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Original Article

Evaluating Factors Influencing Memorization in Undergraduate Medical Students.

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Abstract:

Objectives: To evaluate the techniques used by medical students for better memorization and identify factors that directly or indirectly influence the process of memorization.

Method: This cross-sectional study included undergraduate medical students from four public/private medical schools of Karachi. Through stratified random sampling, 400 medical students were administered a questionnaire that had been developed through focused group discussions and pre-tested on a smaller population. Data was analyzed using SPSS version 26.0 by applying Pearson's chi square test for categorical variables and Mann Whitney U test for scale variables.

Results: Passion for the medical field was the key motivating factor for most the students (n=133; 33.3%). The source of motivation to study in students was related to the phase of their training at medical school, with preclinical and clinical years showing a slightly significant difference (P=0.049). Silent reading (n=203; 50.8%), intermittent power naps (n=125; 31.2%) and making notes and flowcharts (n=169; 42.2%) were the preferred memorization techniques. 46.9% (n=188) students required < 4 hours of study daily and no significant difference in the number of study hours required per week was observed between the two genders and the students of preclinical and clinical years. Majority of the students considered lack of sleep (n=232; 58%) and social media (n=146;36.5%) their biggest sources of distraction.

Conclusion: Desire to help humanity is the main driving force for medical students. The extensive syllabus requires dedicated number of study hours and use of memorization techniques suited for oneself.

Keywords: Learning preference, Memorization technique, Motivation factor, Memory aid, Academic performance.

Introduction:

Learning style is the unique way an individual uses to gain and retain information[1]. Students rely on understanding, rote memorization, or a combination of both to produce satisfactory outcome of learning, quantified in terms of the score on an examination[2]. Insight into the different learning styles of students can fill the gaps in an educational program by tailoring the lessons based on the styles students learn best, benefiting students by letting them use the techniques most suited for their learning[3].

A key to effective learning for the life-long learners seeking medical profession is the connection between understanding and memorization. Memory is the retention of internal representation over time gained through experience and being able to reconstruct these representations later when required[4]. The three main sub-processes in memory function in order of their occurrence are, encoding, where perception of the stimulus forms a new memory trace, consolidation

which involves stabilizing the memory trace by integrating the new knowledge into the preexisting networks and retrieval which is the ability to access that stored memory.[5] Preferences for memory aids vary individually. Internal aids involve mental maneuvering like forming images or associations, while external aids require manipulation of the environment such as making notes or using color coding to memorize[6]. Different approaches for learning include superficial, deep, and strategic approaches. Students adopting superficial approach rely on rote memorization to complete the task. Students involved in deep learning approach focus on understanding the content and make links of the newly acquired knowledge with their own ideas. Strategic approach involves paying attention to content in a manner to score maximum possible marks through good time management and understanding the assessment requirements[7].

Improvement in students' achievements gauges the performance of an education system and hence many studies have been conducted to date to identify factors affecting students' accomplishments[8]. Individual characteristics like study habits, attitudes, skills, motivation and lifestyle, along with the conduciveness of the learning environment have been found to contribute to the academic success of the students[8]. Many hypotheses have been generated to explain how memory benefits from sleep [5,9]. Inadequate sleeping habits can affect academic performance by negatively influencing the health status, attention span and mental health of the learners[10].

The group of students achieving admission in medical schools come from backgrounds with different learning exposures, which have already helped them shape their preferred learning styles[11]. Considerable intellectual homogeneity is observed in the students of the high merit medical schools of Pakistan. Regardless, university education requires deep understanding and critical thinking skills and the teaching style fails to cater to the individual differences in their environmental factors and personality traits, resulting in heterogeneity in medical students' academic performance[12].

In Pakistan, the undergraduate medical degree is a five-year training program with the first two years focusing on the basic medical sciences, and the clinical training being the focus of the next years. Professional examinations are conducted annually. This is followed by their mandatory one-year clinical internship to be recognized as registered medical practitioners by the Pakistan Medical Council. Attaining admission in a medical school is in itself considered an academic achievement. The challenging amount of knowledge and skills that the medical students have to acquire and retain in a short period of time in the medical school has always earned their learning strategies more attention than non-medical students [11, 13].

Keeping in mind the various external and internal factors that influence memory and consequently academic performance, we conducted a study to investigate the different aspects that impact a range of learning processes among the undergraduate students of the four top rated medical schools of the largest city of Pakistan, Karachi.

Objective:

To evaluate the techniques used by medical students for better memorization and identify factors that directly or indirectly influence the process of memorization.

Methods:

Study Design and Study Setting:

This cross-sectional study included undergraduate medical students of three public and one private sector medical schools of Karachi, Pakistan. In order of their competitiveness measured through the merit of the students entering the colleges (scores based on the Medical and Dental College Admission Test and high school grades), these are Dow Medical College (DMC), Sindh Medical College (SMC), Karachi Medical and Dental College (KMDC) and Dow International Medical College (DIMC).

Study Sampling:

The sample size of 387 were calculated by online open epi software. Four hundred medical students were participated in the study through stratified random sampling with almost equal number from each medical school, ensuring significant representation from each year. Care was taken to allow proportionate representation of both genders. Participants were administered a questionnaire after seeking verbal consent and were requested to return it by the end of the day. All students returned the completed questionnaire.

Questionnaire:

The questionnaire was developed through focused group discussions of the principal investigators with final year students. It was first administered to 40 stu-

dents from Dow Medical College for the pilot study and refinements in the questionnaire were made after critical analysis of their responses. The final questionnaire was then distributed to the sample of 400 students. The questionnaire comprised of three sections. The first section required the demographic details of the students including their age, gender, medical school, and year of study. The second part comprised of questions related to the learning styles and preferences of the students, along with techniques and memory aids used by them. The last part contained questions related to the factors influencing the academic performance of the student.

Statistical Analysis:

Data were entered and the responses were assigned numerical values to allow quantitative analysis of the data. Statistical analysis was performed using IBM Statistical Package for Social Sciences (SPSS)version26.0. Frequencies were computed for categorical variables and data was reported as the number and percentage of respondents in each category. Pearson's Chi square test was applied to compare these frequencies for any significant association between variables. In case of scale variables, normality of the data was checked through Kolmogorov-Smirnov test. Mann Whitney-U test was used to compare the central tendencies. Level of significance (alpha) was kept at 0.05 in all cases.

Results:

Of the 400 students participating in the study, 97 (24.2%) were male and 303 (75.7%) participants were female. Demographic features of the study group have been presented in Table 1. There were 99 students from 1st year of study with a mean age of 19 (SD±0.078) years, 104 from 2nd year (mean age 19.8±0.082), 73 from 3rd year (mean age 21±0.092), 69 students from 4th year (mean age 22.2±0.144) and 55 from final year of study (mean age 22.5±0.155). Different factors influencing students' memorization and consequently their academic performance have been summarized in Table 2.

Passion for the medical field was the commonest motivating factor amongst students (n=133; 33.3%) while exam stress was the next (n=118; 29.5%). Unlike the rest of the medical schools, prospect of earning in the future appeared to be the key incentive for students at DIMC (Table 2). The source of motivation to study in students was related to the phase of their training at medical school, with preclinical and clinical years showing a slight but significant difference (P=0.049; fig 1).

Most of the students in our study preferred to study alone (n=233; 58.3%), but for memorizing, silent reading and group discussions were the almost equally adopted techniques (n=203; 50.8% and n=197; 49.3% respectively). A significant association was seen between technique used for memorizing and study preference (p=0.002). Our results show that only 17% (n=70) students rely on internal memory aids like brainstorming (n=55; 13.7%), forming images in mind (n=11; 2.7%) and crafting stories (n=4; 1%), while the rest use external aids such as highlighting or underlining text (n=161; 40.2%) or making notes and flowcharts (n=169; 42.2%) to aid memorization. 47.3% (n=189) students consider early morning time the best to memorize while 33% (n=132) prefer to study late night.

Table 3 demonstrates the daily study hours observed by male and female students and the students of preclinical and clinical years.

Table 1: Demographic characteristics of the study participants

Total students n=400	Gender		Mean Age (±SD)	Medical School			
	Male n=97	Female , n=303		DMC, n=101	SMC, n=100	KMDC, n=100	DIMC, n=99
First Year, n=99	23	76	19.0 (±0.078)	26	21	28	24
Second year, n=104	23	81	19.8 (±0.082)	24	31	24	25
Third year. n=73	18	55	21.0 (±0.092)	25	24	24	0
Fourth year. n=69	21	48	22.2 (±0.144)	13	14	17	25
Final year. n=55	14	41	22.50 (±0.155)	13	10	7	25

Table 2: Medical student's responses on factors affecting their memorization and academic performance

Learning preferences		
Study Preferences	**Study duration required/day**	**When starts memorizing for Exams**
Alone 233 (58.3%)	< 4 hours 188 (46.9%)	From the beginning of the academic session 196 (49%)
With a friend 123 (30.8%)	> 4 hours 74 (18.5%)	One month before exams 204 (51%)
With a group 44 (11%)	8-10 hours 44 (11%)	
	Not daily 94 (23.5%)	
Memorization techniques and aids		
Best time to memorize	**Technique used for memorization**	**Memory aid used**
Early morning 189 (47.3%)	Silent reading 203 (50.8%)	Highlighting/underlining 161 (40.2%)
Afternoon/evening 79 (19.8%)	Group discussion 197 (49.3%)	Making notes/flowcharts 169 (42.2%)
Night/late night 132 (33%)		Brainstorming 55 (13.7%)
		Making images 11 (2.7%)
		Crafting stories 4 (1%)
Factors influencing academic performance		
Motivating factors	**Major source of distraction**	**Factors negatively affecting memorization**
Passion for the field 133 (33.3%)	Family 76 (19%)	Lack of sleep 232 (58%)
Competition 58 (14.5%)	Friends 48 (12%)	Divorced parents 15 (3.8%)
Family pressure 25 (6.3%)	Social media 146 (36.5%)	Recent relationship trouble 83 (20.8%)
Prospect of earning 45 (11.3%)	Gadgets 106 (26.5%)	Psychological/chronic illness 55 (13.8%)
Exam stress 118 (29.5%)	Others 24 (6%)	Death of someone close 15 (3.8%)
Others 21 (5.3%)		

Figure 1: Comparison of different motivating factors between preclinical and clinical year medical students

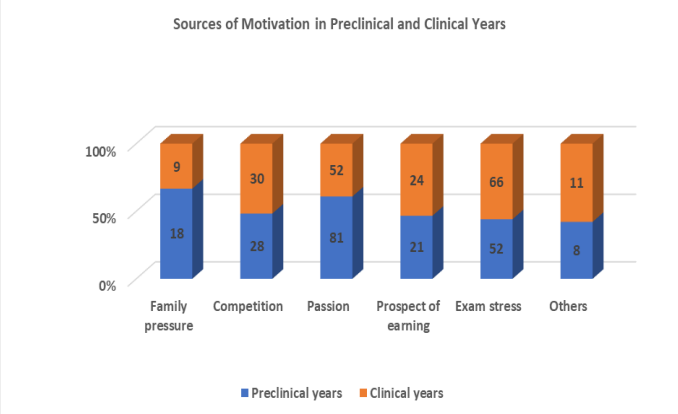

Table 3: Study hours per week observed by different genders and years of study

Study Hours per week				
		Mean ±SD	CI	p value
Gender	Male	24.7 ± 1.74	21.3-28.2	0.062
	Female	21.3 ± 0.88	19.5-23.0	
Year of study	Preclinical	21.6 ± 1.05	19.6-23.7	0.854
	Clinical	22.6 ± 1.19	20.3-25.0	

There was no significant difference in the number of hours of study required by the two genders and the students of preclinical and clinical years. No association was seen between the study approach adopted by students and their year at medical school. 204 (51%) students thought that studying one month prior to examination is a smarter approach because it results in better retention of information, while 49% (n=196) students preferred studying throughout the academic session to cover the extensive syllabus. Students considered lack of sleep and distraction in the form of social media and gadgets the most important factors negatively affecting their academic performance.

Discussion:

Medical education requires depth in understanding, memorization, critical thinking, and problem-solving ability. This study focused on the memorization aspect of students' learning and looked in detail into different factors influencing this process. Our results showed that most students were internally motivated to study as they possessed passion for the field of medicine which would give them an opportunity to help people. These findings are consistent with some other studies reported[14-17]. Exception was at Dow International Medical College, the institution with the highest fee structure, where prospect of earning in the future dominated students' minds. A limitation of the study is, that it mostly included government institutions. Further studies should be conducted to include more private medical schools to see if students' paying high fee for their education resulted in liquidation of altruism.

We found that 11% (n=44) students have to study 8 to 10 hours a day and 18.5% (n=74) study more than 4 hours a day to be able to perform well in exams. Such extensive study hours, along with the university routine is difficult to cope with, as it leads to lack of sleep which majority (n=232; 58%) thinks affects their memory[18] and barely leaves time for recreational activities which are important for the holistic development of students. No significant difference was found in the study hours observed by students of preclinical and clinical years, regardless of the extra load clinical training added on the senior students. 31.2% (n=125) students take power naps in between to enhance their memory[19].

Our results show that only 7.7% (n=31) students seek a teacher's help when they encounter academic difficulty, while the majority of them turn to online resources or prefer asking a friend. 9% (n=36) simply skip the content and move ahead. Extensive use of internet and very limited interaction with teachers is negatively affecting lecture attendance at universities. Medical schools at Pakistan need to establish a culture of group discussions in the form of clubs, giving students platforms to discuss their queries and interact with their teachers in a more informal environment. Our study revealed almost equal number of students adopting superficial and deep learning approaches. Students embracing cramming approach study at the eleventh hour, focusing on memorization rather than understanding and compromising the quality of learning[20]. No significant difference was observed between the learning approach adopted by the preclinical and clinical year students, which shows that students' learning styles, preferences and approaches to knowledge acquisition do not change as they progress in the university. Changes in the examination system need to be made to incentivize deep learning approach. Introducing an aptitude test in the Medical and Dental Colleges Admission Test (MDCAT) in Pakistan will help universities select students with the required ability and interest in the field. Inculcation of research methodology in the curriculum will motivate students towards an inquisitive and innovative approach. A limitation of the study was the questionnaire not catering the group with strategic learning approach. Specially designed questionnaires such as ASSIST[21] should be used in further studies to provide a detailed insight into the learning approaches of the students.

Conclusion:

The same set of study strategies that worked at high school level might not render successful in university because of the greater dimension of knowledge required here[22]. Students entering university are not trained to cope with this change. We tried to gain a detailed insight into the different learning approaches adopted by students who have been already successful in acquiring admission in the four highly rated medical schools of Karachi, Pakistan. The study throws light on a significant number of students relying on rote memorization to gain success in their medical careers.

The high number of study hours students have to spend on memorizing the content do not lessen in years of clinical training, demeaning the importance of experiential learning.

Passion to help people prevails the minds of the medical students. Regardless, education sector needs to look into factors negatively associated with this altruistic approach because in a lower middle-income country, medical professionals have to provide healthcare to the masses with very limited resources. Society has a vested interest in successful students. In a time of financial, political, and healthcare crisis, Pakistan needs competent and selfless doctors. Modifications in the education system are needed to ensure selection of students with the right aptitude and capability who are more inclined towards a deep learning approach[23]. Students need to be engaged into more intellectual discussions with improved outside classroom interaction with their teachers to help them develop into intrinsically motivated visionaries.

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