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RESEARCH ARTICLE

Perceptions, views and opinions regarding the use of mnemonics in teaching-learning: An e-mail based survey among Bangladeshi anatomy teachers

Najnin Akhter[1] | Md Mohiuddin Masum[2] | Farhana Bashar[3] | Khondker Manzare Shamim[2]

[1] Department of Anatomy, Brahmanbaria Medical College, Brahmanbaria, Bangladesh
[2]Department of Anatomy, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh
[3]Department of Anatomy, Mugda Medical College, Dhaka, Bangladesh

ABSTRACT

Background: In anatomy, there are many 'mnemonics' available as memory devices. However, how teachers think about different aspects of these devices regarding teaching-learning has not been adequately addressed. This research aimed to determine the perceptions, views, and opinions of Bangladeshi anatomy teachers on the use of mnemonics.

Methods: This descriptive cross-sectional study was conducted by the Department of Anatomy at Bangabandhu Sheikh Mujib Medical University, Dhaka, from 2017 to 2018. The research involved a self administered survey via e-mail using Google Forms among 63 Bangladeshi anatomy teachers with a post-graduation in anatomy and at least five years of teaching experience. Responses were collected through pre-designed multiple-choice questions, allowing for single or multiple selection and open-ended questions to explore their perceptions, views, and opinions on seven aspects of using mnemonics.

Results: Around 83% of teachers agreed that mnemonics would help effectively memorise anatomical information. Most believed that mnemonic techniques such as 'Acrostic' and 'Rhyme' would be more effective than 'Acronym' and 'Storytelling'. More than 50% felt that Bangla mnemonics would be more effective than English ones. In teaching anatomy, around 85% preferred to explain a topic first and then introduce the mnemonic. Moreover, half suggested that available English mnemonics could be modified into Bangla to better align with students' understanding levels and cultural context.

Conclusions: Most participants indicated that 'Acrostic' and 'Rhyme' were more effective than 'Acronym' and 'Storytelling'. A common view was that modifying English mnemonics to Bangla would yield better results.

Keywords: *mnemonics, anatomy teachers, medical education, teaching-learning*

INTRODUCTION

Anatomy is part and parcel of the Bachelor of Medicine and Bachelor of Surgery curriculum, introducing various structures of the human body to medical undergraduates. It is a vast subject that requires a specialised teaching-learning approach. Retaining detailed anatomical knowledge and its clinical relevance is challenging in future postgraduate training.[1] Although a proper understanding is the best way to remember anatomical information, no one can deny the role of memorisation in learning to recall a large amount of information for examinations and emergencies.[2]

Considering the availability of anatomical aids for retaining information in the brain for extended periods and recalling it more easily later, memory devices or 'mnemonics' are often used.[3] Alternate ways to remember and retain verbal information include 'rote' learning. However, learning by rote is generally considered the least effective method. Hence, people frequently resort to mnemonics or mediators to enhance learning, especially when faced with rote memory tasks.[4] According to Greek mythology, the word 'mnemonic' is derived from the ancient Greek

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HIGHLIGHTS

1. A proper understanding is the best way to remember anatomical information. Still, no one can deny the role of memorisation in learning to remember a large amount of information for examinations and emergencies.
2. Analyzing anatomy teachers' perceptions, views, and opinions regarding the use of mnemonics can play an important role in teaching and learning Anatomy.
3. Most Bangladeshi anatomy teachers agreed that mnemonics would effectively memorise anatomical information.
4. Most Bangladeshi anatomy teachers mentioned that 'Acrostic', 'Rhyme', and Bangla would be more effective than 'Acronym' and 'Storytelling' and English, respectively.
5. Most teachers would like to use mnemonics in teaching anatomy. However, most teachers felt that available English mnemonics may need to be modified for Bangladeshi medical undergraduates, considering their understanding of English and cultural differences.

word "mnemonics," meaning "of memory" or "relating to memory".[5] Through the use of mnemonics, one is required to pay attention to the relevant features of the material and to process it more deeply than by simply rehearsing it.[6]

The most commonly used mnemonic techniques include acronym, acrostic, and chunking; others include loci, linking, or chaining/storytelling methods.[7] When learning with mnemonic techniques, it is essential to associate the information to be remembered with one or more cognitive prompting structures. Educational applications of mnemonic techniques have been reported by surveying university students, with researchers concluding that using mnemonic devices for memorising information is connected to better course results. Students who used mnemonic devices in learning obtained higher GPAs than those who did.[4]

Mnemonic devices can be effective because they provide meaningful connections between informational items that are typically unfamiliar and, therefore, difficult to remember. It is important to note that mnemonic devices use cognitive structures that often have little or no direct relation to the conceptual contents of the materials being learned.[4,8] Individual mnemonics, even of the same type, can vary in their effectiveness regarding the cognitive aspects they utilise to influence memory. For example, an acronym may be meaningful, meaningless, or unrelated to the topic. Similarly, an acrostic, a meaningful sentence, may or may not be meaningfully related to the topic.[9]

Understandably, whenever an undergraduate medical student of Bangladesh (or many other countries) intends to memorise anatomical information, they either do it rote or use mnemonics. In rote memorisation, one verbally rehearses the learning material, expecting to recall it later from memory, often using any 'mediating cuing structures' like sentences or visual images.[4] The authors consider rote learning the least efficient way of remembering. While Bangladeshi medical undergraduates use many anatomical mnemonics, no comprehensive research has been published that has analysed the use of mnemonics from the perspectives of these students or their teachers. The present study examined the perceptions, views, and opinions of Bangladeshi anatomy teachers regarding seven aspects of using mnemonics in teaching and learning anatomy. These analyses are expected to contribute to a better understanding of how teachers and students can exploit the full potential of anatomical mnemonics without making the learning superficial.

METHODS

This cross-sectional study was conducted from March 2017 to February 2018 inviting anatomy teachers from all over Bangladesh.

A "Google Forms" was designed, including questions focused on their experiences regarding the use of mnemonics in teaching-learning,[10] and perceptions, views and opinions regarding seven aspects (given below) of anatomical mnemonics. A consent form and 'instructions to mnemonics with examples' were also prepared. The informed consent form outlined the study's objectives, assured confidentiality despite requiring the participant's name, and granted the right to withdraw at any time. After reading the form, participants provided consent in the designated place on the "Google Forms".

Participants were teachers with postgraduate degrees in anatomy and at least five years of postgraduate teaching experience. One hundred purposively selected teachers (ranked Assistant professors to Professors) were invited to respond via "Google Forms", which were sent to their e-mails. Sixty-three respondents returned the filled-out questionnaire.

The questionnaire: It included three types of questions as multiple-choice questions (MCQs) that required selecting a single option, MCQs that allowed for multiple selections, and open-ended questions for descriptive responses. The open-ended questions aimed to uncover the reasons behind the perceptions, views, and opinions of the Bangladeshi anatomy teachers. The survey questionnaire addressed the following seven aspects of mnemonics:

i. Effectiveness of mnemonics in memorising anatomical information (views): single-answer MCQs

ii. Reasons for using mnemonics in teaching-learning as a useful tool for memorising anatomical information (views or opinions): multiple-answer MCQs and open-ended questions

iii. Which of the mnemonic 'techniques' in a pair is likely to be more effective than the other pairs (opinions): single-answer MCQs

iv. Reasons supporting the above opinions: open-ended questions

v. Views on the benefit of having a compiled list of mnemonics (views): single-answer MCQs

vi. Intended approach to use mnemonics in teaching (perceptions): single-answer MCQs

vii. Modification of the language of anatomical mnemonics for better understanding (perceptions): single-answer MCQs

All seven aspects of mnemonics were analysed by expressing the responses to the closed-ended questions as percentages and frequencies of the selected choices. The responses to the open-ended questions, where teachers gave reasons for their particular responses, were compiled to explore all the possible reasons considered by the teachers.

RESULTS

About 97.0% of the Bangladeshi anatomy teachers participating in the survey had an MPhil degree, and over 95.0% were Professors or Associate professors. Around 84.0% had ten or more years of teaching experience after post-graduation.

Regarding the effectiveness of mnemonics in memorising anatomical information, most Bangladeshi anatomy teachers (82.5%) agreed that using mnemonics in teaching would be effective for this purpose. The reasons provided by these teachers for why mnemonics would be effective are shown in **TABLE 1**. The two most common reasons cited were that "mnemonic techniques help in remembering information for a longer time" (87.0%) and that "even if one understands an anatomical topic, it sometimes requires to recall the information very quickly during examinations or in clinical practice" (81.5%). No responses were provided in the open-ended segment.

TABLE 1 Frequencies of the reasons chosen (from given options) by the surveyed Bangladeshi Anatomy teachers regarding why using mnemonics in teaching would be useful in memorizing anatomical information by medical undergraduates

Reason chosen[a]	Frequency (%) (n= 54)
One cannot remember so much anatomical information without using some mnemonic technique	27 (50.0%)
Even if one understands an anatomical topic, it sometimes requires to recall the information very quickly during examinations or in clinical practice	44 (81.5%)
A mnemonic technique can help in checking whether recalled information is correct	37 (68.5%)
Mnemonic techniques help in remembering information for a longer time	47 (87.0%)
More information can be remembered using mnemonic techniques	29 (53.7%)

[a]As more than one options were offered, the total percentage frequency was more than 100.
n: Number of Bangladeshi Anatomy teachers responding to the question

Regarding the comparative effectiveness of mnemonic 'techniques' in a pair, most teachers thought that 'Acrostics' are likely to be more effective than 'Acronyms' (46.0% and 36.5%, respectively) **(TABLE 2)**. Similarly, 67.7% felt that 'Rhymes' are more

effective than 'Storytelling' (17.7%) **(TABLE 3)**. When it came to the language of anatomical mnemonics, 49.2% preferred Bangla over English (31.7%), with the remaining respondents undecided **(TABLE 4)**. The reasons behind these opinions are presented in respective tables.

TABLE 2 Reasons given by Bangladeshi anatomy teachers for selecting 'Acronym' or 'Acrostic', as more effective than the other as a mnemonic technique in memorizing anatomical information

Reason given behind selection[a]
'Acronym' is more effective than 'Acrostic'
• It's very easy to make, remember and follow acronyms in a short time
• Initial letters could make a suitable word
• Easy to elaborate specifically & recall anatomical information
• Every letter of an acronym serves as a clue to the retrieval of information
• The names and sequence of a topic are maintained
• A single meaningful word can easily be retained in memory for a longer period of duration
'Acrostic' is more effective than 'Acronym.'
• It maintains a sequence of words which is more likely to be remembered
• This method enhances the memory of complex topics and promotes better retention of material to be learned
• For anatomical information which consists of a large list, an acrostic would be better than an acronym because an acrostic may form a meaningful sentence rather than a meaningless word formed by an acronym
• As acrostic is expressed in a complete sentence, in most cases in an interesting way, it is easily remembered and retained long
• Undergraduate students will feel greater pleasure to memorise a lovely and interesting sentence than a word
Undecided
• Both acronym and acrostic are equally effective
• Good understanding is enough for students to memorise
• Mnemonics undermine real anatomical information/knowledge
• t depends on the topic

[a]The language has been kept as it was, except for minimally required grammatical corrections. Some of the teachers' reasons did not fit the issues, so they have been omitted from this list. Moreover, repetitions of reasons from more than one teacher have also been avoided, ultimately presenting any 'reason' just once in the table.

Approximately 70% of the teachers thought providing a compiled list of anatomical mnemonics would benefit the students **(FIGURE 1).**

Perceptions regarding the approach to using mnemonics in teaching-learning: 85.7% of teachers preferred to explain the topic and information first before introducing the mnemonic, while only 6.3% chose to present the mnemonic first and then explain it in the context of the topic. The rest were undecided.

TABLE 3 Reasons given by Bangladeshi anatomy teachers for selecting 'Rhyme' or 'Storytelling' as more effective than the other as a mnemonic technique in memorising anatomical information

Reason given behind selection[a]
'Rhyme' is more effective than 'Storytelling'
• From an early age, we are fond of rhymes
• Rhyme and rhythm help to make information more memorable
• It is easy to remember, and as at the end of each line there is a similar ending, it will create a sound impact on our brain
• If a rhyme is constructed by using an intelligent as well as simple way, it will be very helpful to remember anatomical information for a longer time
• Rhymes are easier to remember as they can be stored by acoustic encoding in our brains
• I think it is simpler and less burden than storytelling
• The rhyme mnemonic builds awareness and understanding in students' thought processes and helps them to become more mindful in their studying
• Attractive to hear and helps in quick memorisation
• Rhyme follows a sequence which is easy to recall
• Storytelling is a lengthy process; something rhythmic may be more effective
'Storytelling' is more effective than 'Rhyme'
• Understanding is easy
• It's easy to form a story rather than a rhyme
• A story persists in our memory for a longer period (than rhyme)
• One can recall an interesting story easily, even after a very long time
• (A story) makes the topic more interesting and easy to understand and remember
Undecided
• Story or rhyme also needs to be memorised
• Usually, we are not familiar with these methods
• It isn't easy to categorise which information will be remembered in which technique
• It depends on the topic

[a]The language has been kept as it was, except for minimally required grammatical corrections. Some of the teachers' reasons did not fit the issues, so they have been omitted from this list. Moreover, repetitions of reasons from more than one teacher have also been avoided, ultimately presenting any 'reason' just once in the table.

Perceptions regarding modifying the language of anatomical mnemonics from English to Bangla for better understanding: 66.0% of the teachers thought that the "understanding level of English" was a key factor, and 50.0% regarded "cultural difference" as a valid consideration. However, a significant portion of respondents were undecided on this issue **(FIGURE 1)**.

DISCUSSION

While commenting on whether mnemonics in teaching would be effective for memorising anatomical information, most surveyed teachers felt their use could be effective. White argued that the 'true application of

TABLE 4 **Reasons given by Bangladeshi anatomy teachers for selecting Bangla or English language, as more effective than the other as a mnemonic technique in memorizing anatomical information**

Reason given behind selection[a]
'Bangla' is more effective than 'English'
• Our students are much more familiar with Bangla
• Bangla is the mother tongue
• Most of our medical students use Bangla as their academic language
• Being a Bangladeshi , Bangla is much more relatable to us than English and about more than 95% of undergrads come from the Bangla medium
• Own language is the best way to memorize
• Our students are very much habituated to speak and understand the topic in Bangla as their medium of instruction from secondary and higher secondary levels was Bangla
'English' is more effective than 'Bangla'
• All anatomical terms are written using English (Latin) letters here
• Most of the medical books available in our country are written in the English language. So medical students are more familiar with English medical terms than Bangla.
• As the learning medium is English, involving the English language needs no reorganization
• Letters and words of mnemonics would go in favor of medical lessons and thinking would proceed in the same way, the textbooks are written in English
• Now a days majority of students know English very well
• English medium would be accepted at home and abroad
Undecided
• It can be a combination of English and Bangla. If acronym, it's better in English, but other forms can be in either language
• I used to use Bangla in some cases and English in other cases
• I found both equally effective during my student life
• Language does not make any difference as in both cases students need to memorize
• Both can be used when it is appropriate and depends on context
• It depends on the familiarity of the mnemonic, Some English poems may be more familiar than some difficult and less familiar Bangla ones
• I think both may be effective. But as there is no such option, therefore I am ticking "undecided"
• Different persons like different languages

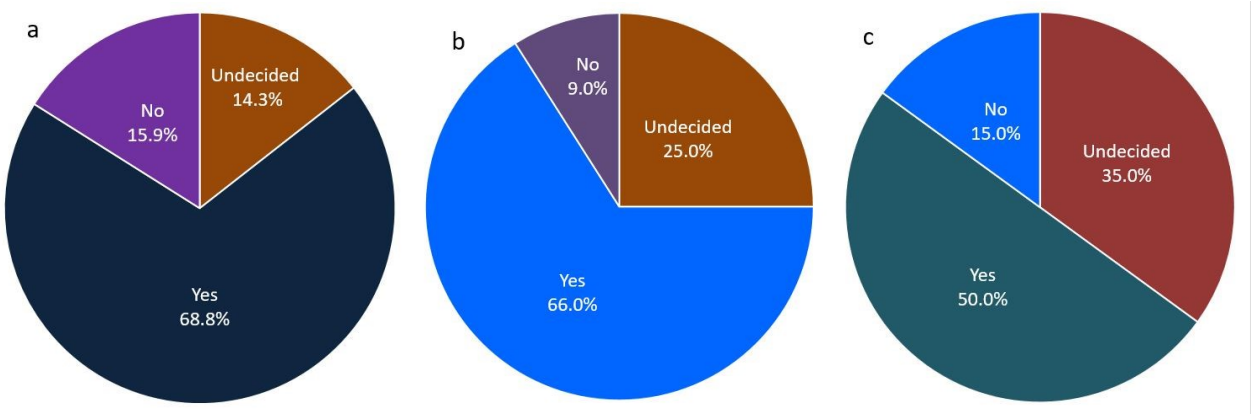
[a]The language has been kept as it was except for minimally required grammatical corrections. Some of the teachers' reasons did not fit the issues, so they have been omitted from this list. Moreover, repetitions of reasons from more than one teacher have also been avoided, ultimately presenting any 'reason' just once in the table.

mnemonics was not making their way into the classrooms, but a change needed to be made for these strategies to be effectively utilised'.[11] The beneficial outcome of mnemonic devices has been extensively recognised in Medicine, Psychology, and Education. The comments of the Bangladeshi anatomy teachers echo this presumption in anatomy education. However, research is scarce on why mnemonics work or how effective mnemonic devices truly are.[12]

Most surveyed teachers (46%) considered 'Acrostics' more effective than 'Acronyms' (36.5%). One teacher pointed out that in an 'Acronym', every letter is a cue for retrieving information. Another teacher commented that since 'Acrostics' contain words that are interesting to hear, students may prefer to use them. Although there was some doubt regarding the beneficial effect of first letter mnemonics or acronyms when learning unrelated words, an optional magnificent impact was noted for recalling the order of previously memorised items.[13] Considering the findings of the present research, these findings were not similar. Regarding the effectiveness of 'Acronyms', it is essential to remember that students must know the information first; otherwise, acronyms will not help recall information.[3]

About one-third of the teachers believed 'Rhyme' would be more effective than storytelling. One teacher mentioned that it provides a 'memory bridge' and allows students to spend less time retrieving information. When comparing the effectiveness of 'Rhyme' and 'Storytelling' in memorising anatomical information among Bangladeshi medical undergraduates during 'memory tests', Akhter *et al.* found that the 'Rhyme' group performed significantly better than both the 'Storytelling' group and the 'Control' group. However, the performance of the 'Storytelling' group did not differ significantly from that of the 'Control' group.[14] 'Storytelling' and 'rhyme' are chain-type memory devices that use intrinsic cues; while 'Rhyme' is a single-use mnemonic, 'Storytelling' can be used multiple times. Nonetheless, both techniques can squeeze information, making it easier to recall, which aligns with Bangladeshi anatomy teachers.[4]

Nearly half of the surveyed teachers believe that Bangla mnemonics are more effective than 'English' mnemonics for memorising anatomical information. They noted that modifying the language in anatomical mnemonics should consider the medical undergraduates' level of understanding and cultural differences. In this regard, "undecided" responses were relatively high. One teacher commented that, as Bangladeshi, Bangla is much more relatable than



FIGURES 1 **Proportion of Bangladeshi anatomy teachers (n=63) who thought: a) providing a list of mnemonics would benefit medical undergraduates; b) availability of Bangla mnemonics is easier; c) understanding level of medical undergraduates due to cultural reasons.**

English, and more than 95% of Bangladeshi medical undergraduates come from a Bangla education medium in their premedical education. However, another teacher who chose English argued that since the medium of instruction in the MBBS course is English, there is no need to recognise anatomical mnemonics to involve the English language. In a different but related context, when English-speaking students were learning Russian, they were given English words that were pronounced similar to Russian words, which sparked interest in using mnemonics for learning Russian.[11] These findings may, therefore, reinforce the role of native language (Bangla) in teaching-learning of anatomy.

Most teachers participating in the survey thought providing students with a compiled list of anatomical mnemonics would be beneficial. Although books on mnemonics or those containing mnemonics are available abroad, no such authorised books are currently available in Bangladesh. Online sources, however, can be utilised. Since most of the mnemonics used by Bangladeshi medical undergraduates are scattered, a compiled list would benefit them.

Regarding the intended approach to using mnemonics in teaching, most anatomy teachers preferred first to explain the topic and information to the students, then introduce the mnemonic to help them correlate with the information. This approach seems logical- attaching more importance to understanding the topic and information first and then using the mnemonic to aid in recalling it. Further research on using different mnemonic techniques in the classroom would provide more precise insights into how mnemonics can be effectively utilised and how teachers can incorporate different mnemonic techniques.[15]

The role of memorisation, combined with the integration of understanding, has been recognised as a challenging task for physicians in training and practice due to the deterioration of retained basic science knowledge. In such situations, the use of mnemonic techniques has been recommended since ancient Greek times.[16]

One limitation of the present study was that it did not consider the relatively low or nonexistent exposure of Bangladeshi anatomy teachers to more complex mnemonic techniques, like methods of loci, keywords, and peg methods. Therefore, this study was designed to focus on four simple techniques—acronym, acrostic, rhyme and storytelling—and analysed the teachers' collected perceptions, views and opinions regarding the use of mnemonics in the teaching-learning of anatomy.

Conclusion

This study revealed that the majority of Bangladeshi anatomy teachers considered ‘Acrostic’ and ‘Rhyme’ as more effective mnemonic techniques and Bangla as a more effective language for mnemonics, compared to ‘Acronym’ and ‘Storytelling’ and English, respectively. Most teachers would like to use mnemonics in their teaching and would prefer to explain the topic first and then introduce the mnemonic during instruction. Most

teachers felt that existing English mnemonics could be modified for Bangladeshi medical undergraduates, considering their understanding of English and cultural differences.

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Author contributions

Conception and design: NA, KMS. *Acquisition, analysis and interpretation of data:* NA. *Manuscript drafting and critical revision:* NA, MMM, FB, KMS. *Approval of the final version of the manuscript:* NA, MMM, FB, KMS. *Guarantor of accuracy and integrity of the work:* KMS.

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Conflict of interest

We do not have any conflict of interest.

Ethical approval

The study was conducted following the ethical clearance (Memo no: BSMMU/2017/9906, dated 28.09.2017) from the BSMMU Institutional Review Board.

Data availability statement

We confirm that the data supporting the findings of this study will be shared upon reasonable request.

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