ORIGINAL ARTICLE

Volume 17 Issue 4 2025

DOI: 10.21315/eimj2025.17.4.12

ARTICLE INFO

Submitted: 03-09-2024
Accepted: 29-07-2025
Online: 31-12-2025

Developing a Mind-Mapping Module for Undergraduate Physiotherapy Students: A Qualitative Study Exploring Perspectives of Physiotherapy Educators

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To cite this article: Dangi AA, Verma CV, Waghule LM, Surve AS. Developing a mind-mapping module for undergraduate physiotherapy students: a qualitative study exploring perspectives of physiotherapy educators. Education in Medicine Journal. 2025;17(4):189–208. https://doi.org/10.21315/eimj2025.17.4.12

To link to this article: https://doi.org/10.21315/eimj2025.17.4.12

ABSTRACT

Mind mapping (MM) has gained prominence in health education because of its visual and interactive approach, which fosters critical thinking, meaningful learning, and long-term content retention. Understanding physiotherapy educators' perspectives on developing an MM training module is essential for identifying key focus areas that can strengthen professional development and academic engagement among undergraduate physiotherapy students. This study explored physiotherapy educators' perspectives on the core components required to design such a module. A qualitative descriptive design was employed. Data were collected in April 2024 through an online focus group discussion conducted via Zoom Workplace Pro, involving seven physiotherapy educators from various institutions across Maharashtra, India. Participants were selected using purposive sampling. The discussion was transcribed verbatim and analysed thematically to identify key patterns and insights. Seven major themes emerged: (a) structuring the MM process for training; (b) application and integration of MM; (c) defining learning objectives and structuring content; (d) module assessment strategies; (e) sequencing module implementation and faculty training; (f) comprehensive integration of MM in the curriculum; and (g) evaluating effectiveness of MM. These educator-informed insights provided the foundation for developing a systematic MM module that addresses both cognitive and affective learning domains while ensuring contextual relevance. The study offers a practical and replicable framework for incorporating MM into physiotherapy curricula, emphasising early curricular adoption, faculty preparedness, phased implementation, and authentic assessment strategies. The findings support the development of a structured, competency-aligned MM module tailored to the pedagogical and clinical learning needs of physiotherapy education.

Keywords: *Physiotherapy education, Mind mapping, Qualitative study, Educator perspectives, Module development*

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INTRODUCTION

Mind mapping (MM) is defined as a "visual, non-linear representation of ideas and their relationships" (1). A mind map comprises a network of linked concepts, where each idea is linked to another. Creating a mind map requires spontaneous reasoning, as the purpose of MM is to establish meaningful associations between concepts—functioning, in essence, as an association map (2). The formal origin of MM dates back to the work of Buzan in the 1970s (3, 4). MM techniques utilise colours, line thicknesses, figures, and illustrations to support memory retention by presenting information vividly and engagingly through the use of keywords (3, 4), as illustrated in Figure 1.

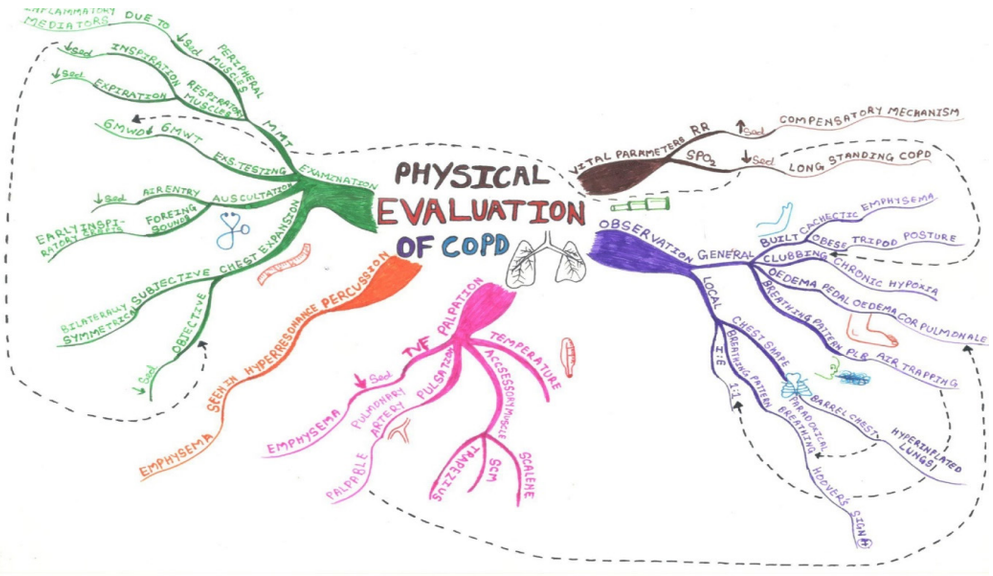

Figure 1: A mind map on physical evaluation of Chronic Obstructive Pulmonary Disease (COPD). The map can be visualised as five primary branches in a clockwise fashion: branch 1, vital parameter assessment, branch 2, observation, branch 3, palpation, branch 4, percussion, and branch 5, examination.

The colourful graphic presentation of mind maps enhances information recall and actively engages students in classroom learning (5). Through interrelated branching, MM connects various knowledge elements and promotes deeper cognitive processing (6). Farrand et al. found that incorporating imagery, colour, or visual-spatial structures in mind maps significantly improved memory retention compared to traditional note-taking in second- and third-year medial students (7), aiding their ability to manage the substantial information load typical in medical education (8). MM has been shown to improve both short-term (9) and long-term memory recall among medical students (10).

Additionally, MM has been found to improve students' critical thinking, information organisation, problem solving, and exam performance (11–13). Wu and Wu (14) found that MM supported critical thinking development in clinical nursing students. Similarly, Seckman and Van de Castle (15) identified mind maps as a tool to promote critical thinking among doctoral nursing students, whereas Yang et al. (16) found that MM was beneficial for reflective learning and critical thinking among nursing students. Turkestani et al. (17) reported similar findings among respiratory therapy students.

Research has demonstrated that MM is an effective teaching method. D'Antoni and Zipp (18) described it as a simple and cost-effective instructional method for classroom utilisation. Boyson (19) emphasised that MM enables instructors to structure logical teaching plans, improve knowledge recall, and increase their teaching confidence. Edwards and Cooper (20) proposed utilising MM to prepare and review lectures, take notes, and update knowledge. Given its wide applicability, MM has been successfully integrated into various health professional programmes, including anatomy (21), surgery (22), microbiology (23), chiropractic education (18), dental education (24), and nursing education (14).

For physiotherapists, critical thinking and clinical reasoning are essential skills for functioning effectively as first-line practitioners (25–27). Trede (28) emphasised that physiotherapists must demonstrate critical thinking, going beyond rigid principles and maintain constant evaluations to benefit patients. Given the benefits of MM for both students and educators, it can serve as an effective educational tool for undergraduate physiotherapy students to enhance their critical thinking, problem-solving, and subject retention. Despite this potential, no structured MM training modules currently exist for physiotherapy students. To address this gap, this study aimed to explore the development process of an MM module for undergraduate physiotherapy students based on the perspectives of senior physiotherapy academicians, gathered through focus group discussions (FGD).

METHODS

Study Design

This study employed a qualitative descriptive approach incorporating FGD and thematic analysis (29, 30). This methodology was selected to gain an in-depth understanding of physiotherapy educators' perspectives on developing an MM module for undergraduate physiotherapy students. FGD was used for data collection (31–33) because they allowed participants to discuss and evaluate their perceptions and experiences of MM (34). The study was reported utilising the Consolidated Criteria for Reporting on Qualitative Research (COREQ) checklist (35) (Appendix 1).

Researcher Characteristics and Reflexivity

Participants were informed about the study's purpose and that the first author would serve as moderator. Participation was voluntary. Although the participants—senior physiotherapy educators from Maharashtra, India—were professionally acquainted with the first author, this relationship did not influence their selection. To mitigate potential ethical concerns, participants were assured that refusal to participate or withdraw at any stage would have no professional consequences. A participant information sheet and informed consent form detailing study procedures, confidentiality, and participant rights were provided in advance. These measures ensured that participants felt respected, autonomous, and comfortable sharing their perspectives without any pressure or obligation. The authors declare no conflicts of interest.

Reflexivity was integral to the research process, given that all authors were physiotherapy educators. The first and second authors possessed extensive experience in professional health education research, while the remaining authors held academic appointments at

the same institution as the first author. An independent qualitative research expert was consulted to provide an external perspective during the theme discussions.

Participants and Data Collection

Purposive sampling with maximum variation was used to recruit seven physiotherapy educators (n = 7) from institutes across Maharashtra, India. The selected participants varied in academic qualifications and professional experience, thereby ensuring the diversity and richness of the data collected (Table 1).

Table 1: Participant details (n = 7)

Characteristics details	Years	n
Gender		
Female		6
Male		1
Age		
Range	41–59	
Median	50	
Educational qualification		
Masters		3
PhD		4
Academic experience		
Range	14–28	
Median	21	
Specialisation		
Neuro physiotherapy		1
Cardiovascular and pulmonary physiotherapy		3
Rehab in hand conditions		1
Musculoskeletal physiotherapy		1
Electromyography and electrodiagnosis		1
Foundation for Advancement of International Medical Education and Research (FAIMER) fellow		
Yes		3
No		4
Designation		
Professor and Head		3
Professor and Principal		2
Principal		1
Professor		1
Familiar with MM		
Yes		7
No		0
Trained in MM		
Yes		2
Partially		2
No		3
Attended workshop/course in MM		
Yes		5
No		2
Using/used MM in teaching schedule?		
Yes		5
Not regularly		1
No		1

The authors used a systematic approach to select participants for FGD. A list of potential participants (principals and professors from physiotherapy institutions in Maharashtra, India) was compiled. During screening, the candidates were contacted through phone calls and email, provided with an informed consent document, and invited to participate in the study. Only those who consented and had prior familiarity with MM were included in the study.

After screening, a final list of seven participants was created. A schedule was finalised for the online FGD, which all participants preferred because of their busy work schedules and locations. Online FGDs are supported by prior research (36, 37) for advantages such as modernity, vitality, and affordability that overcome the traditional challenges of face-to-face FGDs, such as being participant-led, as well as scheduling conflicts and travel (38, 39).

The FGD was conducted utilising the upgraded Zoom Workplace Pro platform. A semi-structured discussion guide was developed, which included opening, introductory, transition, key, and closing questions. The guide was reviewed by two qualitative research experts and modified based on their feedback (Appendix 2). A pilot session was conducted on Zoom with five participants to test the platform features, discussion guide probes, session formats, and moderating roles. A debriefing session with assistant moderators addressed pilot issues.

Three of the authors participated in the final FGD session. The first author facilitated the discussion by utilising a discussion guide, along with probes and prompts. The third and fourth authors provided technological support and recorded field notes. Each session lasted for 75 minutes. Audio and video recordings were obtained with participant consent and stored securely on the first author's Zoom cloud account.

Although purposive sampling with maximum variation was used to capture diverse perspectives, data saturation was achieved during the first FGD session. Saturation was determined through a systematic data review as recurrent themes, ideas, and perspectives consistently emerged across participant responses. Despite their varying academic roles and institutional backgrounds, the participants exhibited a high degree of thematic convergence, with no new insights emerging during the later part of the discussion. This consistency likely stemmed from their shared expertise and familiarity with the topic. Although maximum variation sampling was intended to enhance the transferability of the findings, it did not result in substantial divergence in the core themes, reflecting a collective understanding shaped by their common professional context. Consequently, additional FGDs were deemed unnecessary. Although data triangulation was not conducted because the focus was on exploring expert educators' perspectives, credibility and trustworthiness were ensured through detailed documentation, verbatim transcription, and researcher reflexivity.

Data Analysis

The data were analysed through thematic framework analysis utilising an inductive approach in three phases. In the first phase, a verbatim text transcript was prepared from the FGD audio recordings utilising the Notta App, which converts speech into text. The transcripts were cross-checked with audio recordings to ensure accuracy. Irrelevant data, distractions, and fixed errors were excluded through data cleaning, and the missing text was filled in. The

transcripts were double-checked by the first and last authors, who ensured recordings and transcripts were stored as password-protected files.

During the second phase, the first and second authors read the transcripts multiple times and coded them separately, line by line, by highlighting the text to maintain data credibility. The authors anonymised the excerpts by assigning participant codes prefixed with M for male and F for female. Both authors discussed the generated codes, compared similarities and differences, and concluded when a consensus was reached regarding the differences. The codes improved over time.

During the third phase, all authors met for theme derivation. An external qualitative research expert was invited to obtain the external perspectives. They organised comparable codes into subthemes, which were evaluated and combined to form major themes. All the authors reviewed the themes and relationships to verify that they represented the participants' perspectives and experiences in the MM module development process.

A codebook was created, including each theme, subtheme, codes and corresponding descriptions. Excerpts from the FGD transcript were identified for each code. Data management was facilitated utilising ATLAS.ti (version 23, ATLAS.ti Scientific Software Development GmbH, Berlin, Germany).

Participants received written details about the study's design and objectives. Prior to the FGD, they were informed that participation was voluntary and that they could withdraw from the study at any time without consequences. The participants were assured of the anonymity and confidentiality of their contributions. All participants signed an informed consent form before the FGD.

Trustworthiness of the Study

To maintain trustworthiness and ensure data credibility, coding of the transcripts was performed independently by the first two authors. An external perspective was obtained through a discussion of themes with an invited qualitative research expert who was not directly involved in the research, contributing to accuracy and dependability. All the participants provided demographic information to enhance the transferability of the findings. The first author—who moderated the FGD—received formal training through certified courses and workshops. The moderator was acquainted with the participants, who were senior professors and peers in physiotherapy, and maintained a professional relationship to ensure there were no conflicts of interest. The author's reflexivity established data validity. The authors documented the research process, including the analysis, sampling, field notes, recordings, and verbatim transcripts to ensure dependability and confirmability. Transcripts and results were not returned to the participants for review.

RESULTS

All seven shortlisted physiotherapy educators (six females and one male) aged between 41 and 59 years, with 14 to 28 years of academic experience, participated in the study. Their qualifications ranged from master's to PhD degrees, and they were affiliated with physiotherapy institutions across Maharashtra, India (Table 1).

Thematic analysis of the focus group discussions revealed seven major themes that contributed to the development of a MM training module for physiotherapy education. Each theme is presented, highlighting the module's rationale and design considerations based on the participant inputs.

Theme 1: Structuring the MM Process for Training

Participants characterised MM as initiating a central concept and extending it into hierarchically organised branches. This radial configuration simplifies complex subjects and promotes conceptual clarity. The MM design prioritises tree-like representations and instructs students to identify core themes pertinent to physiotherapy. These insights inform the integration of the MM fundamentals within the module. The MM training module should instruct students in a systematic process, commencing with a central concept and branching into key themes. This structural clarity aids in organising information into coherent visual patterns and enables students to comprehend the content holistically. Consequently, the module should include guided sessions to create radial maps that emphasise connections relevant to physiotherapy topics.

> It is like small chunks of information … should be connected together in the central tree and branch out as per the understanding of the teacher as well as the student. (F2)

Theme 2: Application and Integration of MM

Module development was guided by the MM's adaptability to diverse learning styles and the facilitation of collaborative learning. Educators have highlighted MM's potential of MM to integrate theoretical and practical knowledge through visuospatial and kinaesthetic learning methods. These insights justify blended learning activities and group-based MM exercises in the training module.

> Therefore, using it as a blended tool, and not just as a standalone tool…supporting our practical skills with the relevant theoretical knowledge in the form of a mind map will help in reinforcement, as well as better learning and attainment of knowledge for students.

This module should incorporate MM into academic and clinical learning contexts to demonstrate its applicability in the real world. The participants provided examples of utilising MM to teach about neurological conditions as well as to develop research protocols. These experiences underscore the importance of including clinical case-based exercises and aiding students in organising as well as articulating complex subject matters in theoretical and applied physiotherapy education.

> Just a few days ago, I studied Parkinsonism using mind-mapping. I placed the causes and clinical conditions, clinical symptoms and signs, and treatment on the central theme of Parkinsonism. If you list all the characteristics of Parkinson's, such as rigidity, you should also include the reasons for, what causes rigidity, and how to treat it. Therefore, when we combine that in the form of a mind map, we integrate it practically into the minds of the kids, so when we are teaching them, this is the rigidity and how this is helping, I believe it has a double effect. (F4)

> I have used mind mapping to help students with research protocol writing… They are able to understand all the steps and how to go about doing it using mind maps. (F6)

Theme 3: Defining Learning Objectives and Structuring Content

The participants emphasised the need for explicit task-specific objectives within the MM module. The design should begin with defined outcome-oriented learning objectives covering knowledge acquisition, skill development, and contextual applications. Participants noted that learners should be able to define a mind map, articulate its advantages, understand its usage, and demonstrate its construction abilities. These insights inform the content sequencing from conceptual clarity to practical skills within the module design. Consequently, the training module should incorporate stepwise sessions from foundational theory through guided MM creation to case-based applications aligned with the physiotherapy content. Participants emphasised distinguishing between MM and concept mapping, which requires dedicated theoretical instruction within the module.

> What is a mind map? What are the advantages of our proposed approach? What, and for whom, is this intended? These are specific learning objectives that students should be aware of, when and how they should be used. That is, the knowledge component and then the skills of making it. (M3)

Theme 4: Assessment Strategies for the Module

Participants emphasised that module assessment should include both theoretical comprehension and practical application of MM techniques. This ensures that learners acquire the knowledge and skills necessary for effective utilisation across various contexts. By assessing both aspects, a comprehensive evaluation of learners' MM skills prepares them for use across academic, professional, and creative domains.

> Understanding again becomes cognitive or theoretical. The 2nd dimension of assessment is the ability to create a mind map. (M3)

To facilitate dual assessment, the participants recommended the use of student-generated mind maps, checklists, verbal presentations, and real-world tasks. Creating mind maps was deemed the most effective method for evaluating comprehension and application. Encouraging students to present mind maps reinforces and solidifies their understanding. Using checklists involves evaluating aspects to ensure comprehensive coverage as well as confirming that the required elements, such as central themes, branches, connections, and annotations are present and appropriately linked.

> So, the best assessment would be to ask them to make a mind map. (M3)

> Therefore, let us present a mind map. Because until and unless they can express what they have depicted, I think it does not come to a clear understanding whether it has really gone through…the concept is clear to them. (F2)

> You can have a checklist of the different aspects of having made the mind map, and you can tick off whether they have done all the steps that are required. (F6)

Assessment tasks should include rubric-based evaluations, peer and faculty feedback, as well as application tasks demonstrating knowledge transfer. The emphasis is on authentic, context-relevant formats. These methods assess students' diagram creation and their ability to explain and apply mapped information to physiotherapy.

Participants also emphasised that the module should incorporate formative and summative assessments to evaluate cognitive understanding and the practical application of MM techniques.

Theme 5: Sequencing Module Implementation and Faculty Training

Participants advocated implementing the module in phases, starting with faculty training, followed by student implementation. Educators must first master the MM techniques to ensure effective instruction. Faculty proficiency enables better student guidance and creates a supportive environment in which both groups can effectively utilise the visual learning tool. This approach not only enhances the teaching capabilities of the faculty but also ensures consistency and effectiveness in imparting MM skills to students.

> For delivery, I think first factor should be a module for training the faculty. (M3)

Implementation should begin with clear educational objectives followed by aligned content development. Delivery should involve sequential material presentation and the optimisation of learning through structured instruction. This ensured that each phase supported subsequent phases, fostering effective teaching and learning outcomes.

> I would also say that it will start from formation of the objectives, content development and then we will go on to the rest of the points. (F4)

This justifies a multistep implementation strategy: (a) faculty sensitisation workshops, (b) objective-driven content delivery to students, and (c) post-training reflections and evaluations. This ensures instructional quality and alignment with curricular goals. Participants proposed integrating the module across academic years from foundational sciences through clinical application in later stages.

Theme 6: Comprehensive Integration of MM in Curriculum

This theme emphasises the importance of early and longitudinal integration of MM throughout the curriculum. Participants advocated incorporating MM into the first year of physiotherapy education to build competence over time. The rationale is to align MM with increasing learning complexity across academic years, reinforcing its application in basic sciences and clinical contexts. Introducing MM techniques in the initial years provided students with a valuable tool for enhanced learning. Early exposure enables the gradual development and refinement of MM skills. This approach ensures that by the time students are in final year, they can effectively utilise mind maps to organise, synthesise, and retain complex information. This enabled students to apply MM across subjects, fostering a deeper understanding and retention of interconnected concepts.

> See the basic idea of this module is to make students understand how to use a mind map for their own learning. Therefore, this can be introduced effectively, even early in the curriculum. Why, then, in the first and second years? These anatomical and physiological concepts can be explained using a single mind map. Alternatively, we can collectively teach biomechanics and anatomy by using mind maps. Thus, introducing this early in the curriculum is a process. The process of using mind maps for learning needs to be introduced rather than worrying about individual topics. If they are familiar with the topics, they will use it on their own by the time they reach their final year. (M3)

The development of the affective domain through MM emphasises peer learning, with students creating mind maps in groups, sharing insights, and enriching their learning from diverse perspectives. Group-based MM activities promote teamwork and collaboration, while providing opportunities for students to assume leadership roles. These insights include group tasks, student-led presentations, and collaborative goal-setting exercises to support affective domain development.

> An additional learning outcome that can happen using mind maps and assessment is that asking students to make mind maps in groups will help build up peer learning and develop their team-building skills and leadership skills. Therefore, many affective domain components can also be taught well using mind maps, provided they are used with the objectives in the mind in a very conscious way. (M3)

Theme 7: Evaluating the Effectiveness of MM

Evaluating the effectiveness of MM involves recognising diverse learning styles, as not all students are visual learners. Student feedback is essential for understanding experiences and preferences and helps assess the impact of the module. Based on feedback, mind maps should be adapted to various learning styles and preferences to ensure broader benefits for learners.

> Evaluate the effectivity of the tool by taking feedback from them, because all our learners are not visual learners. Thus, those who enjoy drawing diagrams and remembering their matter will, maybe, be more effectively using mind maps. (M3)

DISCUSSION

This qualitative study examined the perspectives of physiotherapy educators to guide the development of a structured MM training module for undergraduate physiotherapy education. This discussion emphasises how informed design decisions align with contemporary educational frameworks and competency-based physiotherapy strategies.

Educators emphasised the importance of a structured, scaffolded approach to teaching MM, starting with foundational concepts and gradually advancing clinical applications. These insights informed the implementation of a phased module structure wherein content delivery was initiated with basic MM theory, progressing to guided practice, and culminating in authentic clinical tasks. This design aligns with constructivist learning principles in physiotherapy education by emphasising active knowledge construction through contextual learning experiences, as supported by Qasem (40). A phased design facilitates the gradual development of higher-order cognitive skills in Bloom's taxonomy, transitioning from knowledge recall to synthesis and evaluation.

Educators' emphasis on dual feedback during mind map creation within the module, aligns with research exhibiting enhanced effectiveness of multimodal learning approaches. A meta-analysis by Burke et al. (41) confirmed the superiority of dual-modality feedback over single-modality feedback, highlighting the efficacy of visual-auditory or verbal combinations for single-task performance. This provides a rationale for incorporating visual elements (the mind map itself) and verbal components (e.g., reflective discussions and peer critiques) into instruction. This approach may facilitate deeper information processing and retention by engaging multiple sensory channels. Integrating active learning methods into MM activities has shifted the perception of mind maps as static visual tools to utilising dynamic instruments for metacognition and collaborative learning. This aligns with Eppler's (42) observation of the value of reflective dialogue in enhancing conceptual understanding through visual representation. Educators can create an environment that promotes critical thinking and knowledge integration by encouraging students to articulate their thought processes, justifying their map structures, and engaging in peer feedback. This interactive approach enhances knowledge transfer across contexts.

The research participants offered concrete approaches to assessing MM abilities based on the outcomes. They suggested evaluating both the final mind maps and students' reasoning processes and aligning them with authentic assessments in competency-based physiotherapy education. The inclusion of rubrics and presentation-based evaluations corresponds to the mind map assessment framework validated by D'Antoni et al. (8), which focuses on clarity, structure, and conceptual accuracy. These recommendations directly influenced the module's design, incorporating multifaceted assessment tools that not only facilitated learning but also evaluated critical thinking, synthesis, and practical application skills.

The alignment of MM training modules with competency-based education in physiotherapy provides a framework for developing critical clinical skills. By encouraging students to organise complex clinical information visually, MM facilitates the integration of theoretical knowledge with practical applications. This suggests that the module structure should focus on contextualising learning activities within physiotherapy-specific content, such as case-based scenarios and interdisciplinary topics. This methodology aligns with initiatives in health education where MM has been employed to facilitate diagnostic thinking and case synthesis (12, 43).

The implementation of MM in clinical education aligns with Miller's pyramid of clinical competence. Students can utilise mind maps to demonstrate their ability to organise and apply their knowledge to hypothetical clinical cases at the "show how" level. At the "does" level, MM can be utilised for real-time clinical decision-making, enabling students to organise patient data, diagnoses, and treatment options during patient interactions. The module supports the development of functional learning outcomes crucial for physiotherapy practice by integrating MM tasks that simulate clinical reasoning processes, such as developing treatment plans for specific clinical conditions.

A significant finding is the importance educators attributed to feedback mechanisms in MM instruction. They advocated for structured feedback from both students and faculty members to enhance understanding and promote metacognition. Mandouit (44) identified the benefits of feedback on teaching modules, including informing educators about method effectiveness, facilitating teaching dialogue, and providing insights into student challenges. This led to the incorporation of reflective exercises and formative assessment checkpoints into the module. These approaches align with self-regulated learning models utilised in physiotherapy programs to develop learner independence, as noted by Zimmerman (45). The use of peer-led discussions during MM creation aligns with social constructivist theories and enhances communication as well as teamwork—crucial affective skills in physiotherapy practice.

This study's critical contribution lies in advocating the longitudinal curricular integration of MM into early physiotherapy education. Early MM exposure enables students to refine their skills through practice before their final year, helps organise and synthesise information, and supports deep learning. This approach enables MM internalisation rather than isolated intervention as a learning strategy across subjects. Prior research has emphasised the importance of early exposure to metacognitive tools for sustained academic benefit (46, 47). This study highlights the significance of curricular integration, with educators endorsing MM embedding throughout the undergraduate program, from foundational subjects to clinical courses, in alignment with spiral curriculum design principles. While the existing literature documents several studies employing MM in first-year health science courses regarding basic sciences (5, 7, 21, 48), there is a notable absence of long-term study data evaluating the impact of first-year MM on final-year performance.

Faculty training is a critical prerequisite for effective module delivery. Prioritising faculty proficiency in MM techniques ensures a robust foundation for student instruction. This approach provides a supportive learning environment in which both educators and learners can use visual learning tools. This strategy enhances faculty teaching capabilities and promotes consistency in transmitting MM skills to students. This underscores the need for a parallel training program to ensure uniform instruction. The incorporation of faculty sensitisation in module design stems from this finding and aligns with curriculum implementation research, which identifies faculty readiness as the key to instructional success. Faculty development is crucial to effective module delivery. Owing to many educators being unfamiliar with MM techniques, the module incorporates faculty orientation. This aligns with the literature emphasising faculty development in curriculum innovation, particularly in transitioning to learner-centred and competency-driven educational models (49).

Finally, participants highlighted MM's potential to foster soft skills such as leadership, collaboration, and communication. Group-facilitated MM stimulates collaboration and emotional skills, allowing advanced learners to mentor less-proficient peers during mind map construction. Similar perspectives were expressed by Arulselvi (50) in a review study. Based on constructivist learning theory, MM promotes cooperation and idea exchange, and enhances social as well as communication skills (51). These competencies are central to physiotherapy and reflect the affective domain of Bloom's taxonomy. This module addresses affective learning outcomes through group-based MM activities, reflective debriefings, and peer evaluations, thereby complementing cognitive and psychomotor competencies.

This study has certain limitations. First, its generalisability is limited using a single non-probability FGD comprising seven purposively selected academic leaders. However, several strategies have been employed to enhance the data richness, credibility, and transferability. These included ensuring representation from diverse institutions, engaging a trained moderator, allocating sufficient time for in-depth discussions, and collecting detailed demographic information from participants. A second limitation of this study is its focus on academic leaders, principals, professors, and department heads while excluding other stakeholders in physiotherapy education, such as lecturers and students. The inclusion of these voices may have enriched the findings by offering broader insights, thereby capturing a more comprehensive understanding of the educational context.

The study's limitations suggest implications for future research, which should include diverse stakeholder groups, such as students and junior faculty members. Therefore, a larger sample size and multiple FGDs is recommended for future studies. Empirical evaluation of the developed module using a mixed-method approach is crucial for assessing its effectiveness across physiotherapy programmes.

CONCLUSION

This study examined the perspectives of physiotherapy educators to guide the development of a MM training module for undergraduate physiotherapy. These findings provide essential insights for structuring MM, defining precise learning objectives, integrating MM into theoretical and clinical practice, and selecting assessment strategies. Participants highlighted the need for faculty training, phased implementation, and curriculum integration beginning in the early academic years. These recommendations were translated into key design elements to ensure their alignment with the pedagogical needs of physiotherapy education.

Grounded in expert input, this study provides a relevant and practical framework for incorporating MM as a visual student-centred learning strategy within competency-based physiotherapy curricula.

ACKNOWLEDGEMENTS

This study is self-funded. We extend our gratitude to Dr. Medha Deo, M.Sc. PT (Principal of Terna Physiotherapy College, Navi Mumbai, Maharashtra, India) for providing permission and support to conduct the above study. We would like to thank the senior educators in the field of physiotherapy education for their valuable contributions as study participants. We also extend our gratitude to Qualitative Research Expert Dr. Nishtha Mishra (PhD), from Tata Institute of Social Sciences, Mumbai, Maharashtra, India, for helping us during the qualitative analysis process.

ETHICAL APPROVAL

Ethical consent was obtained from the Institutional Ethics Committee (ECARP/2022/63) on 26th August 2022.

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APPENDIX 1

Table A: COREQ (COnsolidated criteria for REporting Qualitative research) checklist

Item no.	Topic	Guide questions/ description	Reported on page no.
Domain 1: Research Team and Rreflexivity			
Personal characteristics			
1	Interviewer/facilitator	Which author/s conducted the interview or focus group?	Page 4 First author conducted the focus group as the moderator.
2	Credentials	What were the researcher's credentials? E.g. PhD, MD	Page 4
3	Occupation	What was their occupation at the time of the study?	Page 4
4	Gender	Was the researcher male or female?	Page 4
5	Experience and training	What experience or training did the researcher have?	Page 4
Relationship with participants			
6	Relationship established	Was a relationship established prior to study commencement?	Page 4
7	Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	Page 4
8	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	Page 4
Domain 2: Study Design			
Theoretical framework			
9	Methodological orientation and theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	Page 4
Participant selection			
10	Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	Page 5
11	Method of approach	How were participants approached? e.g. face-to- face, telephone, mail, email	Page 6
12	Sample size	How many participants were in the study?	Pages 5-6
13	Non-participation	How many people refused to participate or dropped out? Reasons?	Page 6

(*Continued on next page*)

Appendix A (*Continued*)

Item no.	Topic	Guide questions/ description	Reported on page no.
Setting			
14	Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	Page 6
15	Presence of non-participants	Was anyone else present besides the participants and researchers?	Not applicable
16	Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Pages 5-6, Table 1
Data collection			
17	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Pages 6-7, 27-28
18	Repeat interviews	Were repeat interviews carried out? If yes, how many?	Not applicable
19	Audio/visual recording	Did the research use audio or visual recording to collect the data?	Page 7
20	Field notes	Were field notes made during and/or after the interview or focus group?	Page 7
21	Duration	What was the duration of the inter views or focus group?	Page 7
22	Data saturation	Was data saturation discussed?	Page 7
23	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	Page 9
Domain 3: Analysis and Findings			
Data analysis			
24	Number of data coders	How many data coders coded the data?	Page 7
25	Description of the coding tree	Did authors provide a description of the coding tree?	Page 8 A code book was generated
26	Derivation of themes	Were themes identified in advance or derived from the data?	Page 8 From the data
27	Software	What software, if applicable, was used to manage the data?	Page 8 ATLAS.ti software
28	Participant checking	Did participants provide feedback on the findings?	The findings were not shared with the participants
Reporting			
29	Quotations presented	Were participant quotations presented to illustrate the themes/ findings? Was each quotation identified? e.g. participant number	Yes, on pages 9-14
30	Data and findings consistent	Was there consistency between the data presented and the findings?	Yes, on pages 9-14
31	Clarity of major themes	Were major themes clearly presented in the findings?	Yes, on pages 9-14
32	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	No

(*Continued on next page*)

APPENDIX 2

Discussion Guide

1. **Participants' introduction (Opening questions)**
    a. Name
    b. Current designation
    c. Years of teaching experience
    d. Working institute
    e. Since how many years are you using mind mapping?

2. **Participants' experiences regarding development of teaching – learning module/plan (Introductory questions)**
    a. Have you developed a module/plan for a teaching – learning technique? If so, what are your experiences of the same?
    b. What steps did you follow while developing the teaching-learning module/plan? Would you like to share your insights on this?

3. **Participants' experiences regarding mind mapping (Transition questions)**
    a. What is mind mapping, according to you?
    b. Where did you previously use mind mapping? What are the objectives of mind mapping? What specific benefits or uses have you felt regarding learning outcomes with mind mapping? Can you narrate your experiences using mind mapping?

4. **Specific Learning Objectives in mind mapping training module (Key questions)**
    a. What is needed to define Specific Learning Objectives at the beginning of a mind-mapping training module?
    b. Which learning objectives should be defined at the beginning of the mind mapping training module?
    c. How would these objectives help the students during the training?

5. **Content development of the mind mapping training module (Key questions)**
    a. What processes must be followed to develop the content of a mind-mapping module?
    b. According to you, what kind of content/learning materials should be included in the mind-mapping training module for undergraduate physiotherapy students? What are your opinions on including additional training aides/materials in the module?

6. **Assessment strategies within the mind mapping training module (Key questions)**

    a. What assessment strategies and activities should be included in the mind-mapping module? Can you elaborate on this point?

7. **Delivery of mind mapping training module (Key questions)**

    a. What instructional strategies did you use in your teaching schedule? Can you narrate your experience by using the same in your teaching?

    b. What is your opinion about the ideal instructional strategy or method of delivery of the mind-mapping training module to students? Can you elaborate on this point?

8. **Final thoughts (Closing question)**

Is there anything else regarding the development of the mind-mapping training module that has not been discussed previously that you feel strongly about and would want to bring up now?