

# Effectiveness of Mind Mapping as an Active Learning Tool among MBBS Phase-1 Students in Biochemistry

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## Abstract

**Introduction:** Mind mapping, an active learning tool facilitates student learning but remains underutilized in medicine. The present study was conducted with aim of assessing the effectiveness of mind maps as an active learning tool to augment learning in biochemistry and perception of students and faculty of the same.

**Methodology:** Present cross-sectional study included phase-I medical students ( $n=140$ ) from BLDEA Shri B M patil medical college. Participants were randomized into study and control group by using computer generated random numbers and intervened by use of mind mapping and conventional assignments respectively. Student performance was measured using multiple choice questions with a maximum score of 25. Feedback was collected from the students as well as the faculty was analyzed.

**Results:** The mean scores in pre and post test of study group -I and control group-I were (12.19, 12.75) (12.14, 11.73) respectively. After Cross over, the mean scores in the pre and post tests of the study (II) and control groups (II) were (14.98, 16.10) and (14.7, 15.96) respectively. Data was analyzed and compared by Wilcoxon signed rank test and were statistically insignificant in the group -I but highly significant in group-II. Student feedback on mind maps had high positive ratings for longer retention (90%;  $n=126$ ) and better time management (70%,  $n=98$ ). The staff perceived that mind maps are helpful when applied for large information as in the medical curriculum (87%) and made students responsible for individualized learning.

**Conclusion:** Our study concludes that learning to learn becomes more important when there is larger information to be retained as well as analyzed as in medical curriculum and can be effective in making learning abstract concepts as in medical biochemistry more enjoyable and helps integrate basic concepts with other specialties.

It also facilitates lateral thinking and longer retention of concepts which would further help them manage time and to fare better in examinations.

**Keywords:** *Mind maps, Active learning, Medical Biochemistry, lateral thinking, conceptual integration.*

## Introduction

Medical universities offer anatomy, physiology and clinical biochemistry in the first year of the medical

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course. Most of the teaching-learning happens through the traditional mode through didactic lectures, tutorials and practicals<sup>1</sup>. This has been the predominant mode of teaching since the inception of universities. Traditional lecturing defined as "...continuous exposition by the teacher" basically infers that the student activity is limited to taking down the points put across by the lecturer or may be limited to asking desultory and random clarifications or questions to the instructor<sup>2</sup>. This teacher centric or "teaching by telling approach" is now being challenged by a more student centric mode of instruction which is more benefitting to the construction

of understanding by the students<sup>3</sup>. The concepts in biochemistry effectively help in understanding the basis of diseases and also in interpreting various investigations requested for the diagnosis or prognosis of the patients<sup>4</sup> but Practicing physicians as well as most of the medical students do consider that learning biochemistry is irrelevant and does little to help their daily practice of medicine<sup>5-7</sup>. Medical biochemistry should incorporate students' previously learned knowledge with medical applications and fill in the gaps with new knowledge<sup>8</sup>. This can be achieved by Active learning method which compel the students to do tasks that help indeed learning, to think about what they are doing and also assimilate the information. Active learning is best defined as any instructional method that engages students in the learning process. It strives to involve students in the learning process more directly than in other method and it incriminates them in an activity besides just passive listening<sup>9</sup>. It is the need of the hour to make a paradigm shift from the conventional teacher centered approach to an active, student centric learning experience which will promote reflection, knowledge constructing, inquiry, analytic and critical thinking capacity of the learners. The notion of employing mind maps as an active learning tool will prove to be an ingenious technique to promote student learning<sup>10</sup>. The above method exploits the presentation form of radiant thinking and the inspiration for this strategy hypostatized from the notebooks of Leonardo da Vinci<sup>11</sup>. With the application of mind mapping to learning, ability of student for logical analysis is enhanced. Integration of the left brain capacity in rationalizing and creativity, art and memory endowed with the right brain can be maximized. Adult learners stand for enormous benefit in using Mind maps<sup>12</sup> but remains underutilized in medical education<sup>13</sup>. The magnitude of information that medical students are assumed to master is voluminous<sup>14</sup> and the present need to make the process of teaching-learning evidence based prompted this study.

**Aim:** To document the effectiveness of mind mapping in learning biochemistry among the first year medical students.

### Objectives:

1. To assess the attitudes of students and faculty regarding mind mapping as an active learning tool using a feedback questionnaire.
2. To assess the effectiveness of mind mapping to augment the students' learning in biochemistry.

**Methodology:** The present cross sectional study was carried out in BLD (deemed to be university) Shri B M Patil medical college hospital and research centre, Vijayapur over a period of one and half month from august to September 2018. This activity was approved by the university's institutional review board (IRB) and bears the clearance no: BLDE (DU)/IEC/328/2018-19.

The MBBS phase I (140) students were randomized into study group (I) and control group (I) by using the computer generated random numbers. Both the groups were tested for the chosen topics before their exposure to the learning method by a pre test on MCQs (Multiple

Choice Questions) for the chosen topics for a maximum score of 25. This activity was developed as a complementary to the small group teaching activity done during the semester.

The study group (I) was exposed to a detailed 40 minute session of hands on information regarding the origin of mind mapping. They were also trained to construct them for important concepts using characters, symbols, lines, colors, numbers, pictures and keywords for the chosen topics. The idea that mind maps support critical thinking, deep learning, and is creative was also stressed upon before the planned activity was encouraged. In order for the students to demonstrate their understanding of the concepts in a particular topic, assignments for constructing mind maps were administered to the study group (I). The study group (I) was asked to construct mind maps according to Buzan's guidelines: the minds' radiation of thought is reflected by the branches of the mind map, key words are used to represent ideas; color is used to highlight and emphasize them. Related thoughts are in the same color creating clarity to enhance recall.; and images, symbols and codes are used to highlight ideas and stimulate the mind to make connections<sup>15</sup>. The control group (I) were given the conventional assignments of practicing the topics in a question –answer format to complete.

Students maintained reflective journals to register the process of constructing their mind maps on the very same day and to contemplate on the benefits of it. At the end of the assignments both the groups were observed by a post test comprising MCQs for a maximum score of 25. The scores were tabulated for all the students on their performance before and after the intervention. To test the effectiveness a crossover of the groups was done, after the cross over, the study group (I) formed the control

group (II) and the previous control group (I) was the study group (II) for the second set of selected topics. The entire process of intervention was repeated and the pre and post test scores for both the groups were tabulated and compared for statistical significance. At the end of study, a feedback was obtained from the students and faculty<sup>16</sup> regarding the perception of mind mapping as a learning tool in biochemistry. The questionnaires were reconstructed for this study based on the available literature and were validated before use. The students' questionnaire consisted of nine questions rated on a Likert scale with five response categories, strongly agree to strongly disagree to capture the intensity of their feelings for a given item<sup>17</sup>.

### Results

The study participants (n=140) were between the ages of 17 to 20 years. When inquired, approximately all the participants have had past college experiences predicated in a traditional passive learning style, while

ten percent (n=15) students expressed their familiarity with mind maps and its usage but to a limited extent.

The mean and SD of the scores in the pre and post test of both groups (I) and group (II) were compared by Wilcoxon signed rank test as the distribution was not normal. The mean scores of the study group (I) after the mind mapping activity (12.75) were comparatively more than their mean scores in the pretest (12.19) though statistically insignificant, whereas the mean scores of the students in the control group (I) who had exposure to the conventional small group teaching (11.73) were lower than that scored in pretest (12.14), and also statistically insignificant. After the Crossover, the mean scores of the study group (II) after the mind mapping activity (16.10) were comparatively more than their mean scores in the pretest (14.98) and highly significant, whereas the mean scores of the students in the control group (II) who had exposure to the conventional small group teaching (15.96) was also higher than pretest mean score (12.14) and statistically significant

**Table 1: Mean and SD of Pre and post test scores of each group (I)**

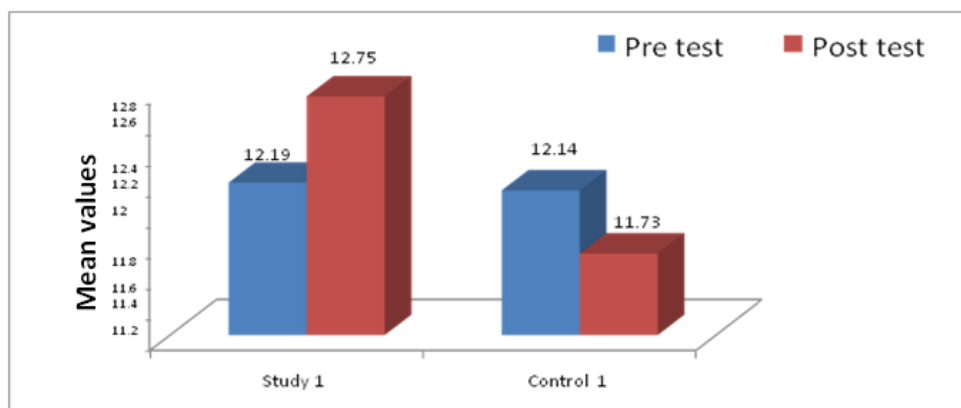
	Pre Test (I)		Post Test (I)		Wilcoxon Matched Pair Test	
	Mean	SD	Mean	SD		
Study (I)	12.19	2.558	12.75	2.119	P=0.136	NS
Control (I)	12.14	2.940	11.73	1.934	P=0.359	NS

NS: Not significant; significance at 5% level of significance (p< 0.05)

**Table 2: Mean and SD of Pre and post test scores of each group (II) after crossover.**

	Pre Test		Post Test		Wilcoxon Matched Pair Test	
	Mean	SD	Mean	SD		
Study	14.98	2.287	16.10	2.001	P=0.0023	HS
Control	14.77	1.77	15.96	1.681	P=0.0003	HS

HS: Highly significant; significance at 5% level of significance (p< 0.05)



**Figure 1: Comparison of Mean score of Pre and post test of each group (I).**

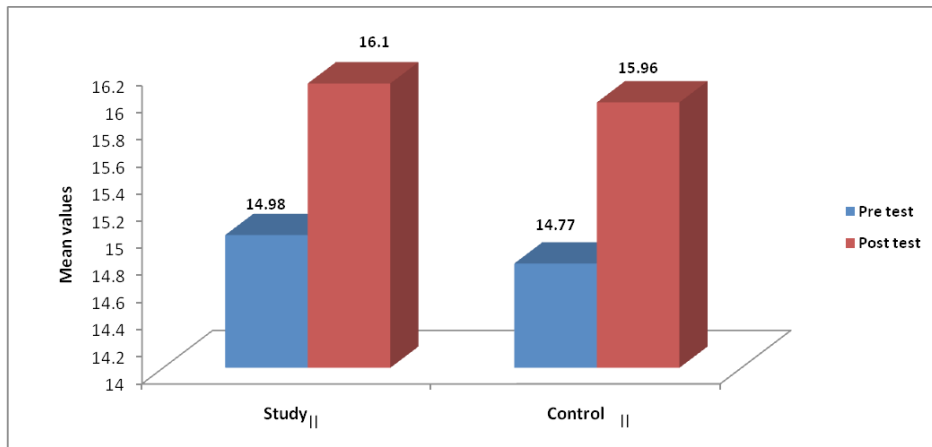


Figure 2: Comparison of Mean score of Pre and post test of each group(II) after crossover.

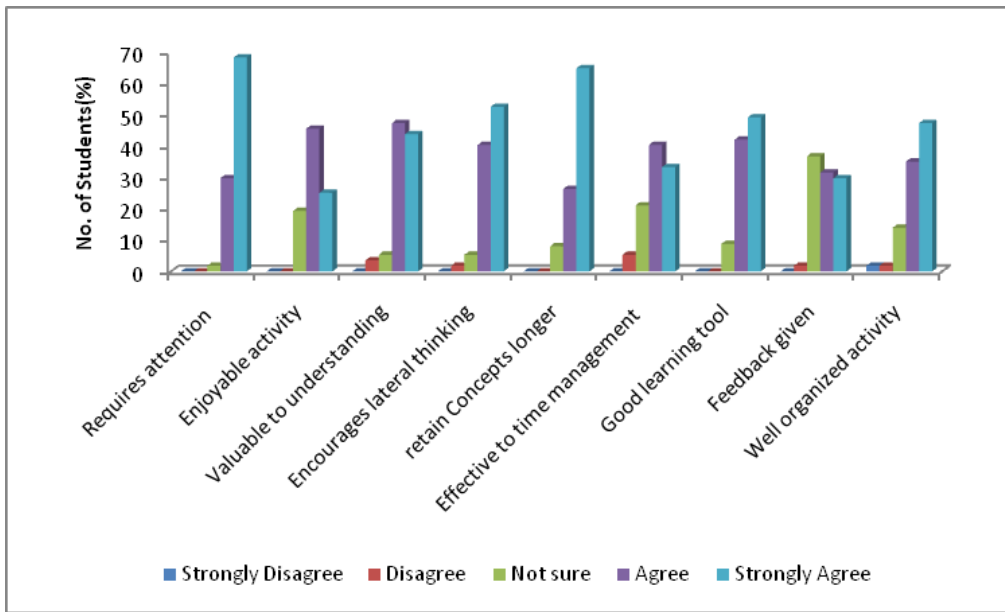


Figure 3: Student feedback on the mind mapping activity

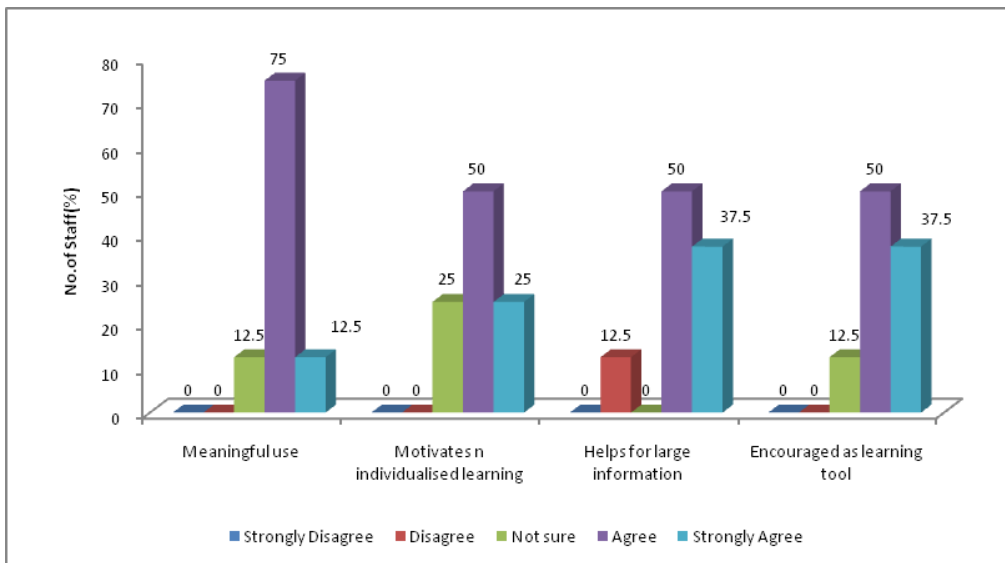


Figure 4: Staff feedback on the mind mapping activity

Ninety-two percent (129) of all students agreed that mind mapping requires increased attention and is equally enjoyable even when they applied it for topics which they previously detested. The staff also stated that the students made meaningful use of the activity. Ninety percent (126) of the participants also related that the concepts were retained much longer with the use of their mind map ideas. Seventy percent (98) of the study group felt that mind mapping was good for effective time management, around ten percent (14) disagreed. Seventy five percent (7) of the staff found that the students were motivated for construction of mind maps which made them responsible for individualized learning. Eighty seven percent staff (8) also felt that mind mapping helps specially when applied for large information and should be encouraged as a learning tool. Analysis by results suggests that mind mapping is an effective learning strategy in the population studied.

### Discussion

All the MBBS phase I participants implemented mind mapping as an active learning strategy to achieve their specific learning objectives. Some students were anxious of building their own mind maps, and others required an extra week to construct the mind maps.

Buzan<sup>18</sup> in his seminal work identified that radiant or central thinking is promoted by the use of mind map and it enhanced the multiplicity of the brain. The students opined that the present activity of mind mapping the biochemistry concepts helped them to explore the concept in detail and also its key associations in a standardized, colorful and also in a logical manner. They also found themselves exploring and understanding the concepts of a particular topic. Picton C<sup>19</sup> also found that the students' ability to describe their critical thinking process and graphic representation of the concepts was enhanced by reflection which was agreed by our study participants. The staff favorably perceived that students made meaningful use of the mind mapping activity in learning biochemistry concepts. A study by Davies also confirms that learning is facilitated when the information is actively processed, visually and pictorially as in mind mapping of the concepts<sup>20</sup>. Students have also expressed that mind mapping encouraged team building with their peers, was interesting, stimulating, and also promoted their learning<sup>21</sup>. Students expressed that mind mapping the concepts taught during lectures were comparatively more enjoyable (Sixty five percent) and particularly beneficial to integrate the subject concepts with other

specialties and were also retained longer which would further help them to fare better in examinations and manage their time well. The staff also observed that the study group did not lose interest while deliberating the biochemistry concepts and shared their experiences about the mind mapping activity with enthusiasm. All the students built different mind maps on same concept which made each mind map different and some had better clarity. The reason for this could be multifactorial as participants were novice and inexperienced in constructing mindmaps.

### Conclusion

Our findings are in line with many studies<sup>16,18,22</sup> corroborate the fact that the Mind maps help students remember information, as they individualize the information and create a mental picture which is easier for the mind to reflect and recall but some have documented both positive as well as negative outcomes<sup>22</sup>. Furthermore, mind maps are observed to be effective in creating learning environments which makes the students desirous to learn and recreate the information which is helpful for the learning process<sup>23</sup>. In view of the aforementioned benefits, there is a need for teachers to include the briefing of the mind map technique so that the students have a meaningful learning than just dispense the information memorized and this is corroborated by conducting such qualitative studies.

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**Conflict of Interest:** None.

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