Journal of Research in Medical Education & Ethics
Vol. 2, No. 3, November, 2012, pp 194-199

DOI: 10.5958/j.2231-671X.2.3.037

PUB: 147/2012

RESEARCH ARTICLE

Reinforcing Learning of Vitamins by mind Maps

Ashakiran S[1]*, Krishna Murthy N[2], Deepthi R[3], Prabhavathi K[4], Ganesh G[4]
*ashes27@rediffmail.com

ABSTRACT: Background: 'Vitamins' are clinically and academically important chapter, which is ideal for expressing as a mind map. Objectives: A group activity was conducted to reinforce learning with the three main objectives, as follows: to organise a group activity for making mind maps on each vitamin; to assess the effectiveness of learning vitamins by using mind maps; and to identify the strengths and limitations of mind maps as a learning material. Materials and Methods: One hundred and fifty students of MBBS 1st year (2010–11 batch) were divided into 14 groups. Each group randomly chose a vitamin. Effectiveness in improvement of knowledge from the activity was tested by using pre-test and post-test questionnaire. A feedback on various aspects about the activity was taken and analysed. Results: Overall pre-test scores were 5.92±1.63 and post-test scores were 8.95±0.87 with a significant improvement ($P<0.001$). Students strongly agreed that such activity promoted meaningful learning, contributing towards reasoning and improvement in communication skills. They felt mind maps were a good revising tool and created interest in learning. Conclusion: Expressing vitamins through mind maps are an effective means for meaningful learning. It created interest in learning and was found to be a good revising material.

Keywords: Evaluation, Group activity, Mind map, Students, Vitamins

INTRODUCTION

Learning strategies, such as mnemonics, charts and maps, are thinking tools that students can use to actively acquire information. In the process of learning that involves higher-order thinking, an extraordinary pattern of neural networks gets activated in the brain. During such process, when students perceive and construct patterns, learning happens.

The amount of information that medical students are expected to master is undoubtedly voluminous. Hence, many learning strategies, like service learning, role playing, reflective learning, the critical incidence conference, videotaped vignettes, preceptorship and concept mapping, are used in medical education that may help students learn, think critically and ultimately integrate information.[1] These learning strategies may differ in efficacy and applicability; they are all based on a conceptual framework called the constructivist theory of learning, which states that meaningful learning, or learning with understanding.[2]

One such learning strategy that is underutilised in medical education is mind mapping.[3] Mind-mapping learning activities enable students to create a visual representation of the relationships between ideas or things and offer an intermediary step between the web of information in the brain and an expository representation of that information. Mind maps are multi-sensory tools that not only help medical students organise, integrate and retain information, but also make it a note-taking strategy, which facilitates critical thinking. D'Antoni[4] describes it as one strategy that helps students to master the tsunami of information presented in medical school.

The inspiration for the mind map strategy arouse from the use of visuo-spatial orientation to integrate information from the notebooks of Leonardo da Vinci.[5] Mind mapping was developed by Tony Buzan; Buzan advocated the application of mind mapping in various daily activities, including writing, as it can develop student's creative writing skills and help remove writer's block.[6]

[1]Professor, Department of Biochemistry, [2]Professor and Head, Department of Biochemistry, [3]Assistant Professor, Department of Community Medicine, [4]Post-Graduate, Department of Biochemistry, Sri Devaraj Urs Medical College, Kolar, Karnataka, India

For several centuries in learning, brainstorming, memory, visual thinking and problem solving, pictorial methods for recording knowledge and modelling systems have been used by educators, engineers, psychologists and others. A mind map is a diagram used to represent words, ideas, tasks or other items linked to and arranged around a central keyword or idea. Such maps are used to generate, visualise, structure and classify ideas. Such creative materials can be employed as an aid to studying and organising information, solving problems, making decisions and writing.[7] In simple terms, it can be stated that it is a creative and logical means of note-taking–note-making that literally 'maps out' your ideas. It is a wonderful exercise that converts a long list of monotonous information into a colourful, memorable and highly organised diagram that works in line with brain's natural way of doing things.

The five essential characteristics of mind mapping are: the main idea, subject or focus is crystallised in a central image; the main themes radiate from the central image as 'branches': the branches comprise a key image or keyword drawn or printed on its associated line; topics of lesser importance are represented as 'twigs' of the relevant branch; and the branches form a connected nodal structure.[8]

'Vitamins' are one among the key chapters included in the syllabus for 1st year MBBS students in biochemistry subject. Its importance extends both for examination and application in clinical practice. In this chapter, each vitamin is presented in a stereo-typed manner. Authors of recommended text books discuss each vitamin under the headings as history, chemistry, sources, recommended dietary allowance, biochemical functions, deficiency manifestations and its other implications.[9] Teaching the chapter on vitamins in didactic lectures also proceeds in a similar fashion. Our aim was to make an innovation in learning 'vitamins' among students by application of elements of creativity and personal involvement. To reinforce learning, the concept of mind map was introduced with the objectives being: to organise a group activity for making mind maps on each vitamin; to assess the effectiveness of learning vitamins by using mind maps; and to identify the strengths and limitations of mind maps as a learning material.

MATERIALS AND METHODS

Participants in the activity were the 1st year MBBS students (2010–11 batch) of Sri Devaraj Urs Medical College, constituent institution of Sri Devaraj Urs Academy of Higher Education and Research, Kolar, Karnataka, India. On completion of syllabus on the chapter 'Vitamins' by didactic lectures, it was proposed to these students that the department would organise a 'Mind Map' group activity on vitamins. An informed consent was taken from all the students, who expressed their desire to participate in the activity. Institution Ethical Committee clearance for the activity and the study was also obtained. The activity was planned for three successive days in the evening, after the regular class hours as per the following schedule.

Day 1: A lecture cum demonstration for 30 min explaining the mind-mapping concept, examples, advantages and disadvantages was conducted. The total strength of 150 students was divided into 14 groups according to their register numbers. A lottery system was used to choose one vitamin by a group. A member from each group was invited to pick a lot in which the name of the vitamin was mentioned. Following this, 10 pre-test multiple choice questions on that particular vitamin was administered to that group of students.[10] Over the next 24 h, students in each of their groups were instructed to gather information on the chosen vitamin and plan an outline of their activity to be performed the following day.

Day 2: In a large hall, which could easily accommodate about 200 students, an arrangement to carry out mind map group activity was made. Each group was provided with a working table, a white chart sheet and one textbook of their choice. Reference textbooks from the department library were made available on request. The students performed the activity by creating a 'mind map' on the vitamin they had chosen on the previous day. Time allocated for completion of the group task was 1 h. Following the submission of their mind maps, a post-test was conducted using the same pre-test

questions. All the 14 mind mapped vitamins were judged on the criteria of 'Mind Map Rubric'[10] by two judges, an Associate Professor from the Department of Community Medicine and a Consultant Nutritionist, working in the same institute. Assessment of each group's activity was devised such that all the components of activity were given equal importance. Total score for the activity was evaluated for 100 marks, which had been distributed as follows: 50 marks for attendance on each of the 3 days (10 marks x 3 days), 20 marks for average of pre-test and post-test scores in each group (10 marks for pre- and 10 marks for post-test) and 50 marks by judges (25 marks x 2 judges).

Day 3: One student of each group gave a 5-min presentation, highlighting their idea of expressing the vitamin by mind map and emphasising key points of that vitamin. A structured feedback form having a 4-point scale response based on Likert's technique for measurement of attitudes was collected on various components of the activity.[11,12] The feedback form also had one multiple response question to know the benefits of mind maps on vitamins. Coefficient of reliability of feedback questionnaire was calculated by applying Cronbach's alpha, which gave a score of 0.71. Following this, three prizes, i.e., 1st, 2nd and 3rd prize, were awarded as an incentive during the valedictory session, in appreciation and encouragement for the student's active participation [Figures 1, 2 and 3].

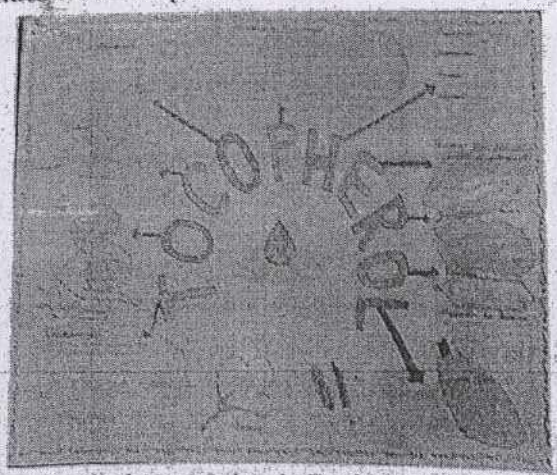

Figure 1: Mind map of vitamin E, which secured 1st prize

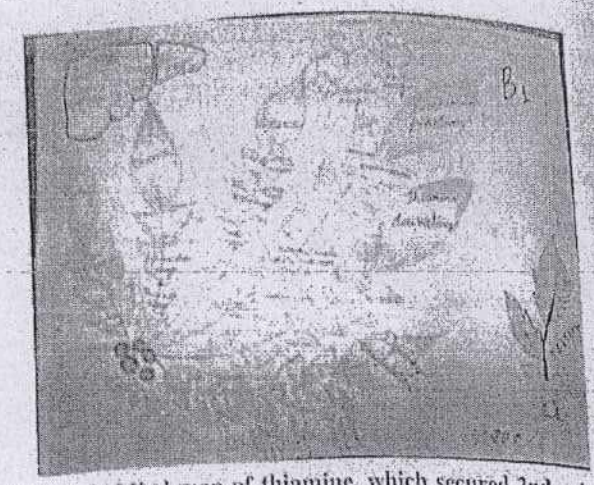

Figure 2: Mind map of thiamine, which secured 2nd prize

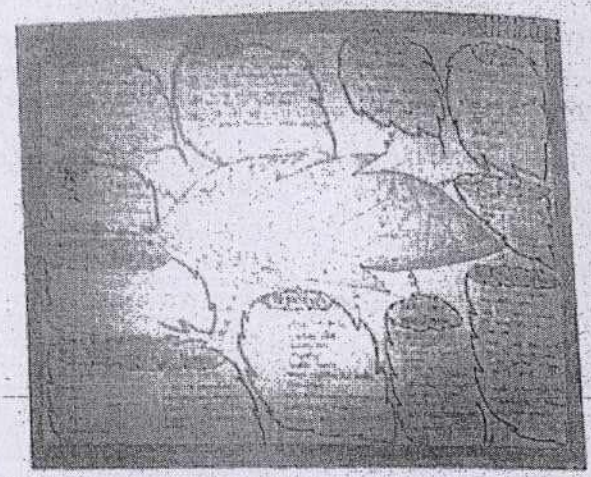

Figure 3: Mind map of folic acid, which secured 3rd prize

Statistical analysis

Mean pre-test and post-test scores in each group were compared using paired *t*-test. Analysis of feedback of 4-point response scale was done and its response was expressed in percentages.

RESULTS

Participation of students on each day of the activity was 91 students attended the day 1 activity, 115 attended day 2 activity and 100 students attended day 3 activity.

There was significant improvement in post-test scores compared to pre-test scores. Overall, mean pre-test score was 5.92 and post-test score was 8.94 [Figure 4].

Figure 4: Mean pre-test and post-test scores of groups

Only 2% of the participants found that the orientation class on mind maps was not helpful. Majority of students (99%) found working as a group useful [Table 1].

Of the 100 respondents, 68 students admitted that mind maps are good revising tools. Forty-six admitted that they aid in active learning [Table 2].

Table 2: Responses to benefits of mind map on vitamins

Response criteria	Percentage of responses, % (*n*=100)
Good revising tool	68
Aids in active learning	46
Learning the concepts	30
Increase in confidence on topic	19
Attaining note-taking skills	17
Acquiring knowledge in depth	10

Table 1: Student's feedback on various components of mind map activity

Criteria	Response (*n*=100)				
Orientation class on 'Mind map'	Extremely helpful (*n*=12)	Helpful (*n*=60)	Somewhat helpful (*n*=26)	Not helpful (*n*=2)	No response (*n*=0)
Mode of choosing vitamin by each group	Nicely done (*n*=46)	Fairly done (*n*=30)	Satisfactorily done (*n*=21)	Not done fairly (*n*=3)	No response (*n*=0)
Environment provided to carry out mind-map activity	Very comfortable (*n*=27)	Comfortable (*n*=52)	Somewhat comfortable (*n*=15)	Uncomfortable (*n*=5)	No response (*n*=1)
Utility of reference materials provided during the activity	Extremely helpful (*n*=17)	Helpful (*n*=60)	Somewhat helpful (*n*=18)	Not helpful (*n*=5)	No response (*n*=0)
Value of contribution of member in the group	Extremely good (*n*=9)	Good (*n*=53)	Satisfactory (*n*=29)	Bad (*n*=8)	No response (*n*=1)
Working together as a group	Totally enjoyed (*n*=30)	Enjoyed (*n*=53)	Somewhat enjoyed (*n*=16)	Not at all enjoyed (*n*=1)	No response (*n*=0)
Marking pattern and incentives for mind maps	Great idea (*n*=13)	Good idea (*n*=67)	Idea was ok (*n*=18)	Bad idea (*n*=2)	No response (*n*=0)
Utility of exercise towards meaningful learning	Strongly agree (*n*=20)	Agree (*n*=72)	Disagree (*n*=8)	Strongly disagree (*n*=0)	No response (*n*=0)
Necessity of software on mind map	Extremely necessary (*n*=18)	Necessary (*n*=47)	Somewhat necessary (*n*=21)	Not necessary (*n*=14)	No response (*n*=0)

DISCUSSION

Learning vitamins by mind maps is an innovative teaching–learning method, which has an ability to create interest among students.[13] Such a group activity gives an opportunity for total involvement by the students during the learning process. Only 60.66% (91/150) of students attended the introductory day. The various reasons, when introspected, could be: this was one of the first such activity held for students and may be they needed little bit of prior motivation regarding the usefulness of such activity and the activity was scheduled after the regular class hours, which made most students residing in hostels easier to attend, but majority of day scholars, however, could not participate.

However, communication among the students themselves could motivate a few more students among various groups to participate on second day in the preparation of mind maps. Attendance improved with 24 more students taking part on day 2 with 76.66% (115/150). However, on day 3, due to similar reasons as mentioned above, attendance was only 66.66% (100/150).

The overall pre-test score was 5.92 and improvement in the performance by the activity was clearly reflected by the post-test score of 8.94 ($P<0.001$). On individual group analysis to check for the improvement in the knowledge by group activity, all 14 groups showed improvement. However, except for the two groups, statistically significant improvement was attained in 12 groups. This clearly indicates the learning benefits derived from group activity and the student's involvement in the preparation of mind maps.

Feedback reflected that majority of students appreciated orientation class, division of groups and environment provided to carry out group activity. A total of 77% felt that the reference materials provided during the course of their activity was helpful. They expressed that contribution from the members in the group was valuable and they totally enjoyed working in a group, expressing about the dynamics of group activity. A total of 80% of students appreciated the idea of marking pattern and incentives given. Majority of students strongly agreed such activity can be utilised for promotion of meaningful learning contributing towards reasoning and improvement in communication skills.[14] A total of 65% of students felt that software was necessary for making such mind maps, which would ease them to carry such activity. Feedback clearly reflects the student's appreciations towards most of the components about such an activity. It is evident from their attitude that the students enjoyed to learn by working as a group. However, few students (8%) expressed frankly that the contribution from members of their group was far less than expected. In total 14% of the students expressed that the use of software for making mind maps was not necessary.

A total of 68% of responses were obtained stating that such mind maps prepared by them would benefit them as a good revising material. Students fairly appreciated that the activity did create interest in active learning and learning the concepts. Similar type of responses was obtained by studies done using mind maps in undergraduate medical education.[15,16] Such positive student's perception, benefits derived and active participation in mind map technique encourages teachers to use them regularly for many such topics.

CONCLUSION

Designing and providing a platform to learn vitamins by a means of mind map group activity was an innovation in teaching–learning–evaluation process. Feedback clearly reflects the effectiveness of learning vitamins by means of group activity. Better performance in the post-test scores indicates articulating vitamins in the form of mind maps was an effective tool for active and meaningful learning. Also it replicates that mind maps created interest among students and reinforced learning. They expressed mind maps would serve as a revising material.

ACKNOWLEDGEMENTS

We thank Dr. Anil N.S., Associate Professor, Department of Community Medicine, Sri Devaraj Urs Medical College, Kolar, Karnataka, India, and Mrs. Madhavi Reddy, Consultant Nutritionist, R.L. Jalappa Hospital, Kolar, Karnataka, India.

REFERENCES

1. Vacek JE. Using a conceptual approach with concept mapping to promote critical thinking. J Nurs Educ. 2009; 48: 45–8.
2. Bodner GM. Constructivism: A theory of knowledge. J Chem Educ. 1986; 63: 87.
3. D'Antoni AV, Zipp GP, Olson VG, Cahill TF. Does the mind map learning strategy facilitate information retrieval and critical thinking in medical students? BMC Med Educ. 2010; 10: 61.
4. D'Antoni AV, Zipp GP, Olson VG. Inter-rater reliability of the mind map assessment rubric in a cohort of medical students. BMC Med Educ. 2009; 9: 19.

5. Gelb MJ. How to Think Like Leonardo da Vinci: Seven Steps to Genius Every Day. New York, NY: Dell; 1998.
6. Buzan T, Buzan B. The Mind Map Book. London, England: BBC Books; 1993.
7. Wikipedia [homepage on internet]. Mind Map. Available from: http://en.wikipedia.org/wiki/Mind_map [Last accessed 12 March 2012].
8. Buzan T. The Mind Map Book. Penguin Books, New York, USA. 1996.
9. Vasudevan DM, Srikumari S, Vaidyanathan K. Textbook of Biochemistry for medical students. 6th edn. New Delhi: Jaypee Publishers; 2011. 379–410.
10. Harkness, SJ. Student Assessment. Pre-Test/Post-Test and the Accumulation of Knowledge Across Sequential Prerequisites [serial on internet]. Sept 2005. Available from: http://www.allacademic.com/meta/p40270_index.html [updated March 2011, cited March 2012]
11. Likert R. A Technique for the Measurement of Attitudes. Arch Psychol. 1932; 140: 1–55.
12. Maurer T, Andrews K. Traditional, Likert and simplified measures of self-efficacy. EducPsychol Meas. 2000; 60: 965–73.
13. Farrand P, Hussain F, Hennessy E. The efficacy of the mind map study technique. Med Educ. 2002; 36: 426–31.
14. Mento AJ, Martinelli P, Jones RM. Mind Mapping in Executive Education: Applications and Outcomes. J Manag Dev. 1999; 18: 390–416.
15. Amila W, Nimali W, Osuka K, Isurujith L, Indika K. Effectiveness of mind maps as a learning tool for medical Students. South East Asian Journal of Medical Education. 2007; 1: 30-2.
16. Rendas AB, Fonseca M, Pinto PR. Toward meaningful learning in undergraduate medical education using concept maps in a PBL pathophysiology course. Adv Physiol Educ. 2006; 30: 23–9.

Received: 07.01.2012
Accepted: 08.08.2012