Original Article

COGNITIVE AND NON-COGNITIVE CHARACTERISTICS PREDICTING ACADEMIC SUCCESS AMONG MEDICAL STUDENTS

Swati Yadav*, Noor us Saba[*], Mohd. Tariq Zaidi[*], Nafis Ahmad Faruqi[*], Mohd. Faheem[**]
*Department of Anatomy, Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh, UP**;**
**Department of Neurosurgery, Uttar Pradesh University of Medical Sciences, Saifai, Etawah, UP

ABSTRACT

Introduction: Medical undergraduates need to possess the ability to acquire knowledge on a wide range of subjects over short period of time. Medical schools worldwide use different methodologies to select ideal candidates, which include cognitive factors and non-cognitive factors. A proper selection will minimize failures during the beginning semesters and will ensure student's capacity to withstand the standard of training. Therefore, we have decided to study the impact of cognitive and non-cognitive factors in predicting the academic success among medical students.

Material & Methods: The study was a survey of 150 first year medical students of Jawaharlal Nehru Medical College (JNMC), Aligarh Muslim University (AMU), Aligarh, admitted in 2018. A data was collected from the Department of Anatomy for initial three part completion tests performance and class attendance, which was tabulated along with the information received from the questionnaire i.e. age, gender, percent secured and language in school, National eligibility cum entrance test (NEET) attempt and marks, residence, category for premedical (PMT) selection (general/ non-resident Indians (NRIs)/ handicap), parents occupation, siblings, family (nuclear/joint/rural/urban), hobbies, time management during PC (part completion) tests, coaching before PMT) given to each student separately.

Observation & Results: Students were observed to lie in three groups according to their performance in PC tests: group I (>60%), group II (50-59.9%), group III (<50%). All the cognitive and non-cognitive factors were compared.

Conclusion: Both cognitive and non-cognitive factors play an important role in the outcome of a medical student. Factors positively influencing the performance of a selected candidate in medical schools cannot be simply based on previous academic performance.

Keywords: Academic success, cognitive factors, non-cognitive factors, selection procedure, medical students

INTRODUCTION

Medicine is a complex and demanding field of education. Medical undergraduates not only require skill and competence in multiple disciplines, they also need to possess the ability to acquire knowledge on a wide range of subjects over short period of time. Medical schools worldwide use different methodologies to select ideal candidates, which include cognitive factors like previous academic performance and non-cognitive factors like personality,

Address for Correspondence:
Dr. Noor us Saba, Department of Anatomy, Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh, UP, India
Mob: 7599113416 Email: noorussaba83@gmail.com

performance at interview, comments by referees, personal statements in forms of essays and assessing the involvement in extra-curricular activities [1-3]. Social and emotional competence was believed to be considered as a determinant for academic achievement [4]. Hence emotions have consistently been seen as an essential components of learning, along with the emphasised cognitive ability [5].

The medical education system in India is one of the largest in the world. It consists of 496 medical schools, each associated with a university, producing around 64,000 doctors each year [6]. The Indian medical education system produces many physicians who emigrating to the United States, United Kingdom and several other countries. The quality of these physicians therefore, has a broad global impact. A proper selection will minimize failures during the beginning semesters and will ensure student capacity to withstand the standard of training [7]. Thus, the objective of this study was to assess the students for medical education on a wider criteria. Therefore, we have decided to study the impact of cognitive and non-cognitive factors in predicting the academic success among medical students.

MATERIAL AND METHODS

The study was a survey, performed on 150 first year medical students of JNMC, AMU, Aligarh, admitted in 2018. Afore mentioned students were informed about the survey and a questionnaire was given to each of them separately. The combined attendance and performance was collected from the Department of Anatomy for initial three part completion tests.

Cognitive factors included performance and language preferences in school, number of PMT attempts, NEET%, category for selection in (Bachelor of medicine and bachelor of surgery) MBBS, hobbies, time management of paper attempt during PC tests, preference of coaching before selection in PMT and class attendance.

The non-cognitive factors were gender, age, present residence during MBBS course, educational status of parents, information regarding siblings, family status with residence and handedness of the students.

All the information received was tabulated and analysed. No statistical methods were used in the survey. The students were divided into three groups on the basis of performance in part completion tests-

Group I- having >60% in PC tests (obtained 360 marks out of 600)

Group II- having 50-59.9% in PC tests (obtained marks between 300-359 out of 600)

Group III- having <50% (obtained <300 marks out of 600)

OBSERVATIONS AND RESULTS

High school and intermediate marks

Students who secured <75% marks in 12th class had also not performed well in PC. Most of them (n= 10,71.4%) were in group III (<50% marks), and none of these students were there in group I (>60% marks), whereas majority of the students (n=58, 42.6%) obtained good marks (50-59.9%, Group II) in PC as well who secured >75% in 12th class, and significant number of these students (n=32, 23.5%) also secured >60% marks (Group I). The relationship of academic performance with 10th boards was not found to be that strong as with class 12th (Table 1).

Medium of school, PMT attempt and NEET marks

Those who preferred English medium for schooling were 42.6% in group II (50-59.9% marks) as compared to those preferring Hindi medium who were 57.1% in group III (<50% marks), more importantly students of Hindi medium were 28.5% in group I (>60% marks) as compared to students of English medium who were 20.9% in the same group. 1st attempters were 30.3% in group I, repeaters were 46.3% in group II and repeated repeaters were 45.7% in group III, showing their maximum percentage in different groups. 40% students were in group II & 30% each were in group I & II who had >600 marks in medical entrance test. NEET marks 400-599 were found to be similar in percentage in group II and were more towards group III in the remaining students. 80% individuals remained in group III had <400 marks in medical entrance (Table 1).

PMT category, Hobbies, Time management during PC test

Only the general category students (22.5%) were in group I (>60% marks). 66.6% NRI were in group II (50-59.9%) and 80% students in handicapped category were in group III (<50% marks). Individuals who spend more time in indoor activities obtained maximum marks (28.5% in group I), whereas least marks were obtained who had outdoor hobbies (50% in group III). 44.2% students were found to be in group II who

followed time management during attempting paper in part completion tests as compared to students who did not follow time limit (45.9% in group III). Percentage was equal in group I for the same (Table 1).

PMT coaching and class attendance

Students who were coached for the entrance exam were 19.8% in group I and the students who did not take coaching were 29.1% in group I. Students who had ≥85% attendance within the duration of part completion were 38% in group I, 15.5% students were in group I who had attendance between 70-84.9%, and <70% class attendance had 73.9% students in group III (Table 1).

Table 1- Outcome of cognitive factors on performance of the students

Factors		No. of students (150 total)	Performance					
			Group I (32 students)		Group II (62 students)		Group III (56 students)	
10th	<75%	6	1	**16.6**	2	**33.3**	3	**50**
	≥ 75%	144	31	**21.5**	60	**41.6**	53	**36.8**
12th	<75%	14	0	**0**	4	**28.5**	10	**71.4**
	≥ 75%	136	32	**23.5**	58	**42.6**	46	**33.8**
Medium in school	Hindi	7	2	**28.5**	1	**14.2**	4	**57.1**
	English	143	30	**20.9**	61	**42.6**	52	**36.3**
PMT attempt	1st	33	10	**30.3**	13	**39.3**	10	**30.03**
	2nd	82	14	**17.07**	38	**46.3**	30	**36.5**
	3rd	35	8	**22.8**	11	**31.4**	16	**45.7**
NEET Marks	<200	1	0	**0**	1	**100**	0	**0**
	200-299	4	0	**0**	0	**0**	4	**100**
	300-399	0	0	**0**	0	**0**	0	**0**
	400-499	3	0	**0**	2	**66.6**	1	**33.3**
	500-599	132	29	**21.9**	55	**41.6**	48	**36.3**
	≥600	10	3	**30**	4	**40**	3	**30**
PMT category	General	142	32	**22.5**	59	**41.5**	51	**35.9**
	NRI	3	0	**0**	2	**66.6**	1	**33.3**
	Handicap	5	0	**0**	1	**20**	4	**80**
Hobbies	Outdoor	64	10	**15.6**	22	**34.3**	32	**50**
	Indoor	63	18	**28.5**	27	**42.8**	18	**28.5**
	Both	23	4	**17.3**	13	**56.5**	6	**26.08**
Followed time management during PC test	Yes	113	24	**21.2**	50	**44.2**	39	**34.5**
	No	37	8	**21.6**	12	**32.4**	17	**45.9**

Factors		No. of students (150 total)	Performance					
			Group I (32 students)		Group II (62 students)		Group III (56 students)	
Medical entrance preparation through coaching	Yes	126	25	**19.8**	53	**42**	48	**38.09**
	No	24	7	**29.1**	9	**37.5**	8	**33.3**
Class attendance	≥85%	50	19	**38**	24	**48**	7	**14**
	70-84.9%	77	12	**15.5**	33	**42.8**	32	**41.5**
	<70%	23	1	**4.3**	5	**21.7**	17	**73.9**

Non cognitive factors

Age and Gender

Female students performed better than boys throughout the PC test. 34.5% female students secured >60% (Group I) as compared to only 13.6% boys. Large number of boys (54.7%) secured <50% (Group III) whereas only 7.2% females obtained <50% marks. Students who were <20 years old performed better than candidates of >20 years of age (Table 2).

Residence and educational status of parents

Day scholars performed better than hostlers consistently. 27.2% day scholars obtained >60% marks as compared to only 19.6% hostlers. Educational status of parents also had an effect on the performance of students. 52.6% students of uneducated parents obtained <50% marks whereas only 35.1% students of educated parents obtained <50% marks (Table 2).

Siblings and nature of family

Students who had more siblings performed poorer than students who had lesser siblings. Students of nuclear family showed better results as compared to joint family. 23.7% students of nuclear family had >60% marks (Group I) as compared to only 12.5% students of joint family (Table 2).

Past residence and handedness

Urban students performed better than rural. 25% students of urban background secured >60% marks (Group I) as compared to only 13.4% of rural students. Right handed students outperformed left handed consistently (Table 2).

Table 2- Outcome of non-cognitive factors on performance of the students

Factors		No. of students 150	Performance					
			Group I (32 students)		Group II (62 students)		Group III (56 students)	
			No.	%	No.	%	No.	%
Gender	Male	95	13	**13.6**	30	**31.5**	52	**54.7**
	Female	55	19	**34.5**	32	**58.1**	4	**7.2**
Age	<20 yrs	102	22	**21.5**	48	**47.05**	32	**31.3**
	≥20 yrs	48	10	**20.8**	14	**29.1**	24	**50**
Present Residence	Hostler	117	23	**19.6**	45	**38.4**	49	**41.8**
	Day Scholar	33	9	**27.2**	17	**51.5**	7	**21.2**
Educational status of parents	Educated	131	28	**21.3**	57	**43.5**	46	**35.1**
	Non educated	19	4	**21.05**	5	**26.3**	10	**52.6**

Siblings	1	12	4	**33.3**	4	**33.3**	4	**33..3**
	2-4	112	25	**22.3**	49	**43.7**	38	**33.9**
	5-7	23	3	**13**	8	**34.7**	12	**52.1**
	$\geq$8	3	0	**0**	1	**33.3**	2	**66.6**
Order of sibling	1st	66	10	**15.1**	33	**50**	23	**34.8**
	$\geq$2	84	22	**26.1**	29	**34.5**	33	**39.2**
Family	Nuclear	118	28	**23.7**	51	**43.2**	39	**33.05**
	Joint	32	4	**12.5**	11	**34.3**	17	**53.1**
Home town	Urban	104	26	**25**	45	**43.2**	33	**31.7**
	Rural	46	6	**13.04**	17	**36.9**	23	**50**
Handedness	Left	11	0	**0**	6	**54.5**	5	**45.4**
	Right	139	32	**23**	56	**40.02**	51	**36.6**

DISCUSSION

Medicine is considered to be the longest and most stressful course of undergraduate study [8]. Present study is one of its own kinds in western region of Uttar Pradesh that evaluates the effects of cognitive as well as non-cognitive characteristics on medical student success or failure.

Our results suggest that past academic performance is one of the predictor of future academic success among medical students. The student's competency in English as assessed by their medium (10th / 12th board) was also a significant predictor of success. Students less competent in English face hurdles while learning and performing at examinations. Their poor knowledge in English also hinders them in participating in academic activities. Our results showed that students of English medium were in average category as compared to students of Hindi medium who performed poorly. Also an important observation was that more number of students of Hindi medium performed fairly as compared to students of English medium. These contradictory findings define the persistent and hardworking nature of some students from Hindi medium.

First attempters performed fairly as compared to repeaters while repeat repeaters performed further poorly. These findings are parallel to some other studies [9-11]. Therefore sessions must be taken to revise the admission criteria in medical schools. Also the students who had higher entrance marks performed well as compared to the student of low entrance marks. The number of failed students showed an increasing trend in lower entrance marks.

Indian culture had old practice of depriving education and job to many based on their caste and category. Those for reservations argued that 'merit' is an amalgam of native endowments and environmental privileges. Those kept away from environmental privileges cannot be equated with others who enjoyed it. The results from the present study support the latter view, because the low rank holders in reserved categories performed poorly as compared the general category. Also those coming from low social background or rural areas performed poorly than those of urban areas who significantly performed above average [7].

The performance was above average for those students who had inclination towards indoor hobbies and poor for the students indulging in outdoor habits. A significant number of students performed average that preferred to spend their time both indoor and outdoor. These findings cannot be generalised as there are different teaching modules and exam schedules across different institutions and courses, hence the results vary from other studies [12].

Students who had practiced time management skills revealed better academic performance in Jazan University [13] as well as in our study.

Coaching to enter medical school first attracted research attention in 2008 [14]. Those who received coaching before medical entrance subsequently show

significantly poorer academic performance compared with those who had not been coached. It suggests that high scores achieved after coaching may not represent true ability to do medicine, or that students who rely on coaching cope less well in academic environments where coaching is not appropriate [15,16]. Attendance policy always can be correlated with better academic performance [17] as good attendance of the students favoured the academic score towards higher side.

Medical schools throughout the world use a variety of criteria to select applicants for admission. These criteria attempts to assess academic performance and personal characteristics suitable for a medical career. Although evaluating academic preparation is simple, assessing personal characteristics are difficult. Non-cognitive testing has been proposed as one such method to assess personal characteristics. However 'non-cognitive' tests at present are associated with numerous questions related to their validity, reliability, fairness and cost. Therefore, before changing admission policies in medical schools by using non-cognitive tests, an open discussion among all stake holders in the admissions process is critically important [9]. Women performed better than men in a study based on clinical performance [18] which is in line with the present findings showing significant difference in poor outcome of male students as compared to females.

A study done in Canada found that learning style positively correlated with younger age at admission to medical school [19], similar to the present findings which showed better performers among students having age <20 years [9]. Day scholars were always good performers as compared to hostlers in contrast to a study done in Maharashtra showing mean score for performance more for hostler students [20].

Educational status of parents and the type of family plays a crucial role in the performance of students. Educated parents in nuclear family can provide student friendly environment to gain knowledge in different fields and impart the importance of education in more productive way. Results of a Nigerian study indicated that parental occupation level significantly influenced student's academic performance, suggesting extended educational support in form of adult literacy programmes to uneducated parents in the country [21]. Furthermore, a single child in the family can perform above average, average or below average in contrast to the 1st born child who showed a decline trend depending on the number of siblings. Some studies disfavour the family

related factors to show any significance for achievements [22,23].

Although the suggesting evidence is very limited and diverse, left hander students were found to be less competent in the study highlighting a growing perception about left handed medical students to face difficulties while performing [24].

CONCLUSION

Both cognitive and non-cognitive factors play an important role in the outcome of a medical student. Factors positively influencing the performance of a selected candidate in medical schools cannot be simply based on previous academic performance.

REFERENCES

1. Ferguson E, James D, Madeley L. Factors associated with success in medical school. Br Med J. 2002; 324:952-957. doi: 10.1136/bmj.324.7343.952.

2. Searle J, McHarg J. Selection for medical school: just pick the right students and the rest is easy! Med Educ. 2003; 37:458-463. doi: 10.1046/j.1365-2923.2003.01496.x.

3. Powis D. Selecting medical students (commentary) Med Educ. 2003; 37:1064-1065. doi: 10.1046/j.1365-2923.2003.01706.x.

4. Austin EJ, Saklofske DH, Egan A. Personality, well-being and health correlates of trait emotional intelligence Personality and Indivd Dif. 2005; 38:547-58.

5. Liff S. Social and emotional intelligence: Applications for development. J Dev Educ. 2003; 26:28-35.

6. Medical council of India. Colleges teaching MBBS. Available at: (http://www.mciindia.org/CMS/information-desk/forstudentstostudyinIndia/list@collegeteachingmbbs. Accessed May 6, 2019.

7. Rohit, Chirukandath R, Kuttichira P. Relationship between entrance ranks and MBBS results in medical colleges of Kerala. Int J Med Res Prof. 2017; 3(2):74-77.

8. Supe AN. A study of stress in medical students at Seth G.S. Medical College. J Postgrad Med. 1998; 44:1-6.

9. Ranasinghe P, Ellawela A, Gunatilake SB. Non-cognitive characteristics predicting academic success among medical students in Sri Lanka. 2012; 12:66.

10. De Silva NR, Pathmeswaran A. Admission to medical schools in Sri Lanka: predictive validity of selection criteria. Ceylon Med J. 2006; 51:17-21.

11. Mettananda DSG, Wickramasinghe P, Kudoluoda Arachchi J. Suitability of selection criteria as a measure of outcome of medical graduates: University of Colombo. Ceylon J Med Sci. 2006; 49:1-12.

12. Nayak SB, Miranda SA, Fitrol OJ, Anthony L, Rao GS, Aithal AP. Online J Health Allied Scs. 2016; 15(2):4.

13. Alsalem WSY, Alamodi LA, Hazazi ATM, Shibah AM, Jabri SA, Albosruor ZA. The effect of time management on academic performance among students of Jazan University. The Egyptian Journal of Hospital Medicine. 2017; 69(8):3042-49.

14. Griffin B, Harding DW, Wilson IG, Yeomans ND. Does practice make perfect? The effect of coaching and retesting on selection tests used for admission to an Australian medical school. Med J Aust. 2008; 189:270-73.

15. Griffin B, Yeomans ND, Wilson IG. Students coached for an admission test perform less well throughout a medical course. Int Med J. 2013; 43:927-32.

16. Griffin B, Wendy CY. Reducing the impact of coaching on selection into medicine. M J A. 2015; 203(9):363.

17. Subramaniam BS, Hande S, Komattil R. Attendance and achievement in medicine: investigating the impact of attendance policies on academic performance of medical students. Ann Med Health Sci Res. 2013; 3:202-5.

18. Haist SA, Wilson JF, Elam CL, Blue AV, Fosson SE. The effect of gender and age on medical school performances: an important interaction. Advances in Health Sci Educ. 2000; 5(3):197-205.

19. Kusurkar R, Kruitwagen C, Cate O, Croiset G. Effects of age, gender and educational background on strength of motivation for medical school. Adv Health Sci Educ Theory Pract. 2010; 15(3):303-13.

20. Mane D, Kakade SV, Alate M. Assessment of study skills between day scholars and hostler students among nursing students. Int J Sci R. 2018; 7(8):348-51.

21. Chukwudi OL, Boniface UU, Ben EO, Victoria CN. Influence of parental occupation and level of education on academic performance of accounting students in Nigeria. 2017; 7(10):21-27.

22. Shawwa LA, Abulaban AA, Merdad A, Baghlaf S, Algethami A, Abu-Shanab J, Balkhoyor A. Factors potentially influencing academic performance among medical students. Adv Med Educ Prac. 2015; 6:65-75.

23. Dillip K, Giri D. A comparative study on the academic achievement of secondary level students of joint and nuclear families in relation to their values and adjustment. 2015:1-9.

24. Alnassar S, Alrashoudi AN, Alaqeel M, Alotaibi H, Alkahel A, Hajjaw W, Al-shaikh G, Alsaif A, Haque S, Meo SA. Clinical psychomotor skills among left and right handed medical students: are the left-handed medical students left out? B M C Med Educ. 2016; 16:97.