I feel adequately prepared to undertake a … caseload.															
2-	I feel that I am able to verbally communicate effectively and appropriately for a … caseload.															
3-	I feel that I am able to communicate in writing effectively and appropriately for a … caseload.															
4-	I feel that I am able to perform subjective assessment for a … caseload.															
5-	I feel that I am able to perform objective assessment for a … caseload.															
6-	I feel that I am able to interpret assessment findings appropriate for a … caseload.															
7-	I feel that I am able to identify and prioritize patient's problems for a … caseload.															
8-	I feel that I am able to select appropriate short- and long-term goals for a … caseload.															
9-	I feel that I am able to appropriately perform treatments for a … caseload.															
10-	I feel that I am able to perform discharge planning for a … caseload.															
11-	I feel that I am able to evaluate my treatments for a … caseload.															
12-	I feel that I am able to progress interventions appropriately for a … caseload.															
13-	I feel that I am able to deal with the range of patient conditions that may be seen with a … caseload.															

Note: * Neurology includes adult neurology and pediatric cases.

2.5.4. The Fourth Section (Physiotherapy Self-efficacy assessment)

The 4th section featured the Physiotherapy Self-efficacy (PSE) questionnaire, which included 13 items detailed in Table **2**. These items described various clinical tasks that students encounter during their clinical practice [5]. Participants were prompted to rate their confidence in performing each task, using a five-point Likert scale where a score of 5 indicates full confidence and a score of 1 denotes the least confidence. This assessment process was repeated across the 3 distinct clinical areas of focus: musculoskeletal, neurology, and cardio-respiratory.

2.6. Pilot Study

A pilot study involving seven students from the initial target group was undertaken to ensure the clarity of the questionnaire and to confirm that the time needed to complete the questionnaire was reasonable and convenient for the students. Feedback from the pilot study participants indicated that the questionnaire was clear, with an average completion time of 25 minutes. Based on this feedback, the final version of the questionnaire was developed.

2.7. Recruitment of Students

Senior PT students from the three targeted cohorts were invited to participate in the study through verbal invitations and *via* their college email. Those who volunteered to take part were provided with the questionnaire in a format that suited their preferences: a hard copy was distributed directly by the researchers. In contrast, a soft copy or the URL for the electronic version was sent to their email.

2.8. Duration of Data Collection

Data collection from each cohort occurred 2 weeks prior to the conclusion of their final semester in the program, a point at which all academic pathway data for the included courses across the three specialties were complete and accessible. For the first cohort, data were gathered in the second semester of the 2022-2023 academic year; for the second cohort, during the first semester of the 2023-2024 academic year; and for the third cohort, in the second semester of the 2023-2024 academic year.

2.9. Responses of Students

The questionnaire was made available in 3 formats: paper-based copy and soft copy, as well as in an electronic copy *via* a Google Form. Participants were given the option to choose the format they preferred for completion. This self-administered questionnaire required participants to first go through section one, which includes participant information and a consent form. After providing the necessary information in sections two (academic background) and three (academic pathway), students were instructed to proceed to the PSE assessment section. Here, they were asked to carefully read each item and

select responses that best reflected their confidence level in performing the specified clinical tasks.

2.10. Variables for Statistical Analysis

The following variables were included in the statistical analysis:

2.10.1. A- Independent Variables

2.10.1.1. Students' Age

2.10.1.1.1. TA Used

Or each specialty and CP course, the TA used (onsite, blended, online) was recorded as reported by students in the third section of the questionnaire.

2.10.1.2. Sufficiency of Clinical Case Exposure

The students' perceived level of sufficiency of exposure to clinical cases in each of the three specialties was collected and reported (Third section of the questionnaire) in categories of good, fair, and poor exposure.

2.10.1.3. Verbal Encouragement and Positive Feedback

Information regarding the frequency of verbal encouragement and positive feedback received from clinical educators was collected (Third section of the questionnaire) across five categories, ranging from always to never, and was applied to the three clinical areas.

2.10.1.4. Physiological Reaction

Students' physiological reactions in terms of body pain and arousal were recorded as reported by students (Third section of the questionnaire) across five categories, ranging from always to never, and was applied to the three clinical areas.

2.11. Dependent Variables

2.11.1. PSE Assessment

The total PSE score for each clinical-specific area (MSK, N, and CR) was calculated. This calculation was based on the sum of participants' responses (fourth section of the questionnaire) to the thirteen questionnaire items. With responses utilizing a 5-point Likert scale (ranging from 1 to 5), the total calculated score varied from 13 to 65.

2.12. Grouping

For statistical analysis of the mentioned quantitative variables, the TAs and clinical-specific areas were categorized into distinct groups. The TAs were grouped into onsite, blended, and online. Similarly, the clinical areas were classified into MSK, N, and CR groups.

2.13. Data Analysis

The data gathered through the survey were coded and input into an Excel spreadsheet before being transferred to the Statistical Package for the Social Sciences (SPSS), version 28, for analysis. Given the relatively small sample size of the target population (25 students), non-parametric statistical methods were employed. Because the CP courses were designed based on the level of students' autonomy into novice, intermediate, and advanced, not on the specialty of the clinical areas, and because all the CP courses were delivered through onsite TA, these CP courses were not included in this analysis while the physiotherapy theory and practical courses were. The only exception was for two courses, PTT2 and PTP2 because they were totally delivered through only online TA. Subsequent analyses were conducted: Median was used to describe the PSE total score in each of the clinical areas and Cross-tabulation was employed to describe the students' perceived sufficiency of exposure to clinical cases across three clinical areas. While the Mann-Whitney U test was used to compare the PSE total score based on the two TAs implemented, the independent samples Kruskal-Wallis H test was used to compare the PSE total score based on the three TAs implemented as well as to compare the mean ranks of PSE total score between the MSK, N, and CR clinical areas. In addition, post-hoc tests were also conducted to determine the pair's wise significance. Moreover, the Spearman's rank correlation coefficient test was used to assess the correlations between each of the following two variables: 1- The PSE total score and clinical areas, 2- The TAs of PTT and PTP courses and the relevant clinical area PSE total score, 3- The students' perceived sufficiency of clinical case exposure and a- PSE total scores, b- the three clinical areas, 4- The clinical educators' positive feedback and a- clinical areas, b- the PSE total scores, 5- The clinical educators' verbal encouragement and a- clinical areas, b- the PSE total scores, 6- The frequency of body pain and arousal, as perceived by senior PT students, and clinical areas, 7- The frequency of body pain and arousal and the total score of PSE. The study involved 17 participants, covering all three clinical areas, totaling 51 instances for analysis.

2.14. Level of Significance

A p-value of 0.05 was established as the threshold for statistical significance.

2.15. Study Reporting

The findings were presented through tables and figures. The STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist guided the reporting process for this cross-sectional study. Augmented artificial intelligence, specifically ChatGPT-4, was utilized for editing purposes.

3. RESULTS

The study targeted three cohorts of PT students who, due to the COVID-19 pandemic, Encountered a combination of onsite, online, and blended TAs as part of their curriculum. This adjustment was necessitated by social distancing measures aimed at preventing the virus's spread. The first cohort commenced their studies in the 2018-2019 academic year, with the final cohort graduating in the Spring of the 2023-2024 academic year. Of the initial fourteen students in the first cohort, seven consented to participate in the study. The second cohort started with ten students, but two did not complete the program by the time of data collection; of the eight who remained, seven agreed to participate. The third cohort consisted of five students, with two not completing the program by the time of data collection, leaving three who

participated. Therefore, out of twenty-five eligible students (14 from the first cohort, eight from the second, and three from the third), 17 students (representing a 68% participation rate) contributed to the study. Their median age was 22 years. For clarity and organization, the results section of this study is structured into 5 distinct parts as follows:

3.1. The Physiotherapy Self-efficacy Total Score in the three included Clinical Areas (Musculoskeletal, Neurology, and Cardiorespiratory)

As the below detailed results indicate, the analysis of PSE total scores across the MSK, N, and CR clinical areas reveals that the type of clinical area significantly correlates with students' clinical self-efficacy. There is a noticeable and statistically significant decrease in students' confidence from the MSK to N and ultimately to the CR clinical area.

3.1.1. Median Scores among Clinical Areas

Table **3A** presents the median of the PSE total score among the MSK, N, and CR clinical areas. It indicates that the CR clinical area displays the lowest median score at 39 out of 65.

3.1.2. Correlation with the Clinical Areas

Table **3B** shows a significant correlation (r= -0.572, *p*= 0.001) between the PSE total score and the clinical areas. This indicates that students' confidence in clinical settings progressively diminishes from the MSK to N and, most markedly, to the CR clinical area.

3.1.3. Comparison among the Clinical Areas

Further analysis, as illustrated in Fig. (**1**), shows significant differences in the mean ranks of the PSE total scores across the three clinical areas (*p*= 0.001). In addition, the post-hoc test clarifies these differences, revealing significant disparities between the CR and MSK clinical areas (*p*= 0.001), as well as between the CR and N clinical areas (*p*= 0.017). These findings underscore the impact of clinical area type on students' self-efficacy, with CR presenting as the area of lowest confidence.

Table 3A. The median of physiotherapy self-efficacy total score of the musculoskeletal, neurology, and cardio-respiratory clinical areas (N=17).

Clinical Area	Median (Out of 65)
Musculoskeletal	56
Neurology	52
Cardiorespiratory	39

Table 3B. Correlation between physiotherapy self-efficacy total score and the musculoskeletal, neurology, and cardio-respiratory clinical areas (N=51).

Correlations	r	*p*-value
Physiotherapy Self-Efficacy Total Score * Clinical Area	-.572	0.001**

Note: ** Correlation is significant at the 0.05 level (2-tailed).

3.2. Effect of Teaching Approaches of Physiotherapy Theory and Practical Courses on Senior Physiotherapy Students' PSE

During COVID-19, online and blended TAs were used to deliver PTT and PTP courses and as illustrated in Table **4**, the only significant differences in the mean ranks of PSE total score based on the used TAs were for the PTT5 course (*p*= 0.008) and PTP5 course (*p*= 0.007), which are corresponding to the PSE for CR clinical area. Among the onsite, blended, and online TAs that were reported for both the PTT5 and PTP5 courses, the online TA had the lowest mean rank of PSE total score. For the PTT5 course, the post-hoc test revealed that significant differences were between the mean ranks of the

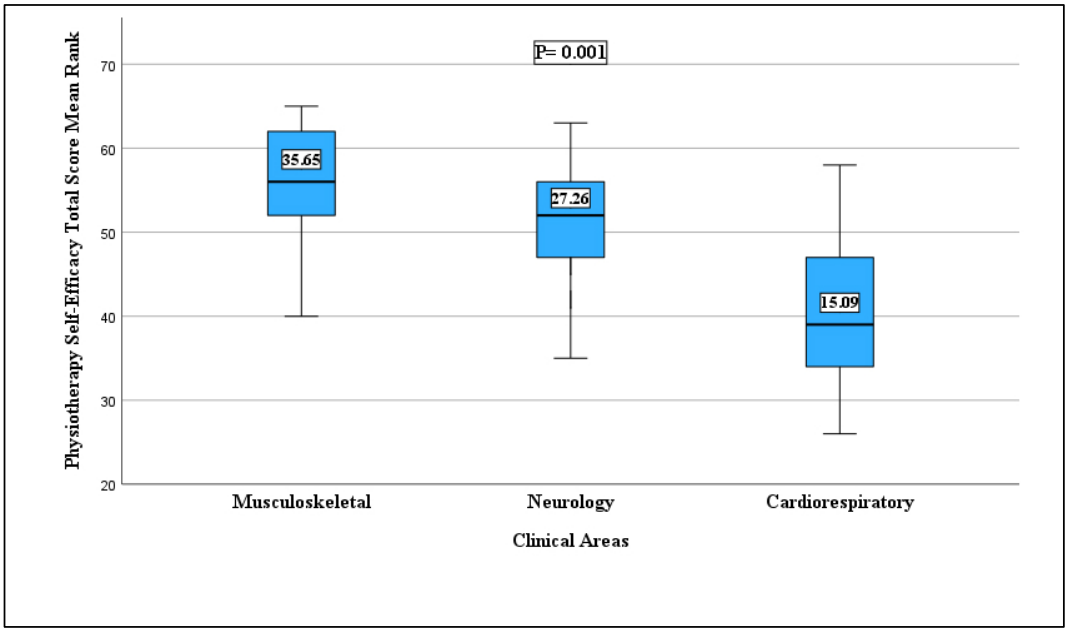

Fig. (1). Comparison of physiotherapy self-efficacy total score across three clinical areas (N=17).

Table 4. Comparison of physiotherapy self-efficacy total score mean rank across teaching approaches of COVID-19 era for physiotherapy theory and practical courses (N=17).

Physiotherapy Self-r=efficacy Clinical Area	Specialty Courses	Teaching Approaches	N	Mean Rank	*p*-value
Musculoskeletal	PTT1	Online	4	11.6	0.232
		Onsite	13	8.2	
	PTP1	Online	6	10.8	0.289
		Onsite	11	8.1	
Neurology	PTT3	Online	15	8.4	0.203
		Blended	2	13.2	
	PTP3	Online	15	8.4	0.203
		Blended	2	13.3	
	PTT4	Online	15	8.2	0.100
		Blended	2	14.5	
	PTP4	Online	14	7.7	0.061
		Blended	2	14.5	
		Onsite	1	16.5	
Cardiorespiratory	PTT5	Online	8	5.0	0.008*
		Blended	4	12.6	
		Onsite	5	12.5	
	PTP5	Online	8	5.0	0.007*
		Blended	5	11.6	
		Onsite	4	13.8	

Note: *Correlation is significant at the 0.05 level (2-tailed).

Table 5. Correlation between relevant clinical area physiotherapy self-efficacy total score and corresponding physiotherapy theory and practical courses during COVID-19 era (N=17).

Correlations		r	*p*-value
Relevant Clinical Area Physiotherapy Self-efficacy Total Score	Corresponding Physiotherapy Theory and Practical Courses		
Musculoskeletal	PTT1	-0.299	0.244
	PTP1	-.265	0.303
Neurology	PTT3	0.318	0.213
	PTP3	0.318	0.213
	PTT4	0.412	0.101
	PTP4	0.590	0.013*
Cardiorespiratory	PTT5	0.722	0.001**
	PTP5	0.783	0.001**

Note: * Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.05 level (2-tailed).

online and the onsite TAs (p=0.009) as well as between the mean ranks of the online and the blended TAs (p= 0.013), but there was no significant difference (p= 0.970) between the mean ranks of the blended and the onsite TAs. Meanwhile, the post-hoc test for the PTP5 course demonstrates that the significant differences were between the mean ranks of the online and the blended TAs (p= 0.021) from one side and between the mean ranks of the online and the onsite TAs from the other side (p=0.004) and there was no significant difference (p= 0.522) between the mean ranks of the blended and the onsite TAs. In addition, the Spearman correlation test indicated that there were significant correlations between the TAs used during COVID-19 and the total score of PSE for PTP4, PTT5, and PTP5 courses (p= 0.013, 0.001, and 0.001, respectively) (Table **5**).

3.3. Level of Clinical Case Exposure Sufficiency and its Relation to Physiotherapy Self-efficacy and Clinical Areas

Fig. (**2**) presents the perceived sufficiency of clinical case exposure, categorized as good, fair, and poor, across the three clinical areas under study. Notably, 88.2% of students reported good exposure to MSK clinical cases, whereas only 5.9% felt they had good exposure to CR cases. Analysis of the correlation between students' perceived sufficiency of clinical case exposure and their PSE total scores (N=51) revealed a positive and significant correlation (r= 0.580, p= 0.001), indicating that increased clinical case exposure is associated with higher PSE scores. Furthermore, a second correlation analysis showed a significant negative correlation (r= -0.728, p= 0.001) between exposure sufficiency and the clinical area, illustrating a decline in perceived exposure sufficiency from MSK to N, and then to CR clinical areas (Table **6**).

3.4. Effect of Clinical Educators' Verbal Encouragement and Positive Feedback on Senior Physiotherapy Students' Physiotherapy Self-efficacy

Table (**7A**, **B**) demonstrates that clinical educators' verbal encouragement and positive feedback were significantly (p= 0.001 and 0.002) more in the MSK clinical area, followed by N, then CR clinical area. While there was a significant correlation between clinical educators' verbal encouragement and PSE total score (p= 0.001), the correlation between clinical educators' positive feedback and PSE total score was not significant (p= 0.194).

Table 6. Correlations between the level of sufficiency of exposure to clinical cases and both the physiotherapy self-efficacy (PSE) total score and the musculoskeletal, neurology, and cardiorespiratory clinical areas (N= 51).

Correlations	r	*p*-value
Level of Sufficiency of Exposure to Clinical Cases * PSE Total Score	0.580	0.001**
Level of Sufficiency of Exposure to Clinical Cases * Clinical Areas	-0.728	0.001**

Note: ** Correlation is significant at the 0.05 level (2-tailed).

Table 7A. Correlations between the clinical educator's verbal encouragement and both the physiotherapy self-efficacy total score and the musculoskeletal, neurology, and cardiorespiratory clinical areas (N= 51).

Correlations	r	*p*-value
Clinical Educator's Verbal Encouragement * PSE Total Score	0.573	0.001**
Clinical Educator's Verbal Encouragement * Clinical Areas	-0.481	0.001**

Table 7B. Correlations between the clinical educator's positive feedback and both the physiotherapy self-efficacy total score and the musculoskeletal, neurology, and cardiorespiratory clinical areas (N= 51).

Correlations	r	*p*-value
Clinical Educator's Positive Feedback * PSE Total Score	0.185	0.194
Clinical Educator's Positive Feedback * Clinical Areas	-0.430	0.002**

Note: ** Correlation is significant at the 0.05 level (2-tailed).

3.5. Senior Physiotherapy Students' Perceived Body Pain and Arousal during Clinical Practice

This study assessed two physiological reactions, body pain and arousal, as experienced by senior PT students during their clinical practice. According to the findings presented in Tables **8** and **9**, there is no significant correlation (p= 0.172) between students' perceived arousal and their total PSE scores. However, a significant correlation (0.025) exists between the perceived body pain during clinical practice and the clinical area. The MSK area is associated with the highest reported body pain, while the CR area reports the lowest.

Table 8. Correlation of senior physiotherapist students' body pain physiological reaction and both physiotherapy self-efficacy total score and the musculoskeletal, neurology, and cardiorespiratory clinical areas (N= 51).

Variables	r	*p*-value
Body Pain Physiological Reaction * PSE Total Score	0.281	0.050
Body Pain Physiological Reaction * Clinical Area	-0.303	0.025*

Note: * Correlation is significant at the 0.05 level (2-tailed).

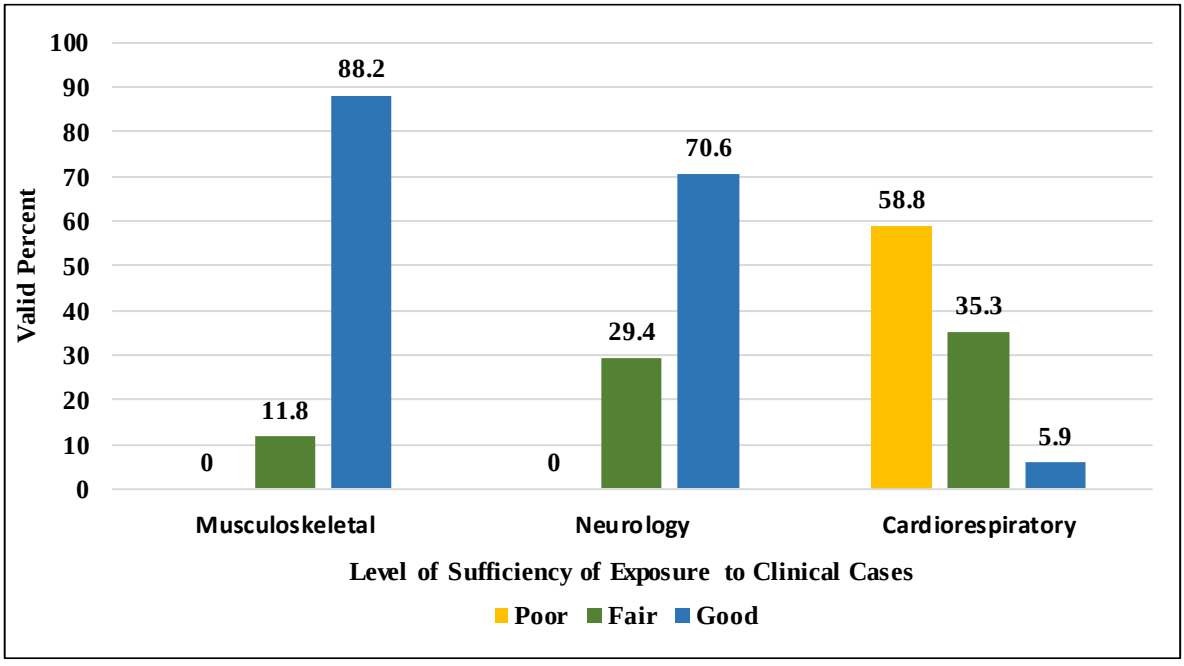

Fig. (2). Level of sufficiency of exposure to clinical cases for the musculoskeletal, neurology, and cardiorespiratory clinical areas as perceived by senior physiotherapist students (N= 17).

Table 9. Correlation of senior physiotherapist students' arousal physiological reaction and both physiotherapy self-efficacy total score and the musculoskeletal, neurology, and cardiorespiratory clinical areas (N= 51).

Variables	r	*p*-value
Arousal Physiological Reaction * PSE Total Score	0.194	0.172
Arousal Physiological Reaction * Clinical Area	-0.199	0.161

Note: * Correlation is significant at the 0.05 level (2-tailed).

4. DISCUSSION

Self-confidence and self-efficacy are vital constructs that influence student performance [24] and are deemed critical for the professional development of health profession students [3, 8, 14]. Bandura (2005) highlighted the importance of context in measuring self-efficacy, noting that assessments must be tailored to specific areas of functioning and stated that no 'one measure fits all' [24]. In this light, employing the PSE questionnaire in the current study provides a focused and accurate measurement of PT students' self-efficacy, enhancing the quality and objectivity of the results. The PSE, by specifically targeting PT students' confidence across three distinct clinical areas, stands as a valid and reliable tool for assessing self-efficacy within PT clinical practice [11]. Consequently, it holds significant value for both educational strategies and research in PT, enabling the comparison of different teaching methods and their impacts on self-efficacy [11]. In addition, this supports the generalizability of the study's results despite the small number of participants.

Traditionally, PT programs have favoured onsite TA due to the hands-on nature of the curriculum, which includes a sizeable portion of practical and clinical courses alongside theoretical ones. The practical component is often conducted in laboratories, where students practice skills on peers, simulated patients, or mannequins. In these settings, educators provide crucial feedback on various aspects of clinical practice, including patient and practitioner positioning, grasp, patient safety, and the effective execution of assessment and therapeutic interventions. In addition to laboratory work, clinical courses take place in real healthcare settings, allowing students to apply their skills with actual patients under supervision. This model of onsite teaching has been the standard for PT programs for decades, emphasizing the importance of direct, in-person instruction and practice. However, the emergence of the global COVID-19 pandemic challenged this traditional approach, prompting a revaluation of teaching methodologies in PT education. The COVID-19 pandemic significantly impacted higher education institutions worldwide, mirroring its effects across all aspects of life. It began spreading during the 2019-2020 academic year, prompting universities to close physical campuses and shift to online TA in the Spring semester. By the Spring semester of 2021-2022, as control over the pandemic improved, universities adopted both blended and online TAs. Traditional onsite teaching resumed in the Fall semester of the 2022-2023 academic year. The same transition scenario also occurred within FCHS, including the PT program, leading to three cohorts of PT students experiencing varied TAs throughout their academic pathway. Given that the PT curriculum heavily relies on practical and clinical courses traditionally conducted onsite, the forced shift to online or blended TAs sparked numerous research inquiries. These inquiries focused on evaluating the effectiveness and quality of non-traditional teaching methods within PT education. Consequently, numerous studies worldwide have explored various facets of this uncommon educational shift. Accordingly, the present study aimed to assess the effect of the online teaching approach on FCHS senior physiotherapy students' clinical self-efficacy for three distinct clinical areas, including musculoskeletal, neurological, and cardiorespiratory. The PT curriculum at FCHS comprises seven CP courses; all were delivered through onsite TA even during the pandemic. However, the PTT and PTP courses were conducted through various TAs over the above-mentioned period. As PTT and PTP courses lay the groundwork for clinical practice, they were utilized as a reflection of the clinical areas in this analysis. The TAs applied in these courses were examined in relation to the corresponding clinical area's PSE total score, aiming to fulfill the purpose of this study.

4.1. Courses' Specialty-dependent Effect of Online Teaching Approaches on Senior Physiotherapy Students' Self-efficacy during COVID-19 Era

The results suggest a selective effect of online TA on the PT Senior students' clinical self-efficacy based on the courses' specialties. In other words, the impact of TAs on the students' PSE is specialty-dependent. Among the courses examined, two for the MSK specialty and four for the N specialty, only the two courses related to the CR specialty (PTT5 and PTP5) demonstrated significant differences in the PSE total scores based on the TA implemented (Table **3**). These differences were most pronounced in favor of the onsite TA, followed by the blended and then the online TAs. This raises questions about the specific influence of TAs on self-efficacy and why such effects are confined to the CR specialty, absent in MSK or N specialties. If the online and or blended TAs during the COVID-19 era are claimed to markedly negatively affect the quality of teaching, development of required clinical competencies, and, subsequently, student confidence during clinical practice, one would expect a uniform impact across all specialties, which was not observed. Several hypotheses are proposed to explain these findings:

4.1.1. Complex Nature of the CR Specialty

The inherent complexity of the CR specialty, rather than the TAs employed, may significantly influence student self-efficacy. The CR specialty skills and competencies require mastery over complex cardio and respiratory assessment tools, techniques, and therapeutic interventions with complicated dosage preparations, which may inherently challenge students' self-efficacy. The CR specialty courses may exhibit a greater dependency on onsite TA compared to MSK and N courses, as the hands-on experience is crucial for students to meet the learning objectives effectively. This is particularly true for CR courses, where students likely need to practice in onsite laboratory settings to fully perform those, as mentioned earlier, detailed and complex assessments and therapeutic interventions required. This hypothesis aligns with Bandura's self-efficacy

theory (1986 & 1994), which identifies 4 primary sources that impact individual self-efficacy [25, 26]. These sources include mastery experiences, vicarious experiences, verbal persuasion, and emotional and physiological responses [25, 26]. Bandura (1994) identified mastery experiences, which refer to an individual's previous performance outcomes, as the most powerful sources of influence. He explained that if a person has successfully completed a task in the past, they are likely to feel confident about performing a similar task in the future [26]. The hypothesis suggests that the CR specialty, which benefits from onsite TA when conveyed through online and blended TAs, may adversely affect students' acquisition of CR-specific competencies. This, in turn, could negatively impact their clinical performance, leading to the observed lower self-efficacy scores that are statistically significant.

4.1.2. Stages Design of Clinical Courses at FCHS

The design of CP courses at FCHS does not follow clinical specificity but progresses through stages. In the novice and intermediate stages, students predominantly observe or practice under close supervision from their clinical educators, and it happens that during these stages, they are primarily exposed to MSK and N clinical areas, respectively. This exposure pattern could lead to a skewed perception of self-efficacy. Meanwhile, in the advanced stage, which is mostly dedicated to medical and surgical conditions, mainly the CR clinical area, students engage more independently with patients, revealing a more accurate reflection of their self-efficacy. In other words, as students progress to more autonomous practice in the CR clinical area, any overestimated self-efficacy from earlier stages may adjust to reflect a truer measure of their confidence and abilities. Bandura (1986) stated that vicarious experiences, or observing the performance of others, rank second in terms of influencing self-efficacy. Watching someone handle a similar situation successfully can boost an individual's own self-efficacy [25]. This is exactly what happened to PT students while they were observing the clinical educators successfully managing MSK and neurology clinical cases, which resulted in magnification of their self-efficacy reported for those clinical areas.

4.1.3. Impact of Lower Allocated Credit Hours for Cardiorespiratory Specialty Courses on Clinical Self-efficacy

Another factor contributing to the lowest PSE scores reported in the CR clinical area, indicative of reduced student confidence in clinical settings, is the allocation of credit hours to courses within the CR specialty. Unlike the MSK and N specialties, which each offer two theoretical and two practical courses, the CR specialty is limited to only one theoretical and one practical course. This discrepancy means that the MSK and N specialties benefit from double the credit hours, allowing for a broader scope of content, increased practice time, and more educational activities aimed at achieving the courses' knowledge, intellectual, and skill-based learning objectives. In contrast, the CR specialty's lower credit hours limit these opportunities, potentially impacting students' acquisition of necessary knowledge and practical skills, negatively affecting their mastery experiences, and thereby affecting their clinical competencies. This discrepancy is reflected in clinical settings as diminished confidence and a lower capacity to manage and treat patients effectively.

4.1.4. Statistical Considerations

The variability is increased with more groups. So, introducing a third TA adds more variability to the dataset and if the three TAs' groups differ significantly in their effect on the PSE total score, this increased variability can make it easier to detect this significant difference when comparing across all groups. The courses related to MSK and N specialties utilized two TAs, while those for the CR specialty employed three TAs. This distinction in the number of TAs could explain the observed impact on CR courses but not on the others from a statistical variability perspective. Furthermore, the inclusion of more groups can affect the statistical power of the analysis. Specifically, if the additional group (s) possess unique characteristics distinct from others, this would enhance the capacity to identify significant differences when present. This principle suggests that courses containing three TAs are more likely to reveal disparities in PSE total scores across TAs, which aligns with the observed trends in the current study findings.

4.2. Senior PT Students' Self-efficacy is Influenced by the Clinical Specific Area

Specialty courses and clinical areas are two sides of the same coin. There were notable discrepancies among the MSK, N, and CR specialty courses in terms of the impact of online TA. Similarly, variations in PSE scores were observed across these clinical areas. As the impact of TAs on the students' PSE was specialty dependent, the PSE is also a clinical specific area dependent. Descriptive statistics (Table **4A**) revealed that the median scores across the three clinical areas descend from MSK at 56 to N at 52 and then to CR at 39. Moreover, the findings of this study give strong support to a significant correlation (Table **4B**) between the clinical area type on PT senior students' level of confidence in clinical settings, as reflected by their PSE total scores ($r= -0.572$, $p= 0.001$). Further analysis indicated that there is a significant correlation between the CR specialty courses and PSE of the CR clinical area (Table **5**), emphasizing the two faces of the same coin-raised concept. There was a progressive decrease in PSE total score from MSK, through N, to CR clinical areas. Therefore, it can be confidently stated that while TAs exert a selective effect on PSE, implying they are not the sole factor influencing students' self-efficacy in clinical settings, the type of the clinical area exerts a more pronounced effect. These findings offer further insight into the observed selective effect of TAs on students' PSE. Search into the underlying notion that the influence on PSE extends beyond just the TAs to include the type of clinical area as well. This aligns with previous observations about the unique challenges presented by the CR clinical area, marked by its complex assessment and therapeutic interventions compared to the MSK and N clinical areas. Such complexities may position students to face more demanding scenarios in clinical settings. In addition, these findings contribute to the ongoing debate regarding the effectiveness of online teaching in higher education, particularly within health professions. These findings suggest that

evaluating the effectiveness of online education should consider the specific nature of the specialty within the health profession program. In the context of the PT program, as emphasized by this study, it is inaccurate to broadly claim that online teaching matches the effectiveness of onsite instruction or to assert that onsite teaching is the sole appropriate TA for health profession programs. Rather, the suitability and effectiveness of online TA should be assessed on a case-by-case basis for each specialty and clinical area to gather more precise and objective evidence regarding the efficacy of online TA.

4.3. Good Exposure to Clinical Cases was associated with Greater Self-efficacy of Senior Physiotherapy Students

As discussed earlier, this study did not totally support the effect of TAs on the senior student's PSE and suggested that it is the clinical area and specialty types that might weigh more in shaping the level of PT students' confidence in clinical settings. This perspective helps explain why TAs notably influenced the courses of CR specialty but not the MSK or N specialties. The particularly low PSE scores associated with the CR clinical areas further strengthen this view. The factor of sufficiency of exposure to cases during clinical practice is adding more emphasis as well. Despite the seven CP courses being delivered with onsite TA, students reported varying levels of sufficiency of exposure to clinical cases across clinical areas. Notably, the MSK clinical area had the highest reported exposure, followed by N, with the CR clinical area at the lowest (Table **6**). It stands to reason that increased patient exposure within a specific clinical area enhances mastery of clinical skills, enabling students to manage assessments and therapeutic interventions more proficiently. This concept is supported by the positive significant correlation found between the level of exposure to clinical cases and the senior students' PSE (Tables **7 - 9**); the more the students' exposure to clinical cases, the more their PSE total score. Meanwhile, the table shows another correlation, a negative one, between the level of sufficiency of exposure to clinical cases and the clinical area. The direct correlation between case exposure and growing confidence is underscored because the CR clinical area not only differed in its response to TAs but also displayed the least sufficiency in clinical case exposure, aligning with the lowest observed PSE scores. Recalling Bandura's (1986; 1994) major sources that influence self-efficacy, particularly mastery and vicarious experiences, provide support to this study's findings [25, 26]. Lower students' exposure to clinical cases is followed by lower opportunities for practicing and developing clinical competency and mastery experience. Meanwhile, lower exposure also induces a lower chance for observation and negatively influences the vicarious experience. So, lower exposure to clinical cases negatively influences the mastery and vicarious experiences and reduces students' self-efficacy.

4.4. Clinical Educators' Verbal Encouragement Enhances Senior Physiotherapy Students' Self-efficacy and is Influenced by Clinical Specific Area

Within clinical settings, PT students receive supervision and, at times, verbal encouragement from clinical educators for demonstrating proficient practices. This study's findings indicate a direct correlation between the frequency of verbal encouragement and heightened levels of student self-efficacy. Again, Bandura's self-efficacy theory (1986 & 1994) provides support to this observation [25, 26]. Based on his theory, the third source of affection that forms self-efficacy is verbal persuasion, such as praise and encouragement. In this context, the opinions of others regarding an individual's performance or ability influence how that person perceives their capability to face the challenge [26]. Applying in the clinical setting, what the clinical educators say about the students' performance in terms of verbal encouragement would shape their self-efficacy in a positive way and vice versa. Additionally, the more trustworthy the source of verbal persuasion, the stronger its impact on self-efficacy [27]. Additionally, this study's findings indicate that the frequency of verbal encouragement received from clinical educators varied by clinical area. The MSK clinical area exhibited the highest frequency of encouragement, followed by the N clinical area, while the CR clinical area had the lowest frequency. This variation could be attributed to the differing levels of clinical case exposure reported by the students, particularly the lowest exposure in the CR clinical area. Reduced exposure to clinical cases in CR may coincide with fewer interactions with clinical educators, subsequently leading to less frequent verbal encouragement, which may explain the findings of this study. Reduced exposure to cases in the CR clinical area might also reduce the students' mastery experience and consequently reduce their chance to receive verbal encouragement from their clinical educators.

4.5. Senior Physiotherapy Students' Physiological Reaction of Body Pain is Influenced by Clinical Specific Area

The final source of influence in Bandura's self-efficacy theory (1994) focuses on the individual's internal sensations, specifically emotional and physiological factors [26]. Physiological influences include bodily responses such as fatigue, pain, pleasure, arousal, and stress hormone levels [26]. According to Bandura (1994), individuals who view these physical reactions as energizing tend to have higher self-efficacy, while those who perceive them as hindrances exhibit lower self-efficacy [26]. The results of this study are in line with Bandura's theory (1994) [26]. Students reported that they experienced body pain in clinical settings while handling CR cases more frequently than treating MSK or N cases. From a practical point of view, treatment of MSK or N cases is more physically demanding and energy-consuming than treatment of CR cases. However, PT practitioners develop coping mechanisms to handle those more physically demanding cases with lower use of energy. As they become more skillful, after treating many cases, the energy consumption and physical demand gradually decrease. The same concept can be applied to PT students, and as they are exposed to more MSK and N cases, they might develop these coping strategies and report less body pain. Meanwhile, in the case of CR clinical area, the lower exposure to clinical cases would hinder the development of such strategies and accordingly, body pain is more likely to occur. Although the body pain showed a relation to the clinical areas but not to the total score of PSE, the arousal physiological reaction did not show any relationship with either of them. This could be explained by the positive, safe, and

supportive environment offered to the students either at FCHS or in the clinical settings. Another study assessed the level of test anxiety among FCHS. The modest level of test anxiety at the college was explained by several factors, among which was the environmental status of Al Ain city and the FCHS [28]. Al Ain city is famous for its green and calm environment, and the same can be said for the FCHS and this healthy environment would reduce anxiety for all and the test anxiety for the students [28] and arousal as well. On the other hand, as noted by Bandura (1994), emotional influences, such as an individual's mood and perspective, can impact how they approach a challenge and a positive attitude may boost self-efficacy, while a negative outlook may reduce it [26].

CONCLUSION

The impact of the online teaching approach, implemented during the COVID-19 pandemic, on the self-efficacy of senior physiotherapy students in clinical settings is specialty-dependent. This effect was particularly significant in the cardiorespiratory specialty courses, where onsite teaching was clearly preferred, while it was negligible in both the musculo-skeletal and neurology specialties' courses. Moreover, additional factors were identified that contribute to students' self-efficacy. These include a higher level of exposure to clinical cases, more frequent verbal encouragement from clinical educators, and fewer physiological responses, specifically body pain, which were all associated with higher self-efficacy scores.

STUDY LIMITATION

Due to the authors' trial not to elongate the questionnaire, this study did not include the students' mood or attitude factor, and this might be one of the limitations of the current study. Another limitation could also be not assessing the students' prior interests, experiences, and preconceptions about each specialty, which might influence how effectively they learn through different TAs. If students are initially more apprehensive about CR, they might find it harder to build confidence without the direct, hands-on experiences typically associated with onsite learning.

EDUCATIONAL IMPLICATIONS

Online teaching significantly impacted higher education during the COVID-19 era, particularly for health profession programs that traditionally rely on onsite teaching due to their emphasis on practical and clinical skills. This study contributes to the existing literature by examining the effects of online teaching on clinical self-efficacy within a specific health professional program—physiotherapy. The findings of this study can assist educators and policymakers in implementing appropriate practices to ensure the clinical self-efficacy of students.

AUTHORS' CONTRIBUTION

It is hereby acknowledged that all authors have accepted responsibility for the manuscript's content and consented to its submission. They have meticulously reviewed all results and unanimously approved the final version of the manuscript.

LIST OF ABBREVIATIONS

PT	=	Physiotherapy
TAs	=	Teaching Approaches
MSK	=	Musculoskeletal
CR	=	Cardiorespiratory
FCHS	=	Fatima College of Health Sciences
PSE	=	Physiotherapy Self-efficacy
PTT	=	Physiotherapy Theory
PTP	=	Physiotherapy Practical
CP	=	Clinical Practice

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The authors received ethical approval from the Fatima College of Health Sciences ethics committee, United Arab Emirates (UAE) on 5th September 2023 (Reference Number: FCEC-04-14-23-PTY-1).

HUMAN AND ANIMAL RIGHTS

All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

The study was conducted in accordance with ethical standards, ensuring participants' confidentiality. All students participated voluntarily and provided informed consent through a signed consent form.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data and supportive information are available within the article.

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None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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Declared none.

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