Original Article ISSN (O):2395-2822; ISSN (P):2395-2814

Analysis of Bangladeshi Medical Undergraduates Ability to Retain Anatomical Information by Using Mnemonics.

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Received: May 2019
Accepted: May 2019

ABSTRACT

Background: Anatomy forms the fundamental base for the medical undergraduates during the earlier period of MBBS course. It is a vast subject and it always needs some specialized approach to teaching-learning. For easier retrieval of recalled anatomical information, medical undergraduates use different mnemonics. But the effectiveness of different mnemonic techniques like 'Rhyme' and 'Storytelling' has not been addressed systematically. **Methods:** This cross sectional analytical study was conducted in the Department of Anatomy, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh from March 2017 to February 2018 and sample was collected from two public medical colleges in Dhaka City. Total 93 first year medical undergraduates of both sex were selected and divided into three groups ('Rhyme', 'Storytelling' and control) in the 'memory tests' on Neuronantomy. The effectiveness in memorizing anatomical information was determined and differences between effectiveness detected by comparing the performances of medical undergraduates. **Results:** Judging by the performances of the medical undergraduates, 'Rhyme' was found significantly more effective in memorizing anatomical information than 'Storytelling' and control group. **Conclusion:** The idea regarding the effectiveness of specific mnemonic techniques should be helpful in deciding on where and how to use or avoid the use of mnemonics according to their actual potentials.

Keywords: Mnemonics; Rhyme; Storytelling; Medical undergraduates.

INTRODUCTION

Anatomy is a vast subject which provides an introduction to the structures of the human body. Anatomy has its own language for describing the organization and structures of the human body and also needs an intellectual attempt to identify different structures, their internal organization and relationships with other structures of the body.[1] This vast subject that raises the necessities of some specialized approach to teaching-learning. But in recent times, period allotted to studying Gross Anatomy in medical courses has been reduced in Bangladesh as well as in abroad.[2] Although there may be genuine points in favor of this reduction in time, lesser time often make students take shortcut methods to learning. It noted that there are two ways to learning: Deep and surface approaches.

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One of the surface approaches to learning is memorizations that includes memorizing facts and information and recall them later while answering questions.[1] Although understanding is the best way to remember anatomical information but large amount of anatomical information is still needed to be learned through memorization. A way of memorizing information so that it can be retained within the brain for a longer time and recalled more easily in later times is using various 'mnemonic' or memory devices.

Mnemonics are learning strategies for encoding information with the purpose of making it memorable. Thus, efficient retention and retrieval of the information is the goal of using mnemonics.[3] The word 'mnemonic' was derived from an ancient Greek word, 'mnemonikos', meaning 'of memory or relating to memory'. It is also related to 'mnemosyne' or remembrance, the name of the goddess of memory in Greek mythology.[4] There are various types of mnemonic devices; these are broadly divided into 'organizational' and 'encoding' devices. In 'organizational mnemonics', one has to associate or

relate memory units of information which at first appear unrelaed.[5] Some of the most commonly used familiar mnemonic techniques are 'Acronym', 'Acrostic', 'Rhyme' and 'Storytelling'. However, not much is formally established about the beneficial outcome of different mnemonic techniques. It has been claimed that mnemonics work better due to their meaningfulness, organization, association, visualization and attention. But scientific evidence are very inadequate, especially considering the variety of factors that may be involved for each, and also taking into account the specific field of Anatomy.[6] Objective analytical assessment of performances of the Bangladeshi medical undergraduates in memorizing anatomical information should also contribute significantly to the effectiveness of different types of mnemonics. For the present research, only two ('Rhyme' and 'Storytelling') of above mentioned techniques were analyzed to determine the effectiveness.

MATERIALS AND METHODS

This was a cross-sectional analytical study that involved determination of effectiveness of two mnemonic 'techniques' in memorizing anatomical information as well as comparing such effectiveness between them ('Rhyme' vs 'Storytelling') through analyses of performances of medical undergraduates in 'memory tests'. This research was carried out in the Department of Anatomy, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from March 2017 to February 2018 and data were collected from first year medical undergraduates of both sex of two public medical colleges in Dhaka city, who were not exposed to "Head and Neck" or "Central Nervous System and Eyeball" cards in their course curriculum. However, foreign students were excluded from the research. This research was conducted according to guideline of Helsinki Declaration and after getting ethical clearance from the Institutional Review Board (IRB) of BSMMU.

Memory test techniques:

1. Mnemonic techniques was used to devote the textual form (i.e. organizational scheme) in which an anatomical mnemonic was organized with a target of helping learners in memorizing one or more (a set of) anatomical information.
Example: Information Mnemonic Technique
Branches of the arch of aorta BCS Acronym

In this example, the 'technique' called 'Acronym' has been used. Mnemonics have been categorized into different 'techniques' as outlined by Bellezza and others. These include 'Rhyme', 'Storytelling', 'Method of Loci', 'Peg-word', 'Acronym', 'Acrostic' and 'Link'.

2. Rhyme is a saying that has similar terminal sounds at the end of each line. Example of a 'Rhyme' mnemonic is-

Rhyme
'Innervations of the diaphragm' - C 3, 4, 5 Keep the diaphragm alive".

3. Storytelling, here a story is created where each word or idea to be remembered cues the next idea that needs to be recalled. Example of a 'Storytelling' mnemonic is-

Storytelling	
'Nerve root values' for two reflexes of the lower limb- "One day, the class teacher at our Rifles School called four of us and gave us different sorts of tasks- why, we never knew. She told Roll numbers 1 and 2 to redo our shoelaces. Roll Numbers 3 and 4 were asked just to kick on a closed door".	Ankle jerk: ankle flexes downward- S 1, 2 Knee jerk: knee extends forward- L 3, 4

4. Mnemonic groups: Each of these groups was comprised medical undergraduates sitting in a particular line in a classroom during the conduction of 'memory tests'. Each group was given a number of set of text, each sets comprising anatomical information on a topic and a mnemonic for memorizing that information. Later, the group was asked questions on each set. Thus, there were two mnemonic groups ('Rhyme' and 'Storytelling').
5. Control (non-mnemonic) groups: Each of these groups was comprised medical undergraduates sitting in a particular line in a classroom during the conduction of 'memory tests'. Each group was supplied with sets of anatomical information and questions identical to those for a corresponding pair of 'mnemonic groups' but was not provided with any mnemonic technique for memorizing the information. Thus, there was one control for above mentioned 'mnemonic groups'.
6. Memory tests: The term 'memory test' is a general one. Numerous types of memory test are in practice for assessing the memorizing ability of individuals regarding auditory, visual or tactile information of different sorts for different purposes and for different ages. Here, 'memory tests' were designed to determine the effectiveness of mnemonic 'techniques' ('Rhyme' and 'Storytelling') of medical undergraduates in memorizing anatomical information.

It may be noted that two 'techniques' of anatomical mnemonics were selected to determine their effectiveness in memorizing anatomical information and compare the effectiveness between the member groups of the pairs. Details of the

grouping of the participants and the comparison plan are shown in [Table 1].

Table 1: Grouping of the participants and plan for comparing different groups of participants for the score in the 'memory tests'

Group*			Comparison plan
B	B1	Rhyme (mnemonic)	B1 vs B3
	B2	Storytelling (mnemonic)	B2 vs B3
	B3	Control (non-mnemonic)	B1 vs B2

*B represents the one pair of mnemonic groups and corresponding control (non mnemonic) group.

Each control (non-mnemonic) group had to deal with the same topics as the corresponding 'mnemonic' group pair 'Rhyme' and 'Storytelling'. Only the anatomical information that require memorization skill rather than understanding skill were chosen for this research. For each topic, mnemonics for the 'Rhyme' and 'Storytelling' groups were newly constructed. 'Single sentence true-false' and 'Multiple choices of two options' (in the form of fill-in-the-gap) were constructed.

About 93 Bangladeshi medical undergraduates of public medical colleges of Dhaka was selected who were not previously exposed to "Head and Neck" or "Central Nervous System and Eyeball" cards and were divided into three groups (31 in each group) containing equal number of males and females as far as possible. Before conducting 'memory tests', a brief outline of mnemonics with examples was given to the participating undergraduates through the PowerPoint presentation. The 'mnemonic' groups were strictly instructed not to memorize the information directly and only to remember them using the given mnemonics. The control or 'non-mnemonic' groups were bound to memorize the information directly. About 20 minutes were allowed to memorize the information with or without mnemonics, as applicable and after that 'memory tests' was taken.

The response to each question from each participant was marked on the answer script ('correct', 'incorrect' and 'unattempted'). Then the 'correct' responses were entered as data into the Statistical Package for Social Science (SPSS) version 20 and different groups were compared using Bonferroni version of the ANOVA post hoc test.

RESULTS

Total 93 Bangladeshi medical undergraduates from two public medical colleges were divided into three groups, each consisting of 31 undergraduates- two 'mnemonic groups' and corresponding control ('non-mnemonic') groups. The performances of the medical undergraduates of two 'mnemonic' groups 'Rhyme' (Rh) and 'Storytelling' (St) in terms of their scores (number of correct-responses to the questions) were compared with corresponding control ('non-mnemonic') groups respectively. The results are shown in [Table 2].

Table 2: Effectiveness of 'Rhyme' and 'Storytelling' group in memorizing anatomical information

Group	Score (no. of correct responses)*		Comparison	Probability	Significance of difference	95% confidence interval
	Range	Mean±SD				
Rhyme	12-15	14.48±0.77				
			'Rhyme' vs Control	0.059	S	1.37-0.01
Control	11-15	13.81±1.28				
			'Storytelling' vs Control	1.000	NS	0.57-0.82
'Storytelling'	11-15	13.68±1.25				

* These scores are those attained by the undergraduates in the 'memory tests'
n (number of undergraduates in a group): 31
S: Significant (p≠ 0.05 was considered as the level of significance)

Table 3: Comparison of effectiveness between the members of mnemonic groups

Group	Score (no. of correct responses)*		Comparison	Probability	Significance of difference	95% confidence interval
	Range	Mean±SD				
Rhyme	12-15	14.48±0.76				
			'Rhyme' vs 'Storytelling'	0.017	S	1.50- 0.11
'Storytelling'	11-15	13.67±1.24				

* These scores are those attained by the undergraduates in the 'memory tests'
n (number of undergraduates in a group): 31
S: Significant (p≠ 0.05 was considered as the level of significance)

The scores attained by the 'Rhyme' group were significantly higher than their corresponding control group except 'Storytelling'. Thus, proving the effectiveness of 'Rhyme' in memorizing anatomical information than control and 'Storytelling'.

On the other hand, while comparing the effectiveness between the mnemonic groups ('Rhyme' and 'Storytelling') by performances of medical undergraduates in 'memory tests' 'Rhyme' was found significantly higher than 'Storytelling'. The results are shown in [Table 3].

DISCUSSION

The aim of the present research was to determine the effectiveness of mnemonic groups in memorizing anatomical information as well as to compare such effectiveness between 'Rhyme' and 'Storytelling' through analyses of the performances of the Bangladeshi medical undergraduates in the 'memory tests'. Judging by the statistical analyses of the performances of the undergraduates, 'Rhyme' was found significantly more effective in memorizing anatomical information than 'Storytelling' and control group. But regarding 'Storytelling', the performance did not differ significantly from that of the control. Although 'Descriptive story' created no difference in immediate recall, but at one week interval, 'Descriptive story' performed better.[7] It is noted that different mnemonic techniques had been found to facilitate learning and they were effective aids to learning in different paradigms, but it was not known which mnemonic was most effective in specific paradigms.[8] As 'Rhyme' is rhythmic, this character helps in memorizing anatomical information effectively. 'Rhymes' are constructed through an intelligent as well as simple way that is very much helpful in memorizing anatomical information. 'Storytelling' is also a way that seems to be effective in memorizing anatomical information and one can recall an interesting story easily even after a long time. As an effective study tool, mnemonic strategies can be utilized with all students and applied to any type of content but the appropriate method must be chosen otherwise it will not benefit the learner.[9] In such a scenario prevailing, more research regarding the use of different mnemonic techniques in the classroom with students would provide a clear idea about how the use of mnemonics in the classroom can be useful and how the teachers would be able to incorporate different mnemonic techniques in the classroom effectively.[6] The benefit of mnemonic devices for teaching has been extensively recognized in the field of Medicine, Psychology and Education, but there is lack of research on why mnemonics work or has effective are mnemonic devices.[10]

CONCLUSION

This study suggest that using mnemonics in memorizing anatomical information leads to better retention only in 'Rhyme' but the 'Storytelling' was found not effective as the former. Before concluding, it may be fair enough to put more emphasis in research on different mnemonic techniques. Although the present research has put some light on some issues of mnemonics, including those not previously investigated, it is felt that extensive research may be carried out for finding out the details about different categories ('techniques') and subcategories ('characteristics') of anatomical mnemonics, as well as teachers' and students' opinions on mnemonics and effectiveness in memorization.

Limitations of the study

1. No authorized book was available in Bangladesh from which the anatomical mnemonics most commonly used by the Bangladeshi medical undergraduates or teachers could be collected.
2. The group sizes were small. The number of topics-information that was covered through mnemonics was also small.
3. Only short-term impact of mnemonics on memorization was tested. To assess the impact on long-term memorization would need longer time and much elaborate arrangement that would have been beyond the feasibility of this thesis research.

Acknowledgements

This research was a post graduate thesis. The authors would like to thank all the Bangladeshi medical undergraduates of Dhaka Medical College and Shaheed Suhrawardy Medical College, teachers and members of staff of above mentioned medical colleges as well as all the staffs of Department of Anatomy, Bangabandhu Sheikh Mujib Medical University, Dhaka. Financial support was obtained from the research council of the Bangabandhu Sheikh Mujib Medical University, Dhaka.

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How to cite this article: Akhter N, Chowdhury MSIT, Uddin ME, Rahman MZ. Analysis of Bangladeshi Medical Undergraduates Ability to Retain Anatomical Information by Using Mnemonics. Ann. Int. Med. Den. Res. 2019; 5(4):AT01-AT05.