The Impact of Higher Secondary Level Entrance Examination Score on Academic Performance in the First Year of Engineering: A case Study

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Abstract——**The transition from higher secondary education to undergraduate engineering programs in India is frequently shaped by standardized entrance examinations such as the Joint Entrance Examination (JEE), and State Common Entrance Test (CET). This research paper presents a case study exploring the relationship between entrance examination performance and the academic performance of First-Year Bachelor of Technology students, assessed through their cumulative grade point average (CGPA). The study interprets data from students admitted through entrance examinations over three academic years 2022– 23, 2023–24, and 2024–25.Utilizing statistical tools including correlation analysis, regression models, and Hypothesis test for mean differences. The analysis showed that the academic performance of high merit students is satisfactory, and the academic performance of low merit students goes on decreasing year-wise. The study also examines whether entrance exam scores can reliably predict students' academic outcomes in their foundational year. The findings indicate a weak to moderate positive correlation between entrance examination scores and academic performance, as measured by CGPA. The relationship between students' entrance scores and academic performance was examined by gender, as well as by the type of secondary school board attended, and the conclusions are discussed in this paper.**

Keywords—**Academic Performance; CBSE; CET; Entrance Exam; JEE; SSC.**

ICTIEE **Track—Assessment, Feedback, and Learning Outcomes.**

ICTIEE Sub-Track—Learning Analytics for Evaluation and Improvement.

I. INTRODUCTION

EDUCATION is a process of gaining knowledge and skills, and developing character. Education is essential for personal development and the advancement of society, equipping individuals with knowledge, skills, and the ability to think critically. It empowers individuals with knowledge, skills, and critical thinking abilities for better career opportunities, increased earning potential, and improved quality of life.

Nowadays, passing the entrance exam is the primary requirement for admission to any higher educational institute. Specifically to evaluate a student's suitability for a specific program or institution, the entrance tests are conducted. Some of the entrance exams are at the National level, some are at t h e State level, and some Institutes have their own specific Entrance Test (CET) and the Joint Entrance Examination (JEE). CET is a state-level examination, like the MHT-CET in Maharashtra or KCET in Karnataka, and primarily determines admissions to colleges within that specific state. On the other hand, JEE is a national-level entrance exam conducted in two stages: JEE Main and JEE Advanced. JEE Main scores play a critical role in admission to institutions such as the National Institutes of Technology (NITs), Indian Institutes of Information Technology (IIITs), and other leading engineering colleges across India. Students who qualify in JEE Main become eligible to appear for JEE Advanced, which is the entry exam for the Indian Institutes of Technology (IITs). In JEE Main, each correct MCQ earns 4 marks, and 1 mark is deducted for each wrong answer, encouraging a more cautious approach to answering questions. Maharashtra Common Entrance Test (MHT-CET), conducted by the State Common Entrance Test Cell, Maharashtra, do not use a negative marking scheme and is used for admission to Engineering Colleges. JEE Mains and CET exams assess a candidate's knowledge in Physics, Chemistry, and Mathematics. The scores are then used to calculate ranks or percentiles which in turn determine eligibility and seat allocation during the admission process. The type of school they attended may differ, such as some students may be from the Central Board of Secondary Education (CBSE) or from the Maharashtra State Board of Secondary Education (SSC), or may be through any other boards but they have to go through these entrance exams for admission to Engineering Colleges. These Entrance exams can be related to academic performance, but it vary based on different factors affecting them. Some studies show a positive correlation between entrance exam scores and academic performance while others find a weaker or even no significant relation in several studies on the relationship between entrance exam scores and academic performance. A lot of studies have analyzed that the students from private schools and public schools show a significant difference in their academic performance (Estacio et al., 2022). According to Silfverberg and Orbeta (2016), a positive correlation was observed between academic performance in Math, Science &

English and entrance examination scores. However, the study of Birari & Randhawa (2014) showed that the performance of students in the MBA entrance exam has a very weak correlation with the graduation and post-graduation marks. Their study further categorized according to gender, also reserved & unreserved candidates. In addition to the study, it was also observed that whether the students are grouped according to gender or the type of school they attended does not play any significant role in their entrance exam scores and academic performance (Pastor et al., 2024). In the study, by Fabito et al., (2019), the entrance test was divided into two sections, old instruments (General Information, Mental Alertness and Comprehension) and new instruments (English, Math, Science and Aptitude) and analyzed the data of 213 students and concluded that the new instrument of the entrance test had more significant correlation with academic performance of the students to that of the old instrument. Furthermore study by Sereda et al., (2024), demonstrated the correlation of Academic performance (GPA) with various Factors such as entrance exam performance, learning motivation, and perception of teacher leadership and concluded various results like learning motivation had a strong relationship with the academic performance, whereas teacher leadership plays a very small significant role in the academics and also entrance assessment does not have very large impact on the performance of their academics. Some studies also show that the academic performance of male and female students differs due to some affecting factors. According to the study of Asante et al.,(2023), in senior high school, males performed better than females,but at the tertiary level, the academic performance of female was improved compared to that of male.

For engineering admissions at Savitribai Phule Pune University (SPPU), students fill out an online form, submit documents, and follow the admission process. Admission is based on entrance exam scores and merit lists. An autonomous institute affiliated to SPPU aims to nurture innovation in the field of technology, and the entrance test (JEE/CET) is the key to get in admitted to this institute.

This research examines how scores from higher secondary level entrance tests (JEE/CET) impact the academic performance of first-year engineering students. Also it focuses on the variation in the performance of students, gender wise. Furthermore, the study explores the impact of various secondary-level study boards on both academic achievement and entrance test results. This analysis helps to understand how a student's previous educational background might correlate with their success in engineering and on standardized tests. In essence, the paper provides a multifaceted view of factors affecting academic success in engineering, focusing on the interplay between entrance exam scores, gender, and the influence of different secondary education systems.

II. Methodology

The study interprets data from students admitted through entrance examinations over three academic years (AY) 2022– 23, 2023–24, and 2024–25, 1062, 1126 and 1161 students respectively. Entrance exam data was already collected by the institute during the admission process. Data included the type of entrance exam, and their score, gender, and the secondary board they attended.

The analysis was done using a paired t-test, regression analysis, and Pearson's correlation. Correlation shows how two variables are related and how a change in one is linked to a change in the other. The present study examines two parameters which is entrance test scores and academic performance. A regression model examines how changes in one or more independent variables affect a dependent variable by fitting a line to the data using the least squares method. The coefficient of determination (R^2) shows how much of the change in one variable is explained by the other variables. The paired t-test is used to check if the average difference between two related sets of data is significantly different from zero, assuming the differences are roughly normally distributed.

Entrance exam scores as well as academic performance based on CGPA are categorized using the following value ranges with their descriptions:

Range	Description of performance
90-100	Outstanding
80-89	Excellent
70-79	Very good
60-69	Good
50-59	Average
40-49	Below Average
Below 40	Poor

TABLE I
MERIT- WISE PERCENTAGE OF ADMITTED STUDENTS

Merit Range	2022-23		2023-24		2024-25	
	F	% of Admitted Students	F	% of Admitted students	F	% of Admitted students
90-100	180	16.95	271	24.07	334	28.77
80-89	239	22.50	267	23.71	356	30.66
70-79	146	13.75	194	17.23	213	18.35
60-69	189	17.80	159	14.12	110	9.47
50-59	104	9.79	95	8.44	39	3.36
40-49	84	7.91	58	5.15	40	3.45
Below 40	120	11.30	82	7.28	69	5.94
Total	1062		1126		1161	

TABLE II
MERIT- WISE PASS PERCENTAGE OF F. Y. B. TECH. STUDENTS

Merit Marks	Percentage of Students Passed		
	2022-23	2023-24	2022-23
90-100	14.60	21.31	25.41
80-89	15.16	18.65	22.57
70-79	6.69	11.01	10.51
60-69	8.38	8.35	4.82
50-59	3.39	3.64	1.64
40-49	2.07	1.60	1.29
Below 40	2.92	2.93	1.21

From Table I, it is observed that the maximum percentage of admitted students was in the 80–89 range for all A.Y. 2022–23, 2023–24, and 2024–25, respectively. From fig. 1, it is observed

that the percentage of admitted students with higher merit scores (80–100) has been increasing year by year, while the percentage of students with lower merit scores (0– 40) has been decreasing over the same period.
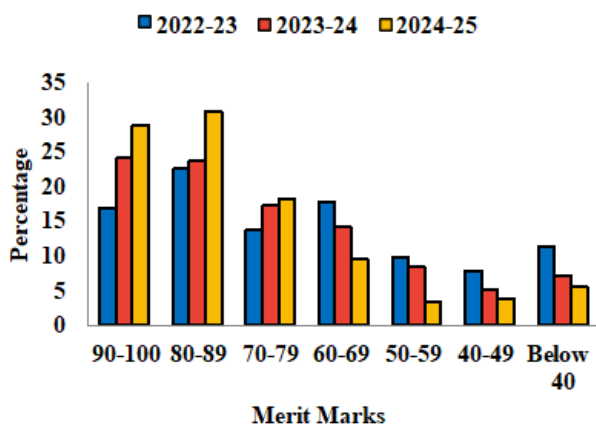

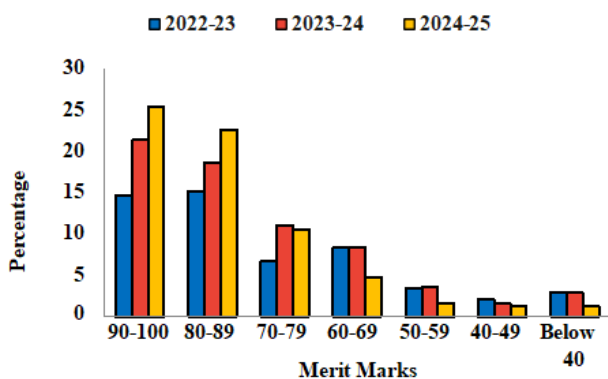Fig. 1. Merit-wise Percentage of Students Admitted

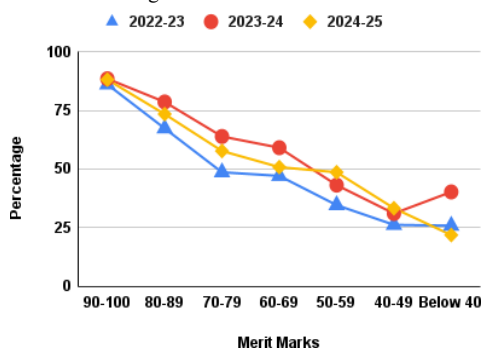Fig. 2. Merit-wise Pass Percentage of First Year Students

Fig. 3. Relative Variation in Percentage of Passed Students with Respect to Admitted Student

Table II, indicates an upward trend in passing percentages for the 90–100 and 80–89 merit ranges across 2022–23 to 2024– 25, while other ranges indicate a marginal decline. From fig. 2, it is observed that the percentage of students passing with higher merit scores (70–100) has increased year by year, while the proportion of students with lower merit scores (0–40) has declined over the same period. Students admitted in the merit range of 0–69, however, demonstrated unsatisfactory performance.

TABLE III
MERIT-WISE RELATIVE VARIATION IN THE PERCENTAGE OF FAILED STUDENTS WITH RESPECT TO ADMITTED STUDENTS

Merit Marks	Relative Variation in Percentage of Failed Students with Respect to Admitted Students		
	2022-23	2023-24	2024-25
90-100	13.85	11.44	11.83
80-89	32.64	21.35	26.53
70-79	51.37	36.08	42.28
60-69	52.91	40.88	49.18
50-59	65.38	56.84	51.37
40-49	73.81	68.97	66.72
Below 40	74.17	59.76	78.16

Table III presents the relative variation in the percentage of passed students with respect to admitted students. The data reveals a strong correlation between the student merit range and the passing percentage. It is observed that students admitted with a merit score between 90–100 consistently achieve a passing rate above 85%, whereas those in the 0–40 merit range record a significantly lower passing percentage, except in AY 2023–24, where the lowest passing rate is found in the 40–49 merit range. Both Table III and fig. 3 indicates a consistent trend across academic years: as merit scores decrease, passing percentages also decline. The passing performance of students with low merit scores is particularly poor, with the lowest outcomes typically occurring in the 0–40 range. A passing percentage corresponding to a merit score below 59 is considered very low ,highlighting the need for targeted academic interventions to improve performance among these student groups.

Regression analysis measures the average relationship between two or more variables using the original data. Using the least squares method, a regression line is drawn that best fits a two-variable distribution. The coefficient of determination (R-squared) shows how well the data fits this line, ranging from 0% (no fit) to 100% (perfect fit).

TABLE IV
CORRELATION AND R2 VALUE FOR ENTRANCE SCORE AND ACADEMIC PERFORMANCE

AY	R	R^2	Percentage R^2
2022-23	0.472	0.223	22.30%
2023-24	0.431	0.186	18.60%
2024-25	0.465	0.216	21.60%

From Table IV it has been observed that over the three academic years, the correlation between entrance scores and academic performance remained positive, indicating that students with higher entrance examination scores generally tended to achieve better academic results. In AY 2022–23, the correlation coefficient was 0.4722, with an R² value of 0.223 (22.30%), meaning that about 22.30% of the variation in academic performance could be explained by entrance scores. For the AY 2023–24, the correlation coefficient decreased slightly to 0.4312, with an R² of 0.186 (18.60%), indicating a weaker predictive relationship compared to the previous year. Whereas, in AY 2024–25, the correlation coefficient rose slightly to

0.4647, with an R² of 0.216 (21.60%), showing a moderate improvement in predictive strength from the previous year.
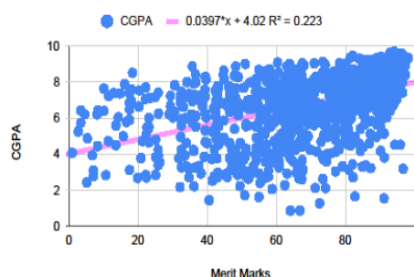

Fig. 4. R2 value for the Entrance Score and CGPA

The data from all the years suggests that there is a relationship between the entrance score and academic performance. They do not have many variations. Observation shows that for the AY 2023-24 shows the weakest correlation. But for the AY 22-23 and AY 24-25, approximately 22% variation was observed, resulting in a moderate relationship, which suggests that there is a scope to predict a relationship between the entrance exam and academic performance. Overall, while the strength of the relationship fluctuated slightly, entrance scores consistently explained between 18% and 22% of the variation in academic performance, suggesting that other factors beyond entrance scores also play a significant role in determining students' academic outcomes.

Table V includes the data of the correlation Coefficient, an R-squared value, and percentage of variation grouped according to gender. The table shows that for the A.Y. 2022-23, for the male students, the correlation coefficient is 0.457 with an R-squared value of 0.209 or 21% of variation resulting in a moderate positive relationship between the entrance exam and academic performance, whereas for the female students, the correlation coefficient is 0.497 with an R-squared value of 0.247 or 25% of variation resulting in a moderate positive relationship, suggests that female student's performance is better than the male students.

Similarly, for the A.Y. 2023-24, male students have a correlation coefficient of 0.405 with an R-squared value of 0.164, which indicates a positive relationship between entrance score and academic performance. About 16% of the variation is observed, leading to a weak relationship between the entrance exam and academic performance. However, female student has a correlation coefficient of 0.538 having R-squared value of 0.289; approximately 29% of the variation is observed, resulting a moderate positive relationship between entrance and academic performance.

A.Y.	Gender	R	R^2	R^2 in percentage
2022-23	Male	0.457	0.209	20.90%
	Female	0.497	0.247	24.70%
2023-24	Male	0.405	0.164	16.40%
	Female	0.538	0.289	28.90%
2024-25	Male	0.442	0.195	19.50%
	Female	0.541	0.293	29.30%

Here, the difference or the variation observed between the male and female students is higher compared to that of the previous year. Furthermore, for the A.Y. 2024-25, male students have a correlation coefficient of 0.442 with an R- squared value of 0.195, which indicate a positive relationship between entrance score and academic performance again. About 19% of the variation is observed, leading to a weak relationship between the entrance exam and academic performance. However Female students have a correlation coefficient of 0.541, having an R-squared value of 0.293; approximately 29.3% of the variation is observed, resulting in a moderate positive relationship between entrance score and academic performance. Hence, the above table concludes that there is a positive correlation between the entrance exam score and academic performance for all three years when grouped according to gender, but the performance of the female students is better compared to the male students. Girls demonstrate stronger academic performance as they are generally more disciplined, organised, and consistent in managing their studies. In addition their typically more positive classroom behaviour enables sustained focus and engagement, which further supports their learning outcomes.

Table VI, shows that across the academic years 2022–23, 2023–24, and 2024–25, no significant differences were found in CET or JEE scores between male and female students at the 0.05 level of significance. In each year, the calculated t-statistic was less than the corresponding critical value, indicating a lack of statistical significance. Thus, for both CET and JEE examinations over these three years, gender-wise differences in scores were not statistically significant at the 95% confidence level. Whereas table VII, indicates across the academic years 2022–23, 2023–24, and 2024–25, CET and JEE scores exhibited gender-wise differences at the 0.05 level of significance. In 2022–23 and 2024–25, the calculated t-statistic exceeded the critical value, indicating statistically significant differences between male and female students. However, in 2023–24, the t-statistic was lower than the critical value, suggesting no statistically significant difference.

TABLE V
CORRELATION (R) AND R2 VALUE FOR ENTRANCE SCORE AND
ACADEMIC PERFORMANCE, GENDER WISE

TABLE VI
GENDER-BASED STATISTICAL EVALUATION OF ENTRANCE TEST PERFORMANCE USING T-TEST

AY	Type of Entrance	Gender	F	M	Mean Difference	t-value	p-value	Remark
2022-23	CET	Female	314	70.02	2.60	1.79	0.0736	Accept H0
		Male	613	67.41				
	JEE	Female	34	71.96	4.71	1.20	0.2341	Accept H0

AY	Type of Entrance	Gender	Frequency	Mean	Mean Difference	t-value	p-value	Remark
		Male	101	67.25				
2023-24	CET	Female	319	72.87	0.19	-0.13	0.8985	Accept H0
		Male	672	73.07				
	JEE	Female	34	73.43	0.21	-0.08	0.9376	Accept H0
		Male	101	73.65				
2024-25	CET	Female	341	78.75	2.33	1.86	0.0633	Accept H0
		Male	676	76.43				
	JEE	Female	38	80.20	1.39	0.71	0.4813	Accept H0
		Male	106	78.81				

TABLE VII
TEST GENDER-BASED EVALUATION OF FIRST-YEAR ACADEMIC PERFORMANCE USING T-TEST

AY	Type of Entrance	Gender	F	M	Mean Difference	t-value	p-value	Remark
2022-23	CET	Female	314	70.76	4.80	3.81	0.00015	Reject H0
		Male	613	65.97				
	JEE	Female	34	71.52	8.12	2.77	0.00730	Reject H0
		Male	101	63.40				
2023-24	CET	Female	319	74.43	7.80	6.93	0.00000	Reject H0
		Male	672	66.63				
	JEE	Female	34	71.52	4.98	1.63	0.10808	Accept H0
		Male	101	66.54				
2024-25	CET	Female	341	77.47	8.85	8.49	0.00000	Reject H0
		Male	676	68.62				
	JEE	Female	38	79.94	10.65	4.85	0.00000	Reject H0
		Male	106	69.29				

TABLE VIII
STATISTICAL ANALYSIS OF SCHOOL BOARD INFLUENCE ON ENTRANCE TEST AND ACADEMIC PERFORMANCE USING T-TEST

AY	Description	Type of Board	Frequency	Mean value	Mean Difference	t-value	p-value	Remark
2022-23	Entrance Test	SSC	855	67.32	-4.95	-2.77	0.0061	Reject H0
		CBSE	148	72.27				
	Academic Performance (CGPA)	SSC	855	66.25	-4.92	-3.33	0.0010	Reject H0
		CBSE	148	71.17				
2023-24	Entrance Test	SSC	899	72.66	-2.87	-1.65	0.0994	Accept H0
		CBSE	170	75.53				
	Academic Performance (CGPA)	SSC	899	68.39	-5.02	-3.86	0.0001	Reject H0
		CBSE	170	73.41				
2024-25	Entrance Test	SSC	914	77.99	1.39	0.87	0.3867	Accept H0
		CBSE	184	76.60				
	Academic Performance (CGPA)	SSC	914	71.28	-2.65	-2.04	0.0424	Reject H0
		CBSE	184	73.93				

From Table VIII, it is observed that in AY 2023–24 and AY 2024–25, the *t*-statistic for the entrance exam score is less than the *t*-critical value, indicating that there is no significant difference in entrance exam scores based on the board attended. However, in AY 2022–23, the calculated *t*-statistic is greater than the *t*-critical value, suggesting a significant difference in entrance exam scores with respect to the board attended. In contrast, for all the academic years considered, the *t*-statistic for academic performance is greater than the *t*-critical value, indicating a significant effect of the board attended on academic performance. Students from the CBSE board are more competent academically compared to the students from the SSC board. Another one is that the CBSE board syllabus is more generous in giving academic performance ratings as compared to the SSC board. It involves CCE (Continuous and Comprehensive Evaluation). CCE in CBSE helped reduce exam stress by assessing students through regular tests, projects, and activities throughout the year. It promoted overall development by evaluating both academic performance and co-scholastic skills like creativity, teamwork, and discipline.

CONCLUSION

The analysis shows that the percentage of students passing with higher merit scores (70–100) has increased year by year, while the proportion of students with lower merit scores (0– 40) has declined over the same period. Whereas, passing percentage corresponding to a merit score below 59 is considered very low, highlighting the need for targeted academic interventions to improve performance among these student groups. The strength of the relationship between entrance exam scores and academic performance varied slightly over the three academic years, with entrance scores explaining between 18% and 22% of the variation in academic performance. This indicates that while entrance exam scores have a measurable impact, other factors also contribute significantly to students' academic outcomes. Across all three years, a positive correlation was observed between entrance exam scores and academic performance when t h e data were grouped by gender. Female students consistently outperformed male students in academic performance. The percentage of admitted students with higher merit scores (80–100) has been increasing year by year, while the percentage of students with lower merit scores (0–40) has been decreasing. Indicates that the percentage of failed students is lowest in the 90–100 merit range. In the 80–89 range, the failure rate shows a slight increase, while in ranges below 80, it increases progressively. This trend demonstrates that the pass percentage is considerably lower in the lower merit ranges compared to the higher merit ranges.

For both CET and JEE examinations, gender-wise differences in scores were examined at the 95% confidence level. The results showed that these differences were not statistically significant in general, although specific years displayed variations. CET and JEE scores exhibited gender-wise differences at the 0.05 level of significance in certain academic years. In 2022–23 and 2024–25, the calculated *t*-statistic exceeded the critical value, indicating statistically significant differences between male and female students. However, in 2023–24, the *t*-statistic was lower than the critical value, suggesting no statistically significant gender-wise difference for that year.

When considering the effect of the board attended, the results show that the *t*-statistic for entrance exam scores was less than the *t*-critical value for AY 2023–24 and AY 2024–25, indicating no significant difference based on the board attended in those years. In contrast, for AY 2022–23, the *t*-statistic exceeded the *t*-critical value, indicating a significant difference in entrance exam scores with respect to the board attended. Importantly, for all three academic years, the *t*-statistic for academic performance was greater than the *t*-critical value. This confirms that the board attended had a significant impact on academic performance across all years studied. Furthermore students admitted in the merit bracket of 0-69 showed comparatively weaker academic performance. To enhance their learning outcomes, it is advisable to provide dedicated academic support, including consideration for forming a separate division at the time of admission.

Overall, the findings highlight that while entrance exam scores are positively related to academic performance, they are not the sole determinant. Gender and board attended both influence outcomes in certain years, with female students generally performing better academically. The impact of the board attended appears consistently significant for academic performance, even when it is not for entrance exam scores.

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