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Research Article

Morning Lectures Are Better Retained Than Afternoon Ones: A Pilot Evaluation Report from I[st] MBBS Anatomy Lectures

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Abstract: We undertook this study to evaluate the retention of gross anatomy lectures conducted in the morning hours versus those conducted in the afternoon hours.Ten lectures of gross anatomy were selected randomly for this study. Five of these were conducted in the morning at 10 am and remaining five in the afternoon at 4 pm. Both sets of the lectures were taken by chalk – board method and included audio, audio-visual and audio-visual-kinesthetic modalities. 24 hour after the lecture, a questionnaire, based on the lecture was given to the students which contained questions testing various aspects of memory viz. A) Obvious facts B) Fine facts--i) <4 items ii) >4 items C) Maneuver D) memory based on understanding E) diagram. Each question was assessed on a ten point scale. Total number of responses received were 1617 (100%). It was observed that the memory for obvious facts > maneuver > memory based on understanding > fine facts (> 4 items) > fine facts (< 4 items). In all aspects tested, retention was better for morning lectures than afternoon lectures. Overall 7% students were totally inattentive in morning lecture in contrast to 20% students during afternoon lecture. Sequence of subtopics taught and time allotted to each subtopic are the other factors affecting learning. Memory for morning lectures can be improved further by 2 - 2.5 times by adding visual aids. Memory for afternoon lectures can be improved further by 8 - 19 times by adding visual aids and kinesthetic aids.
Keywords: anatomy education, memory, learning, learning modalitiesm

INTRODUCTION

Memory is an organism's ability to store, retain, and recall information and experiences [1]. It is one of the important physiological functions in ones' life.

Traditionally, memory is divided into-a) Sensory memory: corresponds approximately to the initial 200–500 milliseconds after an item is perceived. b) Short-term memory – ability to recall for a period of several seconds to a minute without rehearsal. Its capacity is very limited c) Long-term memory: can store much larger quantities of information for potentially unlimited duration (sometimes a whole life span) [2].

Ability to recall is very important for students as this helps them in learning, and reproducing their knowledge in examination. In medical discipline it not only helps to score good marks in examinations (may be useful to get admissions to higher courses and to get employment) but also does have long term effects as this knowledge may be utilized for patient treatment and care , thus directly affecting the human life. Thus, it is an important quality in one's life.

While working in Indian set up, it is our general experience that the lectures are scheduled as per availability of the time slot. It is also expected that the lecture in the morning hour will be better retained than that in afternoon ones. However, does it really happen? If it is so, how to improve the efficacy of afternoon lectures as many times there is no alternative but to conduct afternoon lectures. This is still an area being relatively under explored in many settings including India.

With this background, we undertook this study to evaluate the retention of morning lectures versus afternoon ones. We also studied the effect of addition of audio, audio-visual and kinesthetic modalities on memory retention of the lectures.

MATERIALS AND METHODS

The study was conducted in department of Anatomy, B J Medical College, Pune. Ten gross anatomy lectures were selected randomly for this study. All the first MBBS students attending the lectures participated in the study.

To have unbiased results, a double blind method was adopted. All the lectures were taken by chalk – board method. Lectures were more or less of same difficulty level and delivered by same teacher. Five lectures were conducted in the morning at 10 am and five in the afternoon at 4 pm. The lectures were delivered taking into account the all aspects of good teaching as described by Rokade *et al.* [3]. It also fulfilled the basic requirement for the lectures like-audibility of voice, clarity of pronunciations, visibility of board, easy to understand language etc.

After having regular day- to -day activity for 24 hour after the lecture, a questionnaire, based on the lecture was given to the students which contained questions testing various aspects of memory. The model example of questions asked along with the various aspect of memory tested and types of input modality are given in annexure I.

The answers were evaluated by a single teacher, and each question was assessed on a ten point scale with 0 being poorest answer, and 10 being excellent answer. The data was processed statistically.

Annexure I: **Questionnaire of Model Lectures**

Lecture 1

Sl. No.	Question asked	Which aspect of long term memory it tested?	Input modality
1	Draw a labeled diagram of posterior relations of stomach.	Diagram/ maneuver	Audio-visual
2	Enumerate the anterior relations of stomach.	Obvious facts: three items	Audio-visual
3	Name the quadrants in which stomach is located.	Obvious facts: three items	Audio-visual
4	Name the various parts of stomach.	Obvious facts: four items	Audio-visual
5	How will you identify the pyloric end of stomach?	Fine facts :two items	Auditory
6	Enumerate the arteries supplying stomach.	Fine facts: 5 items	Audio-visual
7.	'Acidity leads to heart burn'. Explain on anatomical basis.	Building memory based on conceptual understanding	Auditory

Lecture 2

Sl. No.	Question asked	Which aspect of long term memory it tested?	Input modality
1	Enumerate the structures present in the substance of parotid gland.	Obvious facts: three items	Audio-visual
2	Give the nerve supply of parotid gland.	Fine facts :two items	Auditory
3	Trace the secretomotorfibres to parotid gland	Fine facts: 8 items	Audio-visual
4	Enumerate the structures pierced by parotid duct.	Building memory based on understanding	Audio-visual
5	How will you palpate parotid duct?	maneuver	Audio-visual-kinesthetic

RESULTS

Total number of responses received was 1617 (100%).

Table 1: average scores achieved by the students

Memory tested for-	Obvious facts	Fine facts - 2 items	Fine facts >4 items	Memory based on conceptual understanding	Diagram	Maneuver
Morning Lectures	6.77	4.13	4.55	4.82	3.39	--
Afternoon Lectures	5.53	1.22	1.48	2.18	--	5.75
Average score	6.06	2.48	2.81	3.32		--

Table 2: Frequency distribution of students as per their scores

Score achieved (max 50)	Morning Lectures n=700(%)	Afternoon Lectures n=917 (%)	Total n=1617(%)
0	07(01)	21 (2.29)	28 (1.73)
1-5	07(01)	105(11.45)	112(5.62)
6-10	56(08)	238(25.95)	294(18.18)
11-15	105(15)	105(11.45)	210(19.05)
16-20	126(18)	218(19.85)	308(19.05)
21-25	119(17)	105(11.45)	224(13.85)
26-30	84(12)	42(4.58)	126(7.79)
31-35	98(14)	63(6.87)	161(9.96)
36-40	49(07)	35(3.81)	84(5.19)
41-45	28(04)	21(2.29)	49(3.03)
46-50	21(03)	7(0.76)	28(1.23)

Table 3:Frequency distribution of students as per scores achieved for each question (n=917)

Memory tested for		Number of students achieved the score in the range of—(%)					
		00%	**1-25%**	**26-50%**	**51-75%**	**76-90%**	**91-100%**
Obvious facts	Morning Lectures	49(7)	14(2)	161(23)	224(32)	14(02)	245(35)
	Afternoon Lectures	161(17.55)	49(5.34)	168(18.32)	91(9.92)	28(3.05)	189(20.61)
	total	210(12.99)	63(3.89)	329(20.35)	315(19.48)	42(2.6)	434(26.84)
Fine facts <4 items	Morning Lectures	147(21)	14(02)	266(38)	147(21)	35(05)	91(13)
	Afternoon Lectures	679(74.04)	00(00)	126(13.74)	7(0.76)	7(0.76)	28(3.05)
	total	826(51.08)	14((0.87)	392(24.24)	154(9.52)	42(2.59)	119(7.36)
Fine facts >4 items	Morning Lectures	147(21)	35(05)	259(37)	84(12)	84(12)	91(13)
	Afternoon Lecture s	546(59.53)	126(13.74)	35(3.81)	21(2.29)	28(3.05)	28(3.05)
	total	693(42.86)	161(9.96)	294(18.18)	105(6.49)	112(6.93)	119(5.63)
Memory based on understanding	Morning Lectures	196(28)	21(03)	154(22)	133(19)	14(02)	182(26)
	Afternoon Lectures	525(57.24)	35(3.81)	98(10.68)	63(6.87)	28(3.05)	49(5.34)
	total	735(45.45)	56(3.46)	252(15.58)	196(12.12)	42(2.59)	231(14.29)
Diagram	Morning Lectures	217(31)	35(05)	252(36)	112(16)	70(10)	14(02)
Maneuver	Afternoon Lectures	189(20.60)	35(3.81)	84(9.16)	35(3.81)	175(19.08)	350(38.17)

Table 4: Comparison of students' performance in different learning modalities studied

	Modality	**Auditory**	**Audiovisual**	**Auditory+visual+kinesthetic**
Average score	Morning Lectures	4.13	6.06	--
	Afternoon Lectures	1.22	5.53	5.75
	mean	2.87	5.83	--

Table 5: Effectiveness of A, AV and AVK modalities

	Modality	**A**	**AV**	**AVK**
Overall scores for	Morning lecture	1	1.5	--
	Afternoon lecture	1	4.5	4.75
Proportion of students benefitted by	Morning lecture	1 : 2.5 : - -		
	Afternoon lecture	1 : 7 : 15		

DISCUSSION

The long term memory of the subjects can be of the declarative type, in which the subject requires conscious recall i.e. Some conscious process must call back the information [4]. Declarative memory is further sub-divided into a) semantic memory, in which facts are taken independent of context; and b) episodic memory which is concerned with the information specific to a particular context, such as a time and place. In this study we tested the semantic component of declarative type of long term memory. The memory was tested by free recall method [5]. Double blind method was adopted so that no conscious efforts were executed to retain the material in memory by both the teachers as well as students.

Students' learn by various modalities[6]. The three most common ones are:

- Visual : learning based on observation and seeing what is being learned.
- Auditory : learning based on listening to instructions / information.
- Kinesthetic: learning based on hands-on- work and engaging in activities.

It is claimed that, depending on one's preferred learning modality, different teaching techniques have different levels of effectiveness [7] . A consequence of this theory is that effective teaching should present a variety of teaching methods which cover all three learning modalities so that different students have equal

opportunities to learn in a way that is effective for them [8]. Guy Claxton has questioned the extent that learning styles such as VAK are helpful, particularly as they can have a tendency to label children and therefore restrict learning [9].

In the present study, we tested learning and memory for various components of lectures viz.

a. Obvious facts
b. Fine facts--
    i. <4 items and
    ii. >4 items—
c. Maneuver –experimenting— kinesthetic mode of learning.
d. Building memory based on understanding.

In our study it was observed that, overall, the memory for obvious facts > maneuver > memory based on understanding > fine facts (> 4 items) > fine facts (< 4 items).

The students' scores were best for memory for obvious facts (average score 6.06) (table 1). So also comparatively more students had better scores. 48.38 % students scored >50%. 19.48 % students scored 51-75%, while 26.84% students scored between 90 and 100%. As the facts were gross, were easy to retain in memory. So also, as the obvious facts were explained immediately after introduction (set induction), the students were in a fresh mood and must have resulted in good retention.

This was followed by the scores for maneuver (average score 5.75) (table 1). 61.06 % students scored > 50% , while 38 % students scored > 90%. Thus more number of students performed best in this parameter. In maneuver, as the students are actively involved, their auditory, visual as well as kinesthetic senses are utilized and hence there is better memory retention. The attention span of the students is described to be 40-45 minutes. However, it is not possible to retain the attention continuously throughout this period. Students are likely to lose the attention in the middle of the lecture. Some jokes or activity during this period does help them get the attention back. Thus the maneuver included in the lecture did help the students to score better.

The students scored 3.31 out of 10 in memory based on understanding (meaningful memory). 29% of the students scored >50%. Students scored 3.39 in diagram. 28% students scored >50% in this parameter. The diagram was drawn by the teacher on board during the lecture. Students who followed teacher's hand, though low in number scored better in this parameter. Would it have been compulsory for all students to take it down; more number of students would have scored better. The memory for the fine facts having > 4 items was fine (average score 2.81). 19.05% students scored >50% while 42.86% students scored 00%. As these were explained towards the end of lecture, and as students get tired towards the end of the lecture, it might have resulted in poor performance by most students. However it was better than memory for fine facts <4 items. The students scored worst in fine facts (< 4 items). In this, 51.08% students scored 00%.while 24.24 % students scored 26-50%. In fine facts having > 4 items, there were almost 12 items in it, so this was easier for students to remember for some 4 or 6 items out of 12 than to remember 1 or 2 of the 2 items. Also, the next item was dependent on previous one. Thus, students could remember those by logical thinking. The fine facts though only 2, were explained at the middle of the lecture, and hence may have been forgotten in the midst of piles of material of the lecture.

Morning vs. afternoon lecture

In our study all aspects of memory tested were adversely affected in afternoon lectures (table 1). In both categories, obvious facts are better retained, and fine facts were most affected followed by memory based on understanding. The percentage of students scoring different landmark scores in morning and afternoon lectures are given in table 2. It shows that 54% students scored >50% in morning lectures in contrast to only 25.31% of students in afternoon lecture. Students scoring <30% were 25% for morning lectures in contrast to 51% students for the afternoon class. Thus more number of students scored better for morning lecture than the evening one. The number of students totally inattentive in the class was much greater for afternoon lecture (20%) than the morning lecture (7%).

Comparison of Auditory (A), Audio-visual (AV), Audio-Visual-Kinesthetic (AVK) modalities of learning

We found that overall learning was best with AVK followed by AV and auditory method, in that order (table 4). Students' scores were improved by adding visual and kinesthetic aids for both lectures (table 5). However, lectures having AVK and AV modalities are more beneficial for students attending afternoon lectures. The number of students benefitted by addition of AV were7 times more compared to auditory alone while those benefitted from addition of AVK were 15 times more. It was further observed that efficacy of morning lectures can be increased by 2-2.5 times by adding visual aids. The afternoon lectures' efficacy can be increased by 8 - 19 times by adding visual and kinesthetic aids.

Other factors

Time allotted for each subtopic during lecture does have significant impact on the retention. It is expected that more is the time given for a point during the lecture, more time is available to grasp the facts and hence better retention of memory. As the time allotted for obvious facts (7 min), maneuver (7 min) and fine

facts (>4 items) (10 min) was more, students scored better in these parameters. In the present study the sequence of the subtopics taught during lecture 2 along with the scores achieved in those are as follows

a. Obvious facts (5.53),
b. Maneuver (5.75),
c. Understanding (2.18),
d. Facts –fine < 4items (1.22),
e. Facts fine >4 (1.48)

These figures show that the students scored better in the initial two subtopics followed by gradual decline in scores in successive topics. This clearly indicates the importance of the position of the subtopic during lecture in memory retention. Topics taught at the beginning and end of the lecture are better retained in memory than those taught in the middle where students are likely to loose attention. So also the comfort of the teacher as well as students during the lecture (decided by quality of seating arrangement, atmosphere of the venue and other factors) is equally important. As we do not find any similar study in India and abroad, we cannot compare our findings.

CONCLUSION

- In a given lecture, the facts are retained in memory in the following order
- Obvious facts > Maneuver > memory based on conceptual understanding > fine facts (>4 items) > fine facts (<4 items).
- In all aspects tested, memory is better for morning lectures than afternoon lectures. Hence morning lectures are strongly recommended.
- Overall 7% students were totally inattentive for morning lecture in contrast to 20% students during afternoon lecture.
- Sequence of subtopics taught, time allotted to each subtopic and comfort of teacher and students during lecture are the other factors affecting learning.
- Memory for morning lectures can be further improved by 2 - 2.5 times by adding visual aids.
- Memory for afternoon lectures can be further improved by 8 - 19 times by adding visual aids and kinesthetic aids.

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