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Research Article

Assessment of Relationship between Intelligence Quotient and Academic Performance of Medical Students

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Abstract

Introduction: One of the key criteria in our society to judge the potential and the capacity of an individual is academic achievement. Studies have shown time and again that performance on intelligence tests correlates with school performance. Student achievement and academic performance depend on variables such as the type of school, the socio-economic level of the student, the education of the parents, intelligence, personality, and so on. Gender differentiation in Intelligence quotient has also been a topic of interest for the researchers.

Aims and Objectives of the Study: The study was conducted to determine the IQ levels of the participants, to assess the academic performance of the participants and to find the association between IQ and academic performance of the participants.

Observations: The study was done in a span of 2 months from August to September 2022 in Mayo Institute of Medical Sciences, Barabanki.

A total of 100 students of 2019 MBBS batch responded in the study, out of which 60 (60%) were males and 40 (40%) were females. In the present study 20 students scored marks above 70% marks which in our study is taken as very good. 65 (65%) students scored between 60-70% marks which is considered as Good in our study, 10 students (10%) scored between 50-60% marks which is considered as Average in our study, while 5 students (5%) students scored below 50% marks which is considered Poor in our study.

Conclusion: The study focuses on evaluating the IQ levels and finding its association with the academic performance of medical students. Only 20 students had an IQ to qualify for Average category, where as majority of the students were in the category of below average IQ, we found a direct relationship of IQ with Academic performance of the students wherein students of higher IQ performed better in the Examinations.

Keywords: Relationship; Student; Society

Introduction

A person's education has become an indicator of status in the society. One of the key criteria in our society to judge the potential and the capacity of an individual is academic achievement. Therefore, academic achievement occupies a very important place in education as well as in the learning process [1]. Studies have shown time and again that performance on intelligence tests correlates with school performance. Intelligence is a concept that has affected the life of every individual in all walks of life [2]. It is responsible for academic performance and ultimately for success in life. It helps us overcome life's challenges and be a winner. A child can develop their intellectual abilities to the full if they are given a nurturing environment [2,3]. Extensive researches have been conducted to examine the role of various factors on academic

achievement. According to Watkins, Lei and Canivez (2007), some researches show intelligence and academic achievement as highly correlated, others believe that it is reciprocal while some think it is linked to success. RadhaRahi (1992) revealed that gender differences existed in Academic achievement and boys and girls showed a non-significant positive relationship between intelligence and work activity. Archana Agarwal (2002) studied some correlates of Academic achievement and a significant positive relationship was found between academic achievement and intelligence. Brunietal (2006) examined the relationship between academic achievement and demographic and psychology factors [4]. Student achievement and academic performance depend on variables such as the type of school, the socio-economic level of the student, the education of the parents, intelligence, personality, and so on [5]. It is said that intelligence and achievement are not related to each other, but they are strongly related to each other [6] Good academic performance is not achievable in the absence of intelligence but on the other hand those having high intelligence do not ensure high academic performance [7]. Some researchers think that the association between intelligence and achievement is reciprocal [8]. Still others emphasize that intelligence is causally related to achievement. Laidra., *et al*. 2007 stated that the achievements of students depend intensely on their cognitive abilities [9]. Gender differentiation in Intelligence quotient has also been a topic of interest for the researchers. According to the researches done so far there is no gender difference in general intelligence [10] but contrary to these some studies reported that a difference is present between males and females [11]. Some studies show gender differences in specific thinking abilities. Some report females whereas other report males [13] but many of studies find no gender distinctions in intelligence [12].

Intelligence quotient

In 1912, [13] the German psychologist William Stern coined the abbreviation "I.Q.," a translation of the German Intelligent-Quotient ("intelligence quotient), proposing that an individual's intelligence level can be measured as a quotient of their estimated "mental age" and their chronological age.4 Intelligence Quotient = Mental Age chronological age.

When the mental age is the same as chronological age, the IQ is 100. The higher the IQ, the more brilliant is the child. 80 per cent of people have an IQ of or near 100.

This study was aimed at finding the association between Intelligence quotient (IQ) and academic performance of medical students.

Aims and Objectives

- To determine the IQ levels of the participants
- To assess the academic performance of the participants
- To find the association between IQ and academic performance of the participants.

Methodology

- **Study type:** A cross-sectional survey was conducted among the medical students of a Medical College in Barabanki district of Uttar Pradesh, India.
- **Study area:** Barabanki District of Uttar Pradesh.
- **Study period:** August -September 2022 (2 months).
- **Study Population:** All MBBS students' of 2019 batch who were willing to participate.
- **Exclusion criteria:** Students with history of any psychiatric illness or its treatment and those not consenting were excluded.
- **Criteria for Academic performance**: Performance of students in Phase 2 University examinations of MBBS 2019 batch held in February 2022.
- **Sample size:** Sample size is calculated considering prevalence of average IQ level (p) to be 50%, $Z\alpha/2 = 1.96$ at 95% confidence interval, precision (d) of ±10%. Considering 5% non-response rate, the final sample size was 101.
- **Tools of measurement:** Wechsler Adult Intelligence Scale (WAIS) was used to find out the IQ of students [14]. This scale includes 20 questions and each question carries a score of 10 (Appendix A). Table 1. Shows the Interpretation of IQ scores.

The academic performance will be evaluated considering the aggregate marks of students in one semester and is classified as follows.

Ethics clearance

Before starting the data collection process, approval was obtained from Institutional Ethical Committee (IEC).(Approval number - MIMS/EX/2022/). The study participants were informed about the nature of the study, confidentiality, right to withdraw from the study and subsequently consent was obtained.

IQ level	Interpretation
130 and above	Very Superior
120-129	Superior
110-119	Above Average
90-109	Average
80-89	Below Average
70-79	Borderline
60 and below	Extremely low

Table 1: Interpretation of IQ scores.

Aggregate marks/Percentage	Performance
70% and above	Very Good
60-70%	Good
50-60%	Average
<50%	Poor

Table 2: Academic performance level.

Data analysis

Data was entered and analysed using SPSS version 15.

Methodology

A questionnaire based onWechsler Adult Intelligence Scale (WAIS) was prepared of 20 questions and student responses were registered by conducting a session with the students by distributing the questionnaire from April-September2022. The Google form link to the questionnaire is as below - https://docs.google.com/forms/d/e/1FAIpQLSeV70Vz8ZxuYi-DZkiCXgxaE2CxRp0K-CRAaAFxOBkeNw3odpQ/viewform?usp = sf_link

Results were obtained in the form of percentage and compared with the Academic performance.

Measurement of IQ

We will use Binet and Simon method (Binet-Simon test) of measuring IQ who deciphered how to measure IQ based on their work with the French government. In this method to assess a person's IQ, researchers must first test multiple people from the same age grouping to find an average level of intelligence for each group. They collected data from each age group, looking for what at least 70% of participants can do at their age. This testing gives researchers a baseline for what they call mental age. A person's mental age is defined by their level of intelligence compared to others in the same age group. Next, we have to look at that person's chronological age, which is represented by a numerical value corresponding to how many years lived. To calculate IQ, take a person's mental age, divide it by chronological age, then multiply that number by 100. For example, if a person has a mental age of 12 but is 10 years old, then you'd divide 12 by 10, and multiple that number by 100, which would result in an IQ of 120.

The equation would look like this: 12/10(100) = 120

What Does an IQ Test Measure?

While assessing the relationship between Intelligence Quotient and academic performance of medical students it is important to know what does an IQ test measure.

IQ tests do not measure knowledge; instead, they focus on skillsets, such as a person's ability to reason. This means the tests provide specific information and look to see what the participants do with that knowledge based on the ability to use logic and make predictions. Tests look at the following:

- Short- and long-term memory
- The ability to solve puzzles
- Pattern recognition
- The amount of time it takes to recall information

Observations

The study was done in a span of 2 months from August to September 2022 in Mayo Institute of Medical Sciences, Barabanki.

A total of 100 students of 2019 MBBS batch responded in the study, out of which 60 (60%) were males and 40 (40%) were females (Figure 1).

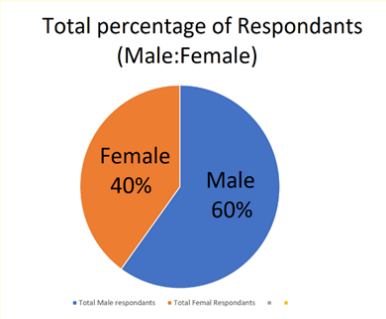

Figure 1: Male: Female ratio of respondents.

The average age of all the students was between 21 years and 22 years only. There was no sex differentiation in the age group.

Criteria taken for assessment of academic performance of MBBS students was their performance in their Phase 2 MBBS University Examinations held in February 2022 and results were declared in March 2022.

Academic performance level

In the present study 20 students scored marks above 70% marks which in our study is taken as very good. 65 (65%) students scored between 60-70% marks which is considered as Good in our study, 10 students (10%) scored between 50-60% marks which is considered as Average in our study, while 5 students (5%) students scored below 50% marks which is considered Poor in our study (Table 3).

Table 3: Relationship between Aggregate marks/Percentage and Academic Aggregate marks/Percentage of the students.

Aggregate marks/ Percentage	Aggregate marks/ Percentage	Total Number of students (n = 100)
70% and above	Very Good	20 (20%)
60-70%	Good	65 (65%)
50-60%	Average	10 (10%)
<50%	Poor	5 (5%)

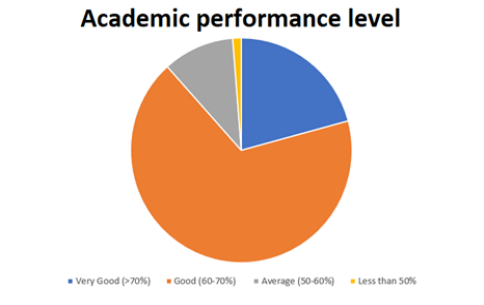

Figure 2: Relationship between Aggregate marks/Percentage and Academic Aggregate marks/Percentage of the students.

Relationship of Academic performance level of medical students with Sex and Academic Aggregate marks/Percentage of the students:

Total number of male students who scored above 70% (Very good score) was 14 (24%) whereas females were 6 (16%), whereas total number of male students who scored between 60-70% (Good score) was 40 (66%) whereas females were 25 (62%), total number of male students who scored between 50-60% (Average score) was 3 (5%) whereas females were 7 (18%), whereas total number of male students who scored below 50% (Poor score) was 3 (5%) whereas females were 2 (5%) (Details Table 4 and Figure 3 and 4).

Table 4: Relationship between Academic performance level of medical students with Sex and Academic Aggregate marks/Percentage of the students.

Aggregate marks/ Percentage	Total Number of students (n = 100)	Male Students (n = 60)	Female Students (n = 40)
70% and above	20 (20%)	14 (24%)	6 (16%)
60-70%	65 (65%)	40 (66%)	25 (62%)
50-60%	10 (10%)	3 (5%)	7 (18%)
<50%	5 (5%)	3 (5%)	2 (5%)

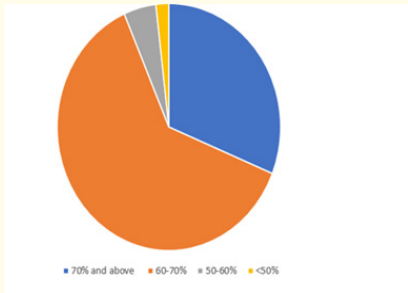

Figure 3: Academic performance level of medical students – Males.

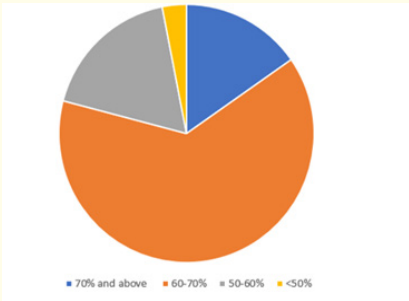

Figure 4: Academic performance level of medical students – Females.

Evaluation of IQ levels of medical students

In the present study no students was found to have an IQ above 110, whereas 20 students (20%) had an IQ between 90 – 110, whereas 65 students (65%) had an IQ between 80-90, 10 students (10%) had an IQ between 70-80 whereas 5 students (5%) had an IQ of either equal to or less than 60 (Details Table 5).

Table 5: Interpretation of IQ scores.

IQ level	Interpretation	IQ of students (n = 100)
130 and above	Very Superior	0 (0%)
120-129	Superior	0 (0%)
110-119	Above Average	0 (0%)
90-109	Average	20 (20%)
80-89	Below Average	65 (65%)
70-79	Borderline	10 (10%)
60 and below	Extremely low	5 (5%)

Intelligence Quotient of medical students with differentiation between males and females

Neither male nor female student had an IQ above 110 in the present study. Total number of male students who had an IQ between 90-100 was 14 (23%) whereas females were 6 (15%), whereas total number of male students who scored an IQ between 80-90 was 40 (66%) whereas females were 25 (62%), total number of male students who scored between 70-80 IQ was 3 (5%) whereas females were 7 (18%), whereas total number of male students who scored IQ below 60 was 3 (5%) whereas females were 2 (5%) (Details Table 6 and Figure 5 and 6).

Table 6: Interpretation of IQ scores with respect to sex.

IQ level	Total number of students	Male Students (n = 60)	Female Students(n = 40)
130 and above	0 (0%)	0 (0%)	0 (0%)
120-129	0 (0%)	0 (0%)	0 (0%)
110-119	0 (0%)	0 (0%)	0 (0%)
90-109	20 (20%)	14 (23%)	6 (15%)
80-89	65 (65%)	40 (66%)	25 (63%)
70-79	10 (10%)	3 (5%)	7 (18%)
60 and below	5 (5%)	3 (5%)	2 (4%)

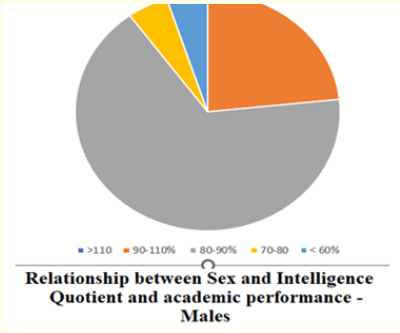

Figure 5

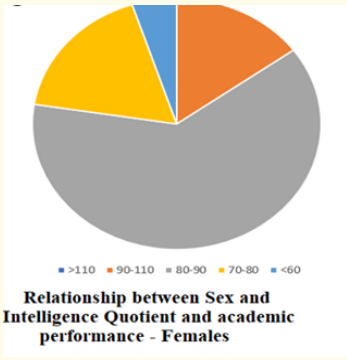

Figure 6

Relationship between IQ and Academic Aggregate marks/Percentage of the students

In the study we found a direct relation between IQ and Academic performance of the students as all the student with IQ between 90-110 had a high percentage of marks i.e., 20 students scored between 70-75%. Majority of students had an IQ of 80-90 which scored between 60-70% marks i.e., 65 students. 10 students had an IQ between 70-80 and this group of students scored between 60-70% i.e., 10 students whereas 5 students had an IQ less than 69 and this group of students scored less than 50% marks i.e., 5 students.

Table 7: Relationship between IQ and Academic Aggregate marks/ Percentage of the students.

IQ level	Total number of students	Aggregate marks/ Percentage	Total Number of students (n = 100)
130 and above	0 (0%)	90-100%	0 (0%)
120-129	0 (0%)	80-90%	0 (0%)
110-119	0 (0%)	75-80%	0 (0%)
90-109	20 (20%)	70-75%	20 (20%)
80-89	65 (65%)	60-70%	65 (65%)
70-79	10 (10%)	50-60%	10 (10%)
69 and below	5 (5%)	<50%	5 (5%)

Discussion

This study was conducted on 100 medical students of 2019 MBBS batchstudying in Second year of the course taking percentage of marks scored in Phase 2 University examinations as base line criteria for evaluation of Academic Performance at Mayo Institute of Medical sciences, Barabanki. A Questionnaire based evaluation form was used to assess the IQ levels of these students using the Binet-Simon testto calculate the IQ from the results and to see the relationship of their academic performance with IQ and also to evaluate any gender difference in IQ. Students are admitted on merit from all over India and belong to a diverse background in terms of schools attended, parental education, socio-economic status etc.The questionnaire was designed in a way to evaluate their cognitive as well as their practical skills as both these skills are the main constituents of intelligence. The results of this study need to be interpreted and understood in the light of previous research on the subject. Traditionally IQ scores had been used in the past as predictors of achievement in life both academic and social as stated by social scientists who study the distribution of IQ scores in populations and the relationships between IQ score and other variables, and as predictors of job performance and income [15,16].

In the present study male respondents were, more than female respondents this also reflects the male to female ratio in medical college although in recent times this ratio is improving in favour of females as more and more females are joining the profession. In our study 60% respondents were males and 40% were females.

Several studies done in the past claim that the male IQs were better than female IQs of medical students [17]. It has also been observed that if a student is subject to IQ testing at different periods in different formats his IQ dies nor remain the same and can differ to some degree for the same person on different IQ tests i.e., a person does not always belong to the same IQ score range each time the person is tested. The effect of genes on IQ varies at different age groups. It is estimated that genes contribute about 20-40% of the variance in intelligence in childhood and about 60% in old age. Thus, the environment and its interaction with genes account for the remaining approximate 50% of intelligence [17].

It has been proved that sex hormones like testosterone and estrogen have a great role in the development of brain and its functions. The hormonal fluctuations has a direct impact on the cognitive abilities of the individual as can be noticed during menstrual cycles in women. The difference of IQ levels in males an females is also based on assessment formats. On spatial questions men tend to perform better, while on reading and other verbal skills women showed better performance compared to men [17]. Inspite of higher IQ of male students than females, it has been noticed that the male admissions in the medical colleges have been decreasing every year and at the same time the outcome performance of female students has been far better than the male students. Despite lower IQs noticed in females their performance in various University examinations have been noticed to be better than males that raises a suspicion that there might not be a direct relationship between the two.

It is a well-known fact that in medical profession students do not get very high marls due to many reasons. In the present study also 20 students scored marks above 70% marks which in our study is taken as very good. 65 (65%) students scored between 60-70% marks which is considered as Good in our study, 10 students (10%) scored between 50-60% marks which is considered as Average in our study, while 5 students (5%) students scored below 50% marks which is considered Poor in our study.

If we look at the relationship of Academic performance level of medical students with Sex and Academic Aggregate marks/Percentage of the students in the present study we find that total number of male students who scored above 70% (Very good score) was 14 (24%) whereas females were 6 (16%), whereas total number of male students who scored between 60-70% (Good score) was 40 (66%) whereas females were 25 (62%), total number of male students who scored between 50-60% (Average score) was 3 (5%) whereas females were 7 (18%), whereas total number of male students who scored below 50% (Poor score) was 3 (5%) whereas females were 2 (5%). i.e., males performed better than females in all the categories except in the category of marks between 50-60% where females performance was better than males. This study does not claim this statement as there is a possibility that good performing female students may not have opted to be a part of the study. Haier, Luders and their associates carried out research studies on brain anatomy, general intelligence, and gender differences [18-20]. They reported that the brains of men and women do differ physically. Men have larger brains than women by about 8–10%, but corpus callosum of female brain is larger than males. Women's

brains were also seen to possess deeper fissures and sulci. At a cellular level, women had nine times more white matter in areas of the brain associated with intelligence than men did, while men had six times more grey matter in these areas.

Evaluation of Relationship between Intelligence Quotient and academic performance of medical students in the present study revealed that no students were found to have an IQ above 110, whereas 20 students (20%) had an IQ between 90 – 110, whereas 65 students (65%) had an IQ between 80-90, 10 students (10%) had an IQ between 70-80 whereas 5 students (5%) had an IQ of either equal to or less than 60. Whereas Relationship between Sex and Intelligence Quotient and academic performance of medical students showed a very similar response. Neither male nor female student had an IQ above 110 in the present study. Total number of male students who had an IQ between 90-100 was 14 (23%) whereas females were 6 (15%), whereas total number of male students who scored an IQ between 80-90 was 40 (66%) whereas females were 25 (62%), total number of male students who scored between 70-80 IQ was 3 (5%) whereas females were 7 (18%), whereas total number of male students who scored IQ below 60 was 3 (5%) whereas females were 2 (5%).

In the study conducted by Veena Y [21] all the subjects (medical students) had an IQ/intelligence interval above 70; Majority of the students had an IQ in range of 80 to 130 (average and above average IQ) without significant gender difference and only 30 (10%) had gifted/genius or extraordinary IQ. Similarly in study "A retrospective review of the neuropsychological test performance of physicians referred for medical infractions" by William P., *et al*. the IQ of medical professional was found to be average. The study also mentioned declining in the intellectual calibre of the entering medical student [22]. Other studies have suggested that the mean I.Q. of individuals with medical degrees is 125 (Matarazzo and Goldstein, 1972; Wechsler, 1972), in our study most of the students had IQ in between 85 to 129 i.e. average and above average IQ [23,24].

Conclusion

The study focuses on evaluating the IQ levels and finding its association with the academic performance of medical students. Only 20 students had an IQ to qualify for Average category, where as majority of the students were in the category of below average IQ, we found a direct relationship of IQ with Academic performance of the students wherein students of higher IQ performed better in the Examinations. Males had a better IQ than females in the study and which was reflected in the Academic performance as well except in the category of Borderline IQ where females performed better than males. The results of this study could provide the necessary guidelines to improve the academic performance of medical students at Institutional level.

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