Toward enhanced competence acquisition in clinical practice: implementing blended learning for physical therapy students

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Background: The curricular changes in educational activities, teaching methodologies, and assessment systems brought about by the COVID-19 closure, which restricted attendance in curricular practices, required adjustments. However, the impact of these curricular adaptations on the acquisition of competencies in the clinical context has not been sufficiently explored.

Objective: The objective of this study was to assess the potential impact on the expected learning outcomes in the Basic Manual Therapy course following curricular adaptations made during the COVID-19 lockdown. We specifically must be focused on acquiring competencies related to the clinical domain, including clinical practice, medical history, and reflective journaling during clinical practices. We aimed to compare these experiences with those of students who did not undergo any adaptations in the previous academic year.

Methods: This is a retrospective cohort study in a sample of physical therapy university students, conducted in accordance with Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. We divided students into two groups based on when they enrolled: the 'non-exposed group' (N_E), which includes those who finished the Basic Manual Therapy course in 2018−2019 and Clinical Stays I in 2019−2020, and the 'exposed group' (E), consisting of students who completed the Basic Manual Therapy course in 2019−2020 and later took part in Clinical Stays I during 2020−2021.

Results: A total of 282 students were included in the study. The results indicated that the curricular adaptations implemented for the Basic Manual Therapy [U(E Mdn = 7.7000, N_E Mdn = 7.7000) = 9,286, z = −0.546, p = 0.585] and Clinical Stays I subjects [U(E Mdn = 8.5900, N_E Mdn = 8.4700) = 9,600, z = −0.078, p = 0.938] did not have a statistically significant impact on the acquisition of competencies and learning outcomes when comparing the two groups. Most differences between groups were observed in reflective journaling marks [U(E Mdn =8.300, N_E Mdn = 8.000) = 7770.5, z = −2.796, p = 0.005] and Student Progress item of this Reflective Journaling [U(E Mdn = 9.000, N_E Mdn = 8.000) = 7216.5, z = −3,668, p = 0.000], favoring

the E cohort. In both groups, a low and positive correlation was found between the ordinary BMT mark and the ordinary CS I mark [Rho ($E = 0.206$, $N_E = 0.170$), $p < 0.05$].

Conclusion: While this study has certain limitations, the findings highlight that the non-face-to-face curricular adjustments implemented during the COVID-19 pandemic, as a substitute for in-person teaching, effectively prevented the pandemic from negatively impacting the acquisition of clinical skills. The activities designed in Basic Manual Therapy subject facilitated positive skill development in Clinical Practice for students in clinical physiotherapy stays, contributing to good learning outcomes, especially in the formulation of Clinical History and Reflective Journaling.

Introduction

The health situation experienced in recent years as a result of the COVID-19 pandemic has made necessary to adapt teaching in the university system. In the Degree in Physiotherapy at the European University of Madrid (UEM) adaptations were made to its subjects during the 2019–2020 academic year to ensure the continuity of non-classroom teaching for students during the period of confinement. Adaptations were implemented in training activities, teaching methodologies and assessment systems.

At the time of confinement, the shift from in-person classes to remote classes was a necessity, facilitating the development of collaborative skills and an improvement in students' adaptability (Ferrel and Ryan, 2020; Papalexopoulos et al., 2021) and enabled the development and promotion of telecare of health degrees, research and collaborative work (Rabe et al., 2020). At the teaching level, the ability to adapt and modify content to electronic-learning (e-learning) format was a challenge in order to keep students engaged in their learning, aimed at achieving the educational objectives set (Pock et al., 2020).

There is a wide variety of preferences among different types of learning among students of different health sciences degrees; that has been studied through diverse observational studies: many undergraduate students in Medical Sciences in Teheran, express their preference for face-to-face classes in traditional classrooms over the online method (Shahmoradi et al., 2018). Among Spanish physical therapy students, most of them prefer the combination of classical in-person teaching with e-learning (Escobio-Prieto et al., 2021) known as blended learning (b-learning). In the case of north American dental care students, They consider that their clinical training has been impacted although most students seem to be comfortable with the technological adaptations in their curriculum (Hung et al., 2021).

For this reason, we think it is necessary to analyze the impact of the implementation of the b-learning method in the Physiotherapy degree at UEM on the knowledge and level of competence achieved by students. For this purpose, we have selected the subject Basic Manual Therapy (BMT), a compulsory subject in the first-year, in which students acquire their initial understanding of the basics of

physiotherapy: joint physiology, mobilizations, muscle and joint assessment and palpatory anatomy. In this subject, students are introduced to clinical reasoning, diagnosis and physiotherapeutic treatment.

This subject is a prerequisite for the Clinical Stays I (CS I) course, the initial exposure to real patients that students undergo in the 2nd year, enabling them to apply all the knowledge acquired in BMT.

The CS I course is carried out in different practice centers where students implement their theoretical and practical knowledge. Due to the characteristics of this subject, its evaluation system focuses on three fundamental pillars: clinical practice (considering palpation skills, basic therapeutic knowledge, relationship-communication with the environment, teamwork, interest in progress and critical reasoning), clinical history (evaluating the patient's functional state, setting objectives and treatment planning, result evaluation, recording of information, critical reasoning), and reflective journaling (assessing the student's evolution, reflection and analysis of the experience, contemplation of one's emotions and their management) (Ruiz-López et al., 2015; Martiáñez Ramírez et al., 2016).

It should be noted that the competency design of BMT and CS I is completely aligned, since BMT is a prerequisite course for CS I that is higher-level course. This alignment exists not only at the competency level, but also in the contents developed in both subjects, since they are intertwined. Recent studies highlight the importance of a continuous vision of education, training, and practice, as well as competency development throughout the curriculum (Timmerberg et al., 2022).

Previous studies analyzing the satisfaction of physical therapist students with online methodologies during COVID-19 bring to the fore a lack of fulfillment, perhaps due to insufficient adaptation by lecturers, to the unexpected situation, or due to the loss of understanding of practical content during this time (Zhang et al., 2020; Escobio-Prieto et al., 2021). Authors such as Mącznik et al. (2015) suggest that more studies are still needed to analyze the use of online technologies in teaching and learning in the field of physiotherapy (Mącznik et al., 2015).

This study was carried out with the idea of constantly improving the quality of clinical practices in the physiotherapy degree. Taking

into account that the number of hospitals and places available for physiotherapy students is limited, the possibility of performing part of their clinical training through on-line activities, representing blended learning, may be a good option. Before implementing these methodologies, we wanted to check that the student's competency development would be at least as good as with face-to-face training.

For this reason, the first objective of this study is to evaluate the impact of b-learning developed on curricular adaptations implemented during the COVID-19 lockdown on the acquisition of competencies in the clinical practices, comparing the experiences of the exposed (E) group with those of the non-exposed (N_E) group from the preceding year. To check whether the knowledge acquired in BMT during the 1st year could be transferred to the learning of CS I, the second objective is to correlate the CS I and BMT scores in the E and N_E groups.

Materials and methods

Study design

This is a retrospective cohort study in a sample of physical therapy university students, conducted in accordance with Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (von Elm et al., 2008).

Ethical approval and consent to participate

The study was conducted according to the guidelines of the Declaration of Helsinki, and was approved by the study protocol (CIPI/22.144) by the Institutional Ethics Committee of the European University of Madrid. Informed consent was obtained from all subjects and/or their legal guardians to participate in this study.

Settings and participants

Students were informed about the aim of the study, and an online Google Forms (Menlo Park, CA, USA) survey was emailed to all participants to obtain their informed consent. A total of 282 students provided their consent to participate in the study, of whom 117 coursed Basic Manual Therapy (BMT) subject in 2018–2019 and Clinical Stays I (CS I) in 2019–2020. This cohort of students completed a regular study plan (non-exposed group, N_E). The other 165 students took the BMT subject in 2019–2020 and during 2020–2021 they enrolled in CS I. This cohort underwent curricular adaptation due to the COVID-19 confinement (exposed group, E).

In N_E group, 57% of students were men and 43% were women; 91 of them were born after or in 1996, and 17 students were born before 1997, establishing a line between students younger than 22 and students older than 22. 78% of students were under or equal to 22 years and 22% were over 22 years. On the E group, 45% were women and 55% were men; 135 were born after or in 1996, and 30 students were born before 1997. 82% of students were under or equal to 22 years and 18% of students were over 22 years. Students aged 22 and under, we believe that they will be more trained in hybrid learning, with the figure for both groups being similar.

Regarding socioeconomic status, all students studied at the European University of Madrid, a private university whose annual cost is estimated at €12,000. In this case, we can acknowledge that the majority of the students have a medium to high socio-economic status.

BMT is considered one of the core subject in first course. This course has a theoretical and a practical part. Each part has its evaluation with different tests and the evaluation process involves the expertise of five assessors, all possessing significant experience in the relevant field. The theoretical part contains the study of physiology of movement of the human body through traditional lectures and different activities. The practical part has learning outcomes that are focused on skill acquisition to implement palpatory anatomy, kinesitherapy, patient evaluation tests and preparation of the physiotherapy clinical history. These skills are developed through simulated practices performed by student peers. Because of this, this subject is important to skills acquisition related to clinical practice that will be necessary the next year in the CS I. CS I is taught in the second course. His learning outcomes are related to applying fundamental concepts given in previous subjects as BMT with real patients. In CS I the student has to acquire the skills and knowledge to prepare a treatment protocol and carry it out in the clinical setting, the ability to improve the application of physiotherapy techniques acquired and developed in the simulated practices in BMT, but in this case, with real patients. In addition, another learning outcomes are the capacity of reflection, and the elaboration of the physiotherapy clinical history with the real patient.

Implementation of curricular adaptation

The COVID-19 lockdown involved changing attendance from in-person teaching in the classroom to virtual synchronous teaching for both master classes and practical classes.

In the N_E group practical classes and skills acquisition were based on paired learning where the teacher demonstrated the technique execution and the students repeated it with a colleague under supervision by role playing.

On the other hand, the E group needed curricular adaptations to be implemented. Changes in teaching were based on: transforming in-person learning into e-learning where teachers had to be helped by articulated dolls in order to allow structures to be mobilized and thus facilitate the understanding of the different kinesiotherapy manoeuvres, some demonstration videos on palpation of structures and muscle strength assessment were created so that students could watch them several times and thus reinforce learning, furthermore, technical skill sheets (in palpation, in kinesitherapy, and in diagnostic tests) were created to facilitate the skills acquisition and improve the manual dexterity. During the confinement period, a uniform approach was implemented where each teacher took responsibility for creating home-made models and using skeletons for practical lessons.

In order to ensure equity in access to practical teaching, additional measures were taken. Detailed video recordings were made during the conduct of the practical classes, and these materials were widely disseminated to all students equally. This strategy allowed every student, regardless of the specific group or teacher, to have access to consistent visual and practical content, thus contributing to a uniform learning experience.

In group E students, in-person training was carried out by the teachers in the first semester of the second year, with the aim of complementing the practical training of the student within the b-learning developed. In this way, the acquisition of these learning outcomes was ensured before the start of clinical practice.

In line with learning activities, evaluation should be adapted to the situation. In this sense, the in-person theoretical test had to be transformed into online exams that guarantee the identity of the student. In-person practical exams, which were previously done in pairs with a teacher, had to be done individually and in the form of an online oral exam. The other assessable activities (anatomy worksheets, goniometry activity, etc.) continued to be delivered in the same way.

Outcome measures

Variables analyzed for this study were the global ordinary marks of BMT subject (that includes the theoretical exam, the practical exam, and some evaluable activities); and global ordinary mark of CS I and different evaluable items that take part in this CS I mark: global clinical practice marks (structural palpation skills, electrotherapy and basic therapy knowledge, relationship-communication with patient, relatives, and interdisciplinary team, teamwork, interest in progressing, critical thinking), clinical history (functional evaluation, objectives, assessment of results, recording of results, critical thinking), and reflective journaling (student progress, experiences analysis and reflection, own emotions and how to manage reflection).

The BMT theoretical exam consists of 30 multiple-choice questions scored out of 10 points. The practical exam is evaluated through a rubric that includes aspects of palpation, muscle balance, and passive and active kinesitherapy. This practical exam, in the presential mode, is developed by pairs of students who perform a palpation question, a muscle balance test, a passive kinesitherapy technique and an active kinesitherapy question, in a practical way on the partner's body, while a teacher evaluates the execution of the techniques. The evaluable activities include goniometry, analysis of scientific articles and clinical cases that are scored on a scale of 0 to 10. On the other hand, both clinical practice, as well as the clinical history and the reflective diary and all their items, are evaluated using a rubric from 0 to 10 in which the degree of skills achievement of each item is evaluated. On the other side, the clinical practice items included: skills in palpation of structures, knowledge of electrotherapy and basic therapy (kinesitherapy, bandages, massage) and application to practice, communication with the patient, family and interdisciplinary team, teamwork, interest in progress and critical reasoning. The clinical history items included: critical reasoning, objectives and treatment planning, outcome evaluation, recording information. The items of the reflective journal were: student's evolution, reflection and analysis of his experience and reflection on his own emotions and their management.

All the rubrics used were designed by a panel of experts following a rigorous methodology. The validation process included the following essential steps:

1 Clearly defining the constructs and specific learning objectives for each test, guided by curriculum requirements.
2 Conducting a thorough review of the literature related to the assessed areas to substantiate and support the validity of the tests. The Canadian Assessment of Clinical Performance scale (Mori et al., 2016) was used as a reference for competency acquisition in clinical practice subjects in the physiotherapy program, evaluating aspects such as objective assessment, intervention effectiveness, treatment strategy, subjective evaluation, interprofessional relationships, conflict management, legal/ethical requirements, and communication skills. Additionally, the scale for assessing teamwork, proactivity, and clinical reasoning from the study by Cruz and colleague was utilized (Cruz et al., 2012).
3 Developing test items through consensus, with each item evaluated by experts who assigned scores ranging from 0 to 10. Only items with an average score exceeding 8 were included.
4 Due to the exceptional circumstances and the need to adapt quickly, formal pilot tests were not conducted, and there were no statistical tests of instrument validity and reliability. However, continuous adjustments and improvements were made in response to feedback received during the implementation of the assessment tests.
5 The rubrics were administered individually and following a specific protocol to guarantee uniformity in the application.

Statistical analysis

Measures of central tendency, dispersion and position were used to report the descriptive data. Prior to the inferential analysis, the Kolmogorov–Smirnov test was applied to contrast the hypothesis of normality of the population, and we assumed that data are not normally distributed as p values are less than 0.05. Separate Mann–Whitney U tests were performed to find out differences in BMT and CS I marks between groups (E vs. N_E). Finally, the Spearman's test was performed in each group to verify if there was correlation between the CS I and the BMT scores. A significant difference and correlation were accepted when $p < 0.05$. The data was analyzed with the SPSS statistical software.

Data availability

The data associated with the paper are not publicly available but are available from the corresponding author on reasonable request. If you need more information, you can write to corresponding author: a.bermejofranco@gmail.com.

Results

A descriptive outcome analysis was carried out for the BMT subject in both analysis groups (Table 1). This analysis found that the measures of central tendency (i.e., mean, median, mode, minimum and maximum) are similar between the groups E and N_E to the curricular adaptations by COVID-19. The same occurs for the standard deviation as a measure of data dispersion and for the percentiles as a measure of position. It is important to note that only 25% of the students in both groups achieved a mark above 8.0 points.

On the other hand, in the analysis of the descriptive results for the subject CS I (Table 2) in both analysis groups, it was observed that the

measures of central tendency (i.e., mean, median, mode, minimum and maximum) were similar in both groups. The standard deviation was also similar between the two groups. Concerning CS I grades in the ordinary evaluation, the N_E group had a minimum overall grade of 4 points compared to the E group, which had a minimum grade of 5.4 points. In both groups, only 25% passed the grade of 9.15 points.

According to the results of the Mann–Whitney U test no statistically significant difference was found between median of the groups in the BMT marks [U($E = 165$, $N_E = 117$) = 9,286, $z = -0.546$, $p = 0.585$] and CS I marks [U($E = 165$, $N_E = 117$) = 9,600, $z = -0.078$, $p = 0.938$] (Tables 1, 2).

When comparing the CS I components, there were no statistically significant differences in the Clinical Practice and Clinical History medians between groups ($p > 0.05$) (Table 2). However, there were differences in the Reflective Journaling marks [U($E = 165$,

$N_E = 117$) = 7770.5, $z = -2.796$, $p = 0.005$] (Table 2), as well in item 1 (Student Progress) of this Reflective Journaling [U($E = 165$, $N_E = 117$) = 7216.5, $z = -3,668$, $p = 0.000$] (Figure 1). As can be seen in Table 2, the Reflective Journaling mark of the E group (Mdn = 8.300) was higher than N_E group (Mdn = 8.000), while item 1 mark also was higher in the E group (Mdn = 9.000) than N_E group (Mdn = 8.000) (Figure 1). In item 2 [U($E = 165$, $N_E = 117$) = 8516.5, z = -1.701, $p = 0.089$] and item 3 [U($E = 165$, $N_{NE} = 117$) = 8403.5, z = -1.867, $p = 0.062$] there were not statistically significant between groups (Figure 1).

Table 3 shows the results of the correlations between the ordinary grade of the two subjects in the N_E students. A low and positive correlation ($p < 0.05$) was found between the ordinary BMT marks and the ordinary CS I marks, as well as with the reflective journaling mark, a component of the CS I marks. On the other hand, all items of the clinical practice and clinical history components correlated positively with the ordinary CS I total scores, and this correlation was strong. However, the reflective journaling scores, as well as two of its three items, did not correlate with the ordinary CS I scores.

In the case of E group, a similarly low and positive correlation ($p < 0.05$) was found between the ordinary BMT scores and the ordinary CS I total scores. The BMT scores also correlated with two of the six items of the clinical practice component, and with the clinical history component scores and three of its five items. On this occasion the BMT scores did not correlate with the reflective journaling scores (Table 4).

In this group, also all items of the clinical practice and clinical history components showed a strong positive correlation with the overall CS I scores, while the reflective journaling scores and none of its items correlated with the CS I scores (Table 4).

Discussion

This study reveals that curricular adaptations carried out during COVID-19 pandemic in the E group did not show a statistically significant difference concerning to N_E group. Furthermore, results

TABLE 1 Descriptive results for BMT marks.

		BMT marks	
		Non-exposed group	Exposed group
N	Valid values	117	165
	Missing values	48	0
Mean		7.0845	7.0475
Median		7.7000	7.7000
Mode		4.00	4.00
Std. deviation		1.89167	1.77911
Minimum		3.00	4.00
Maximum		9.85	9.63
Percentile	25	6.2550	6.3500
	50	7.7000	7.7000
	75	8.5000	8.4000

TABLE 2 Descriptive results for CS I marks.

		Non-exposed group				Exposed group			
		Ordinary marks	Clinical practice	Clinical history	Reflective journaling	Ordinary marks	Clinical practice	Clinical history	Reflective journaling
N	Valid values	117	117	117	117	165	165	165	165
	Missing values	48	48	48	48	0	0	0	0
Mean		8.3731	8.503	8.391	7.657	8.4236	8.428	8.507	8.130
Median		8.5900	8.800	8.600	8.000	8.4700	8.500	8.600	8.300
Mode		7.00[a]	10.0	10.0	10.0	9.00	10.0	9.0	9.0
Std. deviation		1.09406	1.1762	1.2708	1.5178	0.98971	1.1309	1.0732	1.3168
Minimum		4.00	4.9	5.0	5.0	5.40	5.2	5.0	2.0
Maximum		10.00	10.0	10.0	10.0	10.00	10.0	10.0	10.0
Percentile	25	7.6700	7.750	7.650	6.500	7.8750	7.700	8.000	7.200
	50	8.5900	8.800	8.600	8.000	8.4700	8.500	8.600	8.300
	75	9.2700	9.500	9.400	8.700	9.1500	9.300	9.300	9.000

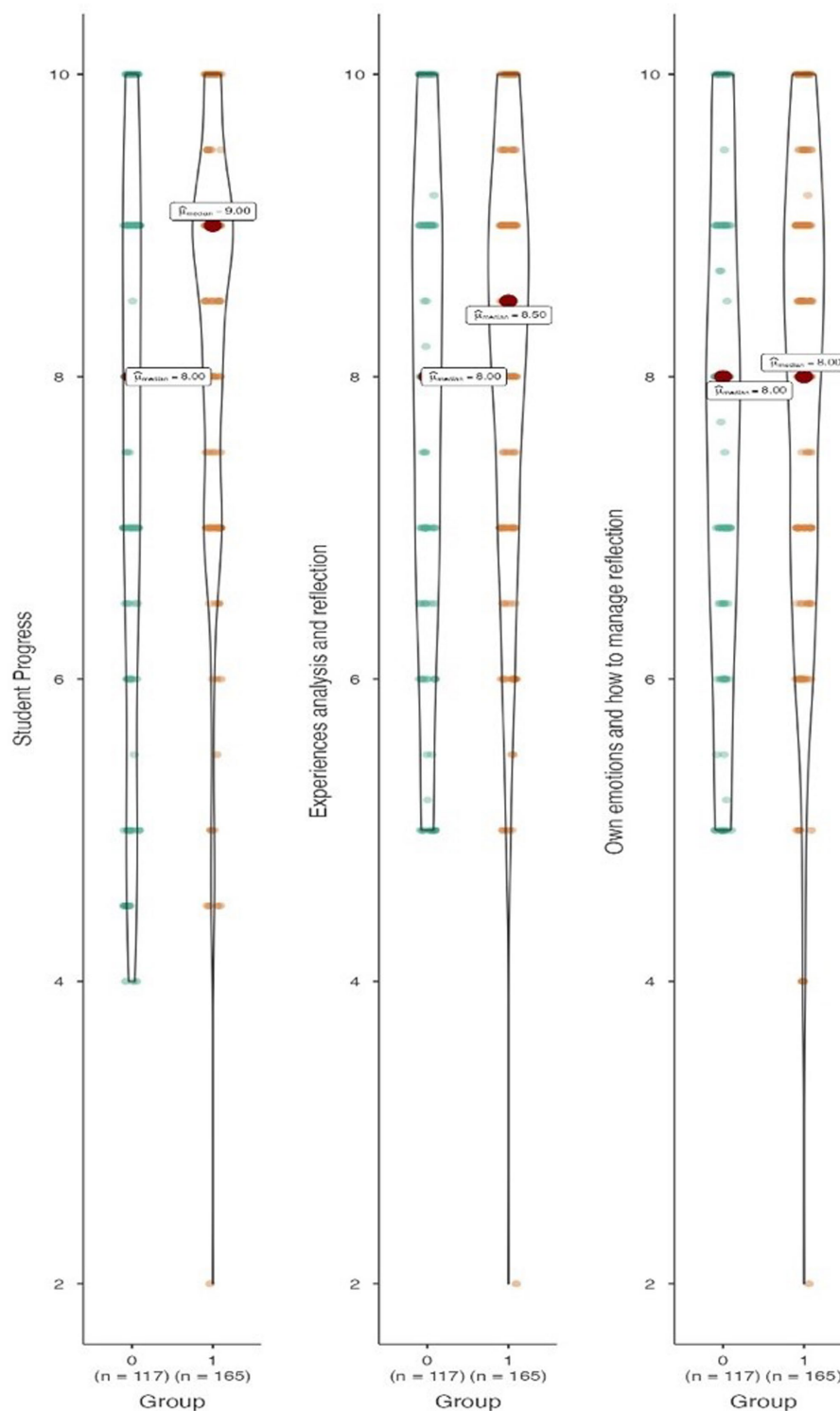[a]Multiple modes exist. The smallest value is shown.

FIGURE 1
Descriptive results for the marks of the reflective journaling items. 0: Non-exposed group; 1: Exposed group.

between marks in both cases (E and N_E group) are correlated between groups in BMT and CS I. It means that in both cases, BMT marks obtained for students have association with the corresponding CS I marks.

When comparing the CS I components, there were no statistically significant differences in the Clinical Practice and Clinical History

medians; however, improvements were found in the scores of the Reflective Journaling marks, as well in item 1 (Student Progress) of Reflective Journaling. The rest of the items did not show statistically significant differences. The statistically significant differences shown in the reflective journal section may be attributed to the E group having slightly higher means than the N_E group, indicating that

TABLE 3 Results of correlations in the NE group (BMT 2018–2019 and CSI 2019–2020).

Spearman's Rho	Non-exposed group			
	BMT marks (*n* = 117)		CS I marks (*n* = 117)	
	Correlation coefficient	Sig. (two-sided)	Correlation coefficient	Sig. (two-sided)
BMT marks	1		0.206	0.026
CS I marks	0.206	0.026	1	
Clinical practice	0.132	0.155	0.951	0.000
Structural palpation skills	0.161	0.085	0.885	0.000
Electrotherapy and basic therapy knowledge	0.155	0.096	0.870	0.000
Relationship-communication with patient, relatives, and interdisciplinary team	0.062	0.51	0.823	0.000
Teamwork	0.119	0.205	0.882	0.000
Interest in progressing	0.142	0.127	0.897	0.000
Critical thinking	0.105	0,262	0.892	0.000
Clinical history	0.17	0.068	0.899	0.000
Functional evaluation	0.178	0.056	0.884	0.000
Objectives	0.16	0.085	0.867	0.000
Assessment of results	0.178	0.056	0.860	0.000
Recording of results	0.145	0.119	0.823	0.000
Critical thinking	0.152	0.102	0.873	0.000
Reflective journaling	0.234	0.011	0.159	0.087
Student progress	0.213	0.021	0.121	0.193
Experiences analysis and reflection	0.228	0.013	0.197	0.034
Own emotions and how to manage reflection	0.203	0.028	0.143	0.124

students may have developed a higher level of reflective character due to the situation.

The reviewed studies describe that COVID-19 and the adopted policies have important effects on health professions education, impacting on aspects such as teaching methods, educational outcomes, health professions education research and the well-being of students, teachers and school (Rabe et al., 2020). However, the present study reveals that no significant differences in student learning were observed in the core subjects of BMT and CS I, but it should be noted that this may have been due to the type of adaptation made in the teaching method and the consequent adaptation of student assessment. Another possible explanation could be that the training was well assimilated and with more consistent time and effort participants might have developed better competency, but it could not be assessed, what could be considered a limitation of the current study (Adje et al., 2023).

Based on these results, authors as Adje et al. (2023), described that including online learning and training as webinars, self-learning sessions assisted by online materials and tasks as we did in E group viewing of videos, the completion of technical skills worksheets and the use of articulated dolls, is used to train and equip participants with knowledge. In our case, we can suppose that b-learning in the BMT subject allowed the development of learning outcomes in group E,

similar to group N_E. This fact suggests that the adaptations made could be correct and adequate for the development of the knowledge and competences required in each of these subjects (Escobio-Prieto et al., 2021).

The students in the E group improved their reflective capacity assessed in the CS I subject compared to the N_E group, as they showed higher scores, both in the overall score of the reflective journaling and in its different items. It could be argued that the adjustments necessitated by the COVID-19 pandemic in training may have impacted the development of competencies associated with reflection. On the other hand, the context experienced by everyone and the harsh reality of the extreme health situation had an impact on mental health, also in students (Rabe et al., 2020; Bermejo-Franco et al., 2022). This fact could awaken the students' search for answers, thus increasing their capacity for reflection compared to the N_E group.

As for the reflective journaling scores of both groups, it is worth noting that there are statistically significant differences between the groups. As mentioned above, and about the descriptive analysis in Table 2, the scores obtained between the different groups vary about a mean of 0.5 points in this evaluable aspect. The reflective nature that the students were able to acquire in the face of an adverse situation such as the one experienced during COVID-19 may have motivated this development in their reflective capacity, which is why

TABLE 4 Results of correlations in E group (BMT 2019−2020 and CS I 2020−2021).

Spearman's Rho	Exposed group (2019−2020)			
	BMT marks (n = 165)		CS I marks (n = 165)	
	Correlation coefficient	Sig. (bilat)	Correlation Coefficient	Sig. (bilat)
BMT marks	1		0.170	0,029
CS I marks	0.170	0.029	1	
Clinical practice	0.106	0.177	0.940	0.000
Structural palpation skills	0.175	0.025	0.874	0.000
Electrotherapy and basic therapy knowledge	0.156	0.046	0.897	0.000
Relationship-communication with patient, relatives, and interdisciplinary team	0.049	0.535	0.848	0.000
Teamwork	0.025	0.748	0.860	0.000
Interest in progressing	0.070	0.371	0.870	0.000
Critical thinking	0.125	0.109	0.884	0.000
Clinical history	0.167	0.032	0.860	0.000
Functional evaluation	0.176	0.024	0.835	0.000
Objectives	0.141	0.071	0.813	0.000
Assessment of results	0.166	0.033	0.795	0.000
Recording of results	0.146	0.061	0.808	0.000
Critical thinking	0.173	0.026	0.816	0.000
Reflective journaling	0.071	0.361	0.092	0.237
Student progress	0.104	0.185	0.116	0.138
Experiences analysis and reflection	0.058	0.457	0.084	0.281
Own emotions and how to manage reflection	0.075	0.338	0.079	0.314

statistically significant differences were observed between the E group and the N_E group. Authors as Pock and colleague described that coronavirus positively impacts on education in general, providing students with experiences that lead to increased adaptability, flexibility and resilience-essential skills for medical personnel that could have influenced these grades (Pock et al., 2020). On the other hand, the increase in the experience of internal tutors could have also influenced the feedback provided to students, potentially positively impacting their reflective thinking (Omer and Abdularhim, 2017; Qureshi, 2017). However, there are different factors that have not been analyzed and it would be advisable to investigate, such as: the student's lack of confidence in their academic tutor, the existing barrier between teacher and student, the type of feedback provided, or the use of specific tools to address areas of improvement related to students' reflective thinking (Tawanwongsri and Phenwan, 2019).

In the N_E group of students, a weak but statistically significant correlation was noted between the BMT score and CS I, particularly in items related to reflection. However, no correlation was observed with items related to clinical practice and clinical history in this instance. It would be expected that, with the simultaneous development of competences in both subjects, the BMT grades would be directly correlated with clinical practice and clinical history; however, this is not the case in the N_E group.

Therefore, an adaptation in the training activities and teaching methodologies entails the need to adapt the assessment systems (Duarte, 2012). Although no significant differences are observed in the grades of the two groups, there is a tendency for the N_E group to obtain slightly lower grades in the final CS I marks. The experience from previous years suggests that in-person assessment systems for the BMT subject are more complex for students, as they have to be assessed in-person with a teacher, as opposed to the possibility offered to the E students to be assessed online, where taking the exam in a secure environment (such as at home) or in front of a device that creates distance from the teacher could have influenced the results. Authors as Hakami (2021) showed better results in the final theory exam of dental students for those groups who take the exam online than those who take it in-person with the same content and assessment test. Studies that analyze the student's psycho-physiological response to in-person tests show that this type of test generates an autonomous anticipatory stress and anxiety response (Ramírez-Adrados et al., 2020). In addition, other studies show that students have a greater preference for electronic tests over traditional paper-based tests (Mahaffey, 2018). Alternatively, authors like Abbasi et al. (2020) explored the perceptions and satisfaction of e-learning among health science students. Their study revealed that a majority of students expressed dissatisfaction with the utility of an e-learning platform for enhancing clinical and technical skills. Nevertheless, additional

research across diverse specialties is essential to comprehensively gauge the influence of e-learning on students' overall performance, encompassing assessments and clinical competency outcomes.

The adaptations made in these subjects during the pandemic increased the activities of clinical cases and online simulated practice, with technological support. This facilitated a seamless adaptation in both training activities and assessment systems, in accordance with recommendations from various authors (Rabe et al., 2020; Escobio-Prieto et al., 2021) provided valuable insights into transitioning to online teaching during the COVID-19 pandemic, emphasizing the importance of not transforming entire lectures into videos.

Similarly, in the E students' group, a significant relationship was found between the scores obtained in the BMT and those achieved in the overall CS I. This relationship is preserved in the clinical history and clinical practice items, but is not maintained in the reflective journaling items. This could because the reflective journaling scores of the E group were significantly higher than those of the BMT subject. The COVID-19 situation may have increased the reflective nature of the students', leading to this lack of correlation between the BMT and reflective journaling scores.

Authors like Nicholls et al. (2016) have emphasized that the primary impact of the COVID-19 pandemic on health profession education institutions focused on psychomotor outcomes in the curriculum, particularly those further developed through clinical practice within CS I. Professions that emphasize skill development, such as physical therapy, encounter more challenges compared to those that concentrate on cognitive outcomes (Tawanwongsri and Phenwan, 2019). The presented results suggest the necessity to strengthen the approach to students' reflective thinking competence in courses preceding the clinical internship, as it directly influences CS I.

This would be the case: our study investigates the outcomes obtained in the physical therapy degree, a profession with a strong practical focus on the development of psychomotor skills and abilities. The results of this study revealed no significant differences between the E group of students exposed to adaptations and those in the N_E group, particularly in the grades obtained in a subject such as BMT, which centers on manual skills and abilities. The observed results in the E group could be attributed to the blended learning (b-learning) approach, incorporating the use of videos, completion of technical skills worksheets, utilization of articulated dolls, and in-person classes where manual dexterity was cultivated before engaging in CS I.

In the early stages of their education, students often require more guidance and supervision from their teachers. As a result, they believe that classes emphasizing practical aspects should predominantly take place in person. This perspective aligns with findings from a study conducted in Australia (Shahmoradi et al., 2018), where undergraduate students expressed a preference for in-person classes over online methods.

Some researchers think that online teaching has presented learning difficulties due to the lecturers' limitations in terms of technical knowledge and the little institutional support provided. The study by Puljak et al. (2020) disagrees, presenting results where the majority of students were satisfied with the exclusive online learning, and the consequent accommodation of the institution's staff. However, in the study by Escobio-Prieto and colleague, the majority of participants preferred the combination of in-person and online learning (Escobio-Prieto et al., 2021). Recent studies support the use of b-learning methodologies as a viable way to develop the clinical competencies of undergraduate students by adapting teaching methods to the context and needs of the students (Ruiz-Ruiz et al., 2023).

In addition to the limitations previously outlined, this study is constrained by being conducted at only one physical therapy school and having a retrospective design. Exploring various curricular adaptations in different schools or conducting a multicenter study could have yielded more diverse and compelling data. Moreover, the findings presented in this study capture only a moment in time. The pandemic context may have influenced the results, considering various factors related to the physical and mental well-being of students and teachers, as well as accessibility constraints to educational resources, among others. On the other hand, despite a rigorous expert validation process of the rubrics used, it would have been desirable to complement this validation with statistical analyses of internal consistency. Despite this methodological limitation, we believe that the instruments had acceptable validity because adjustments were made to the rubrics in response to feedback from students and teachers. The study also faces a significant drawback as it has not examined reliability. It would have been beneficial to assess the consistency and stability of scores across different evaluators (inter-rater), within the same evaluator (intra-rater), and within evaluations of the same students (intra-subject).

To address these limitations and enhance the robustness of future research, it is essential to undertake longitudinal studies. These studies should analyze the differences between b-learning and in-person education systems in terms of students' skill acquisition and their impact on the clinical practice of health professions. Conducting such studies in more controlled settings and prospectively would contribute to improving the reproducibility of the results.

Conclusion

In summary, this study shows that curricular adaptations in teaching (transforming in-person learning into virtual learning where teachers had to be helped by articulated dolls in order to allow structures to be mobilized, demonstrative videos and technical skill sheets to easily the skills acquisition) and evaluation systems (online exams that guarantee the identity of the student) during the b-learning implementation in the BMT subject, conducted amid the COVID-19 lockdown for first-year physical therapy students, did not adversely affect their overall performance in the clinical stays of the second year. The primary differences between groups are associated with the acquisition of reflective journaling skills, showing a stronger correlation with BMT scores in the E group compared to the N_E group, perhaps influenced by the pandemic situation or the blended learning approach, which could amplify the reflective nature of learners. Due to limitations in terms of the validity and reliability of the utilized rubrics, it is advisable to interpret the results cautiously, and decisive conclusions should not be drawn based solely on them.

Contributions to the literature

- Implemented adaptations based on blended learning in the Basic Manual Therapy subject allowed the development of learning

outcomes in group E, similar to group N_E, in physical therapy students.

- Blended learning, based on the use of videos, the completion of technical skills worksheets, the use of articulated dolls and in-person classes where manual dexterity was developed prior to the Clinical Stays I, could be correct and adequate for the development of the knowledge and competences required in the management of the real patient.
- Main differences between groups are related to skills acquisition of reflective journaling items, being more correlated with Basic Manual Therapy marks in E group with regard to the N_E group, perhaps due to the pandemic situation. And it could be due to the blended learning, which could increase the reflective nature of the students.
- Knowing other types of curricular adaptations carried out in other schools or a multicenter study would have provided more interesting data.

Author's note

This paper has been reviewed by antiplagiarism Turnitin program that guarantees the originality of the manuscript.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by European University of Madrid (CIPI/22.144). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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