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Effectiveness of Mind Mapping as an Integrative Teaching Method on Learning Domains among Physiotherapy Students

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KEYWORDS

Mind mapping;

Competency-based education;

Physiotherapy;

Teaching Strategies;

Learning Outcomes;

Integrated Teaching.

ABSTRACT:

Background: Competency-Based Education (CBE) in physiotherapy emphasizes measurable clinical skills, problem-solving, and evidence-based reasoning over rote memorization. However, traditional lecture-based methods often fail to integrate preclinical neuroanatomy with clinical applications, leading to fragmented knowledge and poor clinical reasoning. Mind mapping, a visual and collaborative tool, may bridge this gap by linking anatomy, pathology, and rehabilitation strategies.

Objective: To assess the effectiveness of mind mapping as an integrative teaching method on cognitive, affective, and psychomotor learning domains among final-year physiotherapy students.

Methods: A quasi-experimental, post-test-only educational intervention study was conducted at a physiotherapy institute. Twenty-nine final-year undergraduate students were randomized into two groups: Group A (n=14, traditional teaching) and Group B (n=15, mind mapping). Both groups received teaching on the seventh cranial nerve. Outcomes measured included pre- and post-theory multiple-choice questions (MCQs) and practical assessment scores (Mini-CEX). Feedback on student perceptions was collected through a structured questionnaire. Data were analysed using SPSS v24. Independent t-tests compared inter-group differences, with significance set at $p<0.05$.

Results: The mean age of participants was 21.05 ± 1.25 years, with a female predominance (82.8%). Both groups showed significant improvement in post-theory MCQ scores (p=0.002). However, Group B demonstrated significantly greater gains in mean MCQ score difference (12.94 ± 1.48 vs 6.40 ± 1.34; p=0.00) and post-practical Mini-CEX scores (17.26 ± 0.79 vs 13.20 ± 1.50; p=0.00) compared to Group A. Feedback revealed that 85% of Group B students reported improved visualization of neuroanatomical connections, 80% reported enhanced collaboration and treatment planning, and 78% found the method more engaging than lectures.

Conclusion: Mind mapping as an integrative teaching strategy significantly enhanced theoretical knowledge, practical performance, and clinical reasoning in physiotherapy students. By fostering active engagement and holistic integration of knowledge, mind mapping aligns well with CBE principles. It should be incorporated into physiotherapy curricula for neurorehabilitation training.

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1. Introduction:

Competency-Based Education (CBE) has emerged as a cornerstone of health professions training worldwide, aiming to prepare graduates who are not only knowledgeable but also capable of demonstrating clinical competence in real-world settings. Unlike traditional models that emphasize time-based progression and rote memorization, CBE focuses on the acquisition and demonstration of specific competencies, including critical thinking, clinical reasoning, diagnostic accuracy, communication, and patient-centred decision-making (1,3).

In physiotherapy education, this paradigm shift

is particularly significant. Physiotherapists are frontline providers in rehabilitation and require an integrative understanding of anatomy, physiology, pathology, and therapeutic interventions to deliver evidence-based care. As healthcare becomes more interdisciplinary, physiotherapy students must demonstrate the ability to synthesize knowledge across domains, apply it to clinical contexts, and adapt management strategies to individual patient needs. CBE therefore provides a framework that emphasizes measurable outcomes in the cognitive, affective, and psychomotor domains outcomes that are essential for developing safe, effective, and autonomous practitioners (3,4).

Despite the growing emphasis on CBE, traditional lecture-based teaching remains the dominant instructional strategy in many physiotherapy curricula. While lectures are efficient for delivering large volumes of content, they often encourage surface-level learning, where students memorize isolated facts without developing a deeper understanding or the ability to apply knowledge in novel situations (7).

In neurorehabilitation education, this limitation is particularly pronounced. Neuroanatomy is typically taught in preclinical phases, while clinical neurology and physiotherapy interventions are covered later. This compartmentalized approach results in fragmented knowledge retention. Students frequently struggle to link structural neuroanatomy with functional impairments, and subsequently, to translate these concepts into clinical reasoning and patient management. Passive learning methods may also hinder engagement and discourage the development of higher-order cognitive skills, such as critical thinking, synthesis, and evaluation (13,16).

The seventh cranial nerve, or facial nerve, is a prime example of an anatomical and clinical concept that requires integrative learning. The nerve governs multiple vital functions, including motor control of facial expression, parasympathetic innervation of lacrimal and salivary glands, and sensory innervation for taste on the anterior two-thirds of the tongue. Clinical dysfunctions of the facial nerve—such as Bell's palsy, Ramsay Hunt syndrome, traumatic injury, or iatrogenic damage—pose complex diagnostic and therapeutic challenges, requiring a multidisciplinary approach.

Addressing these challenges requires innovative teaching strategies that actively engage students, promote integration across knowledge domains, and foster the higher-order competencies emphasized by CBE. One such strategy is mind mapping, a visual learning tool that enables students to organize and represent knowledge in a hierarchical, interconnected format (1,2,5).

Mind mapping encourages learners to move beyond rote memorization by creating visual links between concepts, thereby strengthening understanding and long-term retention (2,6,15). In physiotherapy education, mind maps can be used to integrate preclinical knowledge of neuroanatomy with diagnostic reasoning and rehabilitation interventions. Moreover, mind mapping supports collaborative learning, as students often construct maps in groups, promoting discussion, peer teaching, and critical evaluation of ideas. This aligns with the active learning principles that underpin CBE and addresses the shortcomings of passive lecture formats (9,10,20).

Although mind mapping has been widely explored in medical and nursing education, its application in physiotherapy, particularly in neurorehabilitation, remains underreported (9,14,18). Given the critical importance of integrating neuroanatomy, clinical manifestations, and rehabilitation interventions in physiotherapy training, mind mapping offers a promising approach to bridge existing gaps in teaching and learning.

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2. Objectives

The present study was designed to evaluate the effectiveness of mind mapping as an integrative teaching method among final-year physiotherapy students, focusing specifically on the learning domains related to the seventh cranial nerve. By comparing traditional lecture-based teaching with mind mapping, the study sought to determine whether this strategy could enhance theoretical understanding, clinical reasoning, and practical skills in alignment with the principles of competency-based education

3. Methods

Institutional ethical clearance was obtained. Written informed consent from participants This study employed a quasi-experimental, post-test-only educational intervention design. A total of 29 final-year undergraduate physiotherapy students were recruited during the academic year 2024–25 using simple random sampling through the sealed opaque envelope (SNOSE) method. Eligible participants included students enrolled in the final-year curriculum and appearing for the course for the first time.

The study was conducted at a physiotherapy institute. Students were randomly allocated into two groups. Group A (n = 14) received traditional lecture-based teaching on the seventh cranial nerve, while Group B (n = 15) underwent integrative teaching using mind mapping. In the mind mapping sessions, students collaboratively created visual maps linking anatomy, pathology, differential diagnoses, and physiotherapy interventions related to seventh cranial nerve dysfunction.

Learning outcomes were assessed across three domains. In the cognitive domain, theoretical knowledge was measured using pre- and post-intervention multiple-choice questions (MCQs). In the psychomotor domain, clinical and procedural skills were evaluated using the Mini Clinical Evaluation Exercise (Mini-CEX). In the affective domain, student perceptions were collected through a validated feedback questionnaire. *Statistical analysis:* Data were entered in Microsoft Excel and analysed using SPSS version 24. Normality was tested using the Kolmogorov–Smirnov test. Paired t-tests were applied to compare within-group pre- and post-test differences, while independent t-tests assessed inter-group differences. A p-value of less than 0.05 was considered statistically significant.

4. Results

The study included 29 final-year BPTh students (Group A = 14, Group B = 15) with a mean age of approximately 21 years (SD ≈ 1.2). Most participants were female (82.8%), with 2 boys in Group A and 3 in Group B. (Table 1)

Table 1: Demographic Profile of participants

Variable	Group A (n=14)	Group B (n=15)	Total (n=29)
Gender (N) -Boys	**2 (14.3%)**	**3 (20%)**	**5 (17.2%)**
-Girls	**12 (85.7%)**	**12 (80%)**	**24 (82.8%)**
Mean Age (yrs)	**21.0 ± 1.2**	**21.1± 1.3**	**21.05 ±1.25**

Both Group A (n=15) and Group B (n=14) showed significant improvement in post-theory MCQ scores compared to pre-theory scores (p=0.002), indicating that the effectively enhanced theoretical knowledge in both groups (Table 2)

Table 2: Intra-group Analysis of Pre-post Theory MCQ scores of Group A (n=15) and group B (n=14).

Variables	MCQ	Mean (n)	S D	t-value	p-value
Group A (n=15)	**Pre Theory Score**	16.96	±4.51	0.782	**0.002***
	Post Theory score	23.69	±5.85		

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Group B (n=14).	**Pre Theory Score**	14.46	±5.02	0.732	**0.002***
	Post Theory Score	32.40	±3.54		

Group B achieved significantly higher Mini-CEX scores (17.26 ± 0.79) compared to Group A (13.20 ± 1.50) (p=0.00).Group B showed significantly higher improvement in both theory (MCQ) scores and practical (Mini CEX) performance compared to Group A (p=0.00), indicating stronger overall competency gains in Group B. (Table 3)

Table 3: Inter-group Analysis of Mean Difference of Theory Scores (MCQ) And Post Practical Score (Mini CEX) Between Group A And Group B (N=29).

Variables	**Group A (14)**		**Group B (15)**		**t-value**	**p-value**
	Mean	**SD**	**Mean**	**SD**		
Pre Theory MCQ Scores (n)	16.96	±4.51	14.46	±5.02	1.373	0.18
Mean diff. MCQ Theory Scores (n)	6.40	±1.34	12.94	±1.48	-4.84	**0.00***
Post Practical mini CEX Scores (n)	13.20	±1.50	17.26	±0.79	-4.04	**0.00***

A large majority of students reported positive outcomes from the use of mind mapping. About 85% noted improved visualization of neuroanatomical connections, while 80% felt it enhanced collaboration and treatment planning. Similarly, 78% found the sessions more engaging compared to traditional lectures. However, 13% remained neutral or disagreed regarding its role in improving differential diagnosis. Overall, mind mapping was perceived as an effective, integrative, and engaging learning tool. (Table 4)

Table 4: Feedback of participating students in group B (n=15)

Statement	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
1. Mind mapping improved visualization of neuroanatomical connections.	9 (60%)	3 (20%)	1 (6.7%)	2 (13.3%)	0
2. Mind mapping enhanced peer collaborative learning	8 (53.3%)	3 (20%)	2 (13.3%)	2 (13.3%)	0
3. The activity improved clinical reasoning skills.	8 (53.3%)	5 (33.3%)	2 (13.3%)	0	0
4. Helped in better management planning	7 (46.7%)	6 (40%)	2 (13.3%)	0	0
5.Session was more engaging than traditional lectures.	9 (60%)	5 (33.3%)	1 (6.7%)	0	0
6. Activity facilitated integration of theory to clinics	8 (53.3%)	6 (40%)	1 (6.7%)	0	0
7. Improved confidence in handling cranial nerve cases.	7 (46.7%)	5 (33.3%)	3 (20%)	0	0
8. Encouraged critical thinking and active participation.	10 (66.7%)	4 (26.7%)	1 (6.7%)	0	0

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5. Discussion

Theoretical performance of students in Group B, who were taught using mind mapping, significantly outperformed Group A in their theoretical performance scores. This suggests that the integrative nature of mind mapping facilitated meaningful learning by linking disparate concepts into a coherent framework, thus enhancing recall and promoting deeper understanding of seventh cranial nerve anatomy and dysfunction (1,2). As supported by prior studies, concept-based visual tools promote higher-order cognitive processing by encouraging learners to actively construct connections rather than rely on rote memorization (6,8,14).

In practical performance, Group B also demonstrated significantly higher Mini-CEX scores, highlighting the impact of mind mapping on clinical skill acquisition. Visual mapping likely strengthened spatial understanding of neuroanatomical structures and improved the ability to localize lesions, a critical skill in diagnosing seventh cranial nerve dysfunction. Furthermore, mapping exercises encouraged students to align theoretical learning with practical application, thereby enhancing their ability to plan rehabilitation strategies effectively. Compared with the passive nature of traditional lectures, the active and hands-on involvement in mind mapping provided greater opportunities for experiential learning and psychomotor development. These findings are consistent with Hinck et al. (6) and Daley et al. (10), who reported that visual and interactive approaches to teaching improved procedural confidence and skill performance.

Overall, the impact of this study reinforces the alignment of mind mapping with the principles of Competency-Based Education. By integrating the cognitive, affective, and psychomotor domains, mind mapping allowed students to progress from factual recall to applied reasoning and clinical decision-making. Group B participants not only demonstrated improved knowledge and skills but also reported greater confidence in handling cranial nerve dysfunction. This mirrors outcomes from prior studies in nursing and medical education, where mind mapping has been shown to enhance diagnostic reasoning, interdisciplinary collaboration, and problem-solving abilities (9,14,18,19).

Several factors may explain the superior performance of the mind mapping group: Active engagement, where students moved from passive listening to active construction of knowledge; Collaborative learning, where group-based mapping fostered peer discussion and cooperative problem-solving; Visual-spatial reinforcement, where diagrams enhanced memory retention and facilitated application of knowledge; and Holistic integration, which successfully addressed cognitive, affective, and psychomotor domains to provide a well-rounded learning experience (12,15,17).

Limitations: Despite the encouraging findings, certain limitations must be acknowledged. The study was conducted in a single institution with a relatively small sample size (n=29), which may limit the generalizability of results. A post-test-only design restricted the ability to fully assess baseline equivalence between groups. Furthermore, the intervention was applied only to one cranial nerve topic; its effectiveness across broader areas of physiotherapy education remains to be tested. Feedback from students, though valuable, may also reflect subjective bias. Future studies with larger, multi-institutional samples, randomized controlled designs, and longitudinal follow-up would help validate and expand upon these results (11,13,16).

Conclusion: Mind mapping as an integrative teaching strategy significantly enhanced theoretical knowledge, practical performance, and clinical reasoning among physiotherapy students. Its emphasis on visualization, collaboration, and active learning makes it a valuable addition to competency-based physiotherapy curricula, particularly for complex neurorehabilitation topics such as cranial nerve dysfunction.

Future Directions: Extend mind mapping to other neurophysiology and rehabilitation topics, incorporate into routine physiotherapy curricula alongside traditional methods, Explore its role in formative and summative assessments.

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