

## RESEARCH ARTICLE

# Perception of medical students and faculty toward concept mapping as a teaching-learning method in pharmacology

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### ABSTRACT


**Background:** Concept mapping is a proven technique in problem-based learning in many disciplines. This process of making concept maps is widely used along with other teaching methodologies to enhance knowledge with detailed cross-linkage between descriptive knowledge and procedural knowledge. This ultimately leads to enhanced clinical reasoning and decision-making. **Aims and Objectives:** The primary goal was introduced concept mapping to enhance meaningful learning and deeper understanding in the second professional MBBS for teaching pharmacology. The aim was to take feedback from the students and faculty regarding this new teaching strategy. **Materials and Methods:** Faculty and students were sensitized with tool of concept mapping. An interactive session was held followed by random division into five small groups and development of concept maps. The faculty members worked with these small groups as facilitators for this session and helped students in the process. After the session on concept mapping, the feedback was taken from students and faculty on the respective feedback pro forma and evaluated. **Results:** A total of 104 feedback forms were received. About 84.79% of students had positive perception toward the use of concept mapping as teaching strategy. More than three-fourth of students agreed to use this strategy in future classes. However, some raised an issue of time constraint. On an average, 90% of faculty had positive perception toward the use of this strategy. Most of the faculty members raised the concern about lack of time to be devoted to this methodology. **Conclusions:** The results of this study conclude that concept mapping can be used in teaching pharmacology and can enhance meaningful learning and clinical reasoning.

**KEY WORDS:** Concept Mapping; Perception; Pharmacology; Teaching-Learning Method

### INTRODUCTION

Meaningful learning is explained as integration of new knowledge with that of already existing related knowledge, thereby providing motivation to learn. This meaningful learning enhances the confidence of learner over grasp of

knowledge acquired and problem-solving capability.<sup>[1,2]</sup> With the introduction of revised basic Course Workshops by the Medical Council of India, it can be easily interpreted that the scenario of medical education will change with the introduction of principles of adult learning during planning and implementation of new curriculum. To match pace with the changing curriculum and to enhance meaningful learning, a constant change in various teaching strategies is required, with more focus on interactive and student-centered teaching. Further, there is now a shift of focus from traditional medical education to competency-based learning in medical education. With these two major changes in learning environment, there is a need for alternative teaching-learning strategies which can enhance meaningful learning and help students to retain

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vast amounts of information, integrate critical thinking skills, and solve a range of complex problems. One of the innovative strategies that can be added to the armoury can be concept mapping.<sup>[3]</sup>

Concept mapping is the proven technique in problem-based learning in many disciplines and is widely used all over the world right from school education to adult learning.<sup>[4]</sup> This further gives a chance to integrate new information with already acquired knowledge which motivates the learner toward meaningful learning which can be retained for longer and helps in the development of critical thinking skills.<sup>[5,6]</sup> The use of this technique with other teaching methodologies has been shown to enhance knowledge with detailed cross-linkage between descriptive knowledge and procedural knowledge, thereby enhancing clinical reasoning and decision-making.<sup>[6]</sup>

Concept maps are explained as diagrammatic representations with meaningful describing words explaining the interconnection between the concepts, preferably in a hierarchical manner. This is usually done with broader generalized concepts at the top and the specific ones at the bottom with strong propositions used to connect the two.<sup>[7]</sup> The main advantages of using the concept maps in teaching are as follows:

1. Systematic and orderly arrangement of difficult concepts making them easy to understand
2. Identification of the gaps in learning and clarifying misconceptions
3. As an assessment tool

These prove the flexibility of use of this tool in different situations. One of the important points of consideration is the presence of the previous knowledge of the topic to appreciate the interlinking of the concepts and find the gaps in learning.<sup>[8]</sup> The use of this tool can strengthen the concepts in the evolution phase during cognitive structuring of student for learning. Thus, concept mapping might provide a solid tool which can be used on day-to-day basis.<sup>[7]</sup>

Pharmacology is an important subject to build basic concepts of medical management of various disorders. To improve the understanding of interrelated concepts of pharmacology, concept mapping can act as a useful tool. This study was planned to introduce this teaching-learning method in the Department of Pharmacology and to orient the faculty as well as second professional MBBS students toward its use.

## MATERIALS AND METHODS

This prospective, observational study was conducted in MBBS second professional students in the Department of Pharmacology. Permission to conduct this study was taken from the Institutional Ethics Committee before the start of the study, faculty was sensitized with the concept of concept

mapping and proper discussion was held to clarify all the details. The prior consent of the participating faculty was taken after the session. This was followed by designing a plan for successful conduct of the study with discussions with the faculty giving the consent to act as facilitators. The faculty arrived at a consensus to take up the topic of management of arrhythmias for the session. Two separate feedback forms were designed to take feedback. One from students willing to participate in the study as study participants and second from faculty willing to participate as facilitators. The validity of the feedback form was checked beforehand by peer reviewing.

The consent of the students was taken beforehand. Nonetheless, those students who did not give consent to participate were allowed to attend the session on concept mapping. After taking the consent from the students, one session for orientation of the students was held with an aim to develop understanding of the teaching tool. This was followed by the session of interactive lecture of 40 min on management of arrhythmias. The students were randomly divided into five small groups with the help of random number generation online, following which they were given time for the development of concept maps of the given case scenarios of patients of arrhythmias. The first 25 min were given for understanding the case scenario and drawing a comprehensive concept map on management of patient in the given case. The next 10 min were given for discussion of the concept maps in pairs. The next 30 min were given for discussion in a small group allocated to the students. The faculty members worked with these small groups as facilitators for this session and helped students in the process.

After the session on concept mapping, the feedback questionnaire pro forma was distributed to each student who gave informed consent. The students were allowed to fill the given pro forma anonymously and submit it with the department clerk. They were given 20 min to fill the pro forma. The feedback from the faculty was also taken on the respective feedback pro forma. This feedback questionnaire contained 10 close-ended questions for students and eight closed-ended questions for faculty to be answered on a 5-point Likert scale ranging from 1 – strongly disagree to 5 – strongly agree and five and three open-ended questions for students and faculty, respectively, to obtain their perception regarding the use of concept mapping in teaching pharmacology.

Reply to various aspects in the feedback pro forma from faculty as well as student was then evaluated with the help of Microsoft Excel 2007 sheet. Cronbach's alpha coefficient test was used to assess the reliability of the questionnaire pro forma collected from the students. The result of Cronbach's alpha test done with the SPSS version 20.0.0 was calculated as 0.913, thereby representing the reliability of the questionnaire. The results obtained were tabulated in the form of frequencies and percentages.

**RESULTS**

In this study, 110 students and 8 faculty members (including postgraduate students) attended the orientation session on concept mapping and out of them, 105 students and 5 faculty members gave informed consent. Out of them, only 104 returned their feedback questionnaire pro forma. All the faculty members returned the feedback questionnaire pro forma.

There was a positive perception (84.79%) regarding the use of concept mapping as teaching strategy in pharmacology among students [Table 1].

Out of the total, 91 (87.49%) felt that the use of concept mapping enhanced their meaningful learning and led to deeper understanding of the concept, 87 (84.46%) observed that the correlation between already existing knowledge and new information can be established. More than 85% of students experienced generation of interest in the class with almost similar number agreeing to the fact that this method has made the difficult topic interesting.

**Feedback from Students to Open-Ended Questions**

Most of the students felt that the use of concept mapping helped them to enhance learning and understand the concept easily and in a simplified manner. A number of students accepted the linking of the previous knowledge the new information successfully. Many students felt that this will lead to long-term retention of the topic. Many were also of the opinion that concept mapping stimulated their thinking ability. A few also opined that the use of concept mapping helped in correcting their concepts and is a useful tool in revising the topic. This is more beneficial for those having previous knowledge of the topic. Few of the favorable responses are as follows:

“Goes to deeper arenas/concepts that are not comprehended in daily life.”

“Learning happens in fun way and the size of long paragraphs is compressed and can be made interesting.”

“Trains the brain to take decisions quickly and avoid confusion. The situation can be imagined pictorially while making concept map.”

“The pictorial representation in concept mapping helps to place all the concepts and facts related to the topic at one place.”

“Concept mapping leads to better understanding of the topic, not just theoretically but practically too.”

“Since last 1 year, I am unable to understand about concept of arrhythmias but now understanding arrhythmias becomes easy,”

“Very helpful, in making concepts and skill development, enhance quality of learning.”

Few of the other comments are as follows:

“Not so much helpful since it was first experience.”

“Could be used if ample time but not now (Time restriction).”

“It is helpful but time consuming; this can be helpful if used from the start of the session.”

“Somewhat helpful, can be used for few topics.”

“The writing and drawing part has no use in the concept understanding.”

Perception of faculty about the utility of concept mapping is shown in Table 2. All the faculty members agreed to the fact that (1) this tool engaged interest of the students in the class, (2) the process of using concept mapping is clearly understood by them, and (3) this also enhanced the linkage between already

**Table 1: Perception of students about concept mapping**

Questions	Number of responses (n=104)				
	Strongly disagree, n (%)	Disagree, n (%)	Neutral, n (%)	Agree, n (%)	Strongly agree, n (%)
Process to construct clear and well understood	1 (0.96)	0 (0)	18 (17.30)	49 (47.11)	36 (34.61)
Constructing enjoyable	0 (0)	2 (1.92)	21 (20.19)	48 (46.15)	33 (31.73)
Engaged interest in the class	0 (0)	4 (3.84)	11 (10.57)	43 (41.34)	46 (44.23)
Enhance meaningful learning and deeper understanding	0 (0)	1 (0.96)	12 (11.53)	33 (31.73)	58 (55.76)
New information well correlated to already known	0 (0)	1 (0.97)	15 (14.56)	38 (36.89)	49 (47.57)
Use in other pharmacology topics	0 (0)	4 (3.84)	13 (12.5)	45 (43.26)	42 (40.38)
More topics can be taught in other subjects	0 (0)	3 (2.88)	13 (12.5)	36 (34.61)	52 (50.00)
Reasoning skills learnt to help me in everyday life	0 (0)	2 (1.92)	11 (10.57)	32 (30.76)	59 (56.73)
Can be discussed with friends	0 (0)	2 (1.92)	8 (7.69)	48 (46.15)	46 (44.23)
Studying the topic has become interesting after use	0 (0)	3 (2.88)	13 (12.50)	38 (36.53)	50 (48.07)

**Table 2: Perception of faculty about concept mapping**

Questions	Number of responses (n=5)				
	Strongly disagree, n (%)	Disagree, n (%)	Neutral, n (%)	Agree, n (%)	Strongly agree, n (%)
Process to construct clear and well understood	0 (0)	0 (0)	0 (0)	3 (60)	2 (40)
Constructing enjoyable	0 (0)	0 (0)	1 (20)	2 (40)	2 (40)
Engaged interest in the class	0 (0)	0 (0)	0 (0)	1 (20)	4 (80)
Enhance meaningful learning and deeper understanding	0 (0)	0 (0)	1 (20)	3 (60)	1 (20)
New information well correlated to already known	0 (0)	0 (0)	0 (0)	1 (20)	4 (80)
Used in other pharmacology topics	0 (0)	1 (20)	0 (0)	3 (60)	1 (20)
Reasoning skills learnt can help the students in everyday life	0 (0)	0 (0)	0 (0)	2 (40)	3 (60)
Can be discussed with other faculty members	0 (0)	1 (20)	0 (0)	1 (20)	3 (60)

existing knowledge with the newly acquired information. About 80% of the faculty members observed that this tool can be used in future classes for teaching other topics. Most of the faculty perceived this technique to enhance meaningful learning and resulted in deeper understanding of the topic.

### Feedback from Faculty to Open-Ended Questions

Most of the faculty observed that the process of designing concept maps is time consuming and proper orientation and training of the students as well as faculty are required for the further implementation of this methodology. Most of them felt that concept mapping can be incorporated in few topics of pharmacology where the integration of concepts of different systems is required. All of them suggested that the discussion regarding the selection of the topics and implementation of the methodology should be held in the department on regular basis. Further, it was emphasized that this should be continued in future and faculty from other departments should also be oriented toward the utility of this tool. Some of the comments of the faculty are as follows:

“As seen during the class, most the students were found engaged in the activity and during discussion in small group, all the students participated with enthusiasm. The responses given by them and the level of understanding they have achieved after the exercise has motivated me to use this tool in my classes in future.”

“Due to busy schedule and other commitments of the university, it is not possible to include this tool on regular basis. However, after seeing the motivation of the students and enthusiasm shown by them toward discussion and learning, this technique can be used in few pharmacology topics in future.”

### DISCUSSION

As this study was designed to introduce a new tool in teaching-learning methodology in the department of pharmacology and to know the perception of the students as

well as the faculty towards it so that this tool can be used as a teaching-learning strategy in the future. There was a positive perception (84.79%) regarding the use of concept mapping as teaching strategy in pharmacology among students. Out of the total, 87.49% felt that the use of concept mapping helped in enhancement of learning and led to better understanding of the concept. Further, 84.46% were able to form the correlation between already existing knowledge and new information. More than 85% of students experienced gain in interest and acknowledged the fact that this method made the difficult topic interesting. In response to questions regarding the utility of this method, more than 90% of students found this method of teaching and learning as a future prospect to be used in the class for other topics also.

In our study, more than 80% of the students understood the process of constructing a concept map. This is in coherence with a study showing similar percentage of students agreeing to understand the process.<sup>[9]</sup> Almost eight out of 10 study participants found constructing the concept maps enjoyable. This is supported by studies showing almost similar number of students accepting to enjoy constructing concept maps.<sup>[9,10]</sup> This can be seen as an important finding due to the fact that when a person starts enjoying a particular work, it is usually followed by motivation to learn and acquire new knowledge. This can augment further interest in the class which is in agreement with the finding of this study where the same was felt by more than 85% of the students. Almost nine out of 10 students accepted enhancement of meaningful learning and deeper understanding of the topic. The results of this study are in tandem with another study showing similar percentage of students believing in improvement in their learning.<sup>[10,11]</sup> Another study done in subject of biochemistry also concluded the promotion of deeper understanding of the concepts of the subject and improved interlinking of these to medical problems.<sup>[12]</sup> A literature review on utility of concept mapping in medical education also gave the evidence to prove that the use of concept mapping is an effective tool for meaningful learning.<sup>[3,13]</sup> High proportion of students, almost nine out of 10, was able to correlate the new information to already existing knowledge. This is supported by few of the



studies showing similar percentage of students who are in agreement of the statement.<sup>[9,10]</sup>

More than three-fourth of the students exhibited interest in use of this tool for other topics of the subject. This can be attributed to the active learning during the class which helped in the deeper understanding and meaningful learning with the use of graphical organization and representation of information in an integrated and concise manner. Another finding of this study is the belief of almost nine out of 10 students in usefulness of this tool in improving reasoning skills that are used in daily life. More than 90% of students observed that concept maps can be discussed with the friends. This is in concurrence with the studies which also concluded that the use of concept mapping achieves higher level of thinking and improves reasoning skills.<sup>[14,15]</sup> All these findings are in agreement with the previous study with similar percentage of students exhibiting interest in use, improvement in reasoning skills, and scope of discussion with friends.<sup>[9]</sup> Majority of the students and all the faculty members had overall positive perception regarding this tool. Majority of the students perceived that this tool can enhance their understanding of the subject by helping them retain the knowledge for longer periods of time, thereby providing lifelong learning. The positive perception of the students could be attributed to the orientation session toward this tool which might have eased the use of this tool during the actual conduct of the activity. This can further be attributed to the improvement in reasoning skill with the development of deeper understanding and meaningful learning as concluded in many studies. However, it must be considered that a few of the students reported that they were not benefitted by this tool and this tool is time consuming. Very few of them also found it as confusing and difficult to understand. They suggested that this should be used from the beginning of the course. All the faculty members were of the opinion that the process of constructing and using this tool is well understood and this tool relates the previous knowledge with new information. Almost all the faculty members showed interest in future use of this tool in their classes and discussion about this with their colleagues.

### Limitations

Due to limited availability of time, only one topic of pharmacology was taken in a session. The evaluation was done as percentage of total because only one method of teaching was used and that limited the use of elaborate comparative statistical analysis. The study lacked the exploration of long-term effects of this tool. Further, this study is a questionnaire-based study and depends on the responses of the participants. There are chances of favorable response out of fear, leading to bias. This study was conducted in a single department and in one medical college only. This also limits the extrapolation of the results of this study to other departments and colleges. The data of open-ended questions were not evaluated in detail.

## CONCLUSIONS

Concept mapping can be used in medical education as a teaching-learning strategy to teach the subject of pharmacology. With the introduction of this tool in the department, there is scope of making the concepts of pharmacology easily understandable. There is a further scope of enhancement in critical thinking and clinical reasoning with successful integration of various concepts in day-to-day practice which will lead to the development of decision-making skill in actual clinical practice. This can go a long way in shaping the future of the medical students. Further, this can be used for long-term retention of knowledge, thereby converting our students into lifelong learners. The long-term impact of this study might lead to the use of this method for the comprehensive management of patients on regular basis as a lifelong learner.

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