# Predictive Value of Engineering Entrance Test on Academic Performance in Engineering Degree Course

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**Abstract:** The study was conducted to determine the correlation between rank in the Engineering Entrance Test and academic performance as measured by rank in the 1st Year Engineering Degree Examination. The sample consisted of 107 students of B.Tech. (Biotechnology and Biochemical Engineering) studying at 3 Engineering Colleges under the Kerala University. Only 44 students secured full pass in the 1st Year Engineering Degree examination in their first attempt. Their academic ranking was determined on the basis of Grade Point Average (GPA) scores. The ranks of these students in the Engineering Entrance Test varied from 6329 to 50401 at the all Kerala level. These ranks were re-allocated from 1 to 44 to have a one-to-one correspondence with the academic ranking. Correlation between the two ranks was calculated using the Spearman's Rank Correlation Co-efficient. A significant positive correlation was found between the Entrance Test Rank and 1st Year Engineering Rank at 5% and 1% levels of significance, thus establishing the predictive value of the Engineering Entrance Test.
**Keywords:** Predictive value, Academic Performance, Grade Point Average, Rank Correlation Coefficient

## I.   Introduction
Entrance tests for selection of students aspiring to join professional courses such as Engineering and Medicine have now become common in most parts of the world. Such tests were conducted in the US as far back as 1928.But Indian Universities introduced entrance tests only about two decades ago. Many Universities in India are still admitting students to such courses on the basis of marks/ grades obtained in the qualifying examinations such as Higher Secondary.

The selection of students solely on the basis of performance in the qualifying examination has many inherent disadvantages. Scores in qualifying examination do not reflect the aptitude of the student for any chosen professional course. As these examinations mostly test the grasp of the topics covered under the syllabus and not the intellectual capabilities of students, performance measured in terms of marks or grades do not reflect the potential of the students. Secondly, when students from different boards such as the Central Board of Secondary Education (CBSE) and State Higher Secondary Boards compete for seats, the valuation pattern at the Board examinations plays a major role. Students scoring high marks due to the liberal valuation scheme of one Board often gain undue advantage over more capable students who  are evaluated in a tougher manner under another scheme.

Institutions in Kerala currently offering Graduate Engineering programmes fall under various categories are as shown.
* Under full Govt. control
* Govt.Aided colleges
* Self-financing Colleges under state Govt. Depts. and Universities
* Private Self-financing Colleges

The total number of seats available is above 60,000. There are 29 branches of study at UG level. With the supply exceeding demand, the current situation is that of a buyers' market. The self-financing colleges are trying to woo the students by promises of lower fees and other concessions. At the same time, colleges from other states are also active in the market because their seats now remain unfilled following the opening of new colleges in Kerala. They try to convince the parents that their colleges are free from political influence and the students can concentrate on their studies.

The eligibility criteria for admission to the Engineering Colleges in the state of Kerala are decided by the Government of Kerala. The Commissioner for Entrance Examinations is entrusted with the work of conducting Entrance tests and controlling admissions to the Engineering Degree programmes conducted by colleges which fall under the following Universities:
* Kerala University

- Calicut University
- Mahatma Gandhi University
- Kannur University
- Kerala Agricultural University
- Kerala Veterinary and Animal Sciences  University
- Cochin University of Science and Technology (CUSAT)

Entrance Examinations are usually conducted in the months of April or May and admissions are carried out in the months of July- August. There are three papers viz. Mathematics, Physics and Chemistry. Evaluation process includes negative marks for wrong answers. Those scoring 10 marks or above in the Entrance Test are placed in the Eligibility List.

## II.  Literature Review

As entrance tests are of recent origin, only limited studies have been conducted on the correlation between Entrance Test scores and subsequent academic performance. Most of the research work on academic achievement is centred around factors such as High School and Higher Secondary examination scores, residential background and gender. Entry level knowledge has been considered to be an important factor in determining subsequent academic performance by many researchers.

Palsane (1965) studied the prediction potentiality of marks scored in the Secondary School Certificate examination to performance in engineering disciplines [1]. He found that   marks  obtained in Mathematics and Science at Secondary School level were significant   predictor variables for success in engineering disciplines.

Glaser (1967) has emphasised the importance of entry behaviour as a critical element in instructional design [2]. The points of view elaborated here is that certain previously learned capabilities need to be retrieved from the long-term memory and need to be readily accessible in the working memory, whenever a new capability is learned. These resultants of prior learning may support the new learning. An example is the retrieval of a cognitive strategy which permits the encoding of to-be-learned information. An equally important function of retrieval of previously learned capabilities, however, is their incorporation into new learning. When the intellectual skill of adding integers is learned, the previously acquired skill of subtracting whole numbers is incorporated as part of the new capability.

Kaur (1968), however, found that even the marks in subjects like Mathematics, Physics and Chemistry had negative correlation with final success scores in engineering courses [3].

Piaget (1970) is of opinion that cognitive strategies require pre-requisite intellectual growth, in the sense of the maturation of capabilities of logical thought [4]. Learned intellectual skills support this intellectual growth, since they make possible the variety of specific performances required in the practice of cognitive strategies.

Tiwari (1975) found that Algebra and Geometry facilitate learning of various branches of science [5]. The symbolic elements of Algebra and figural elements of geometry were found helpful in developing numerical and spatial reasoning.

Indiresan (1975) concluded that high school marks and aptitude test scores had insignificant correlation with academic performance, but when both the variables were studied in combination, they almost doubled the correlation with academic performance [6].

Sharma (1978) studied the admission procedure in engineering colleges and reported correlation of 0.62 between Pre-university marks and 1st terminal examination marks in Engineering [7].

Anand (1987) studied the correlation between the performance of students in different higher secondary subjects and their performance in Polytechnics [8]. He observed that:

i) The marks obtained in English at Higher Secondary examination have low correlation with total marks obtained in the 1st year and 2nd year Diploma courses.

ii) The total marks obtained in Physics, Chemistry and Mathematics have maximum correlation with pre-engineering test performance as well as total marks obtained in the 1st year and 2nd year Diploma courses.

Mohammad (1987) studied the effect of cognitive and non-cognitive variables for the academic success of students from UAE studying in the US [9]. He investigated the effect of a combination of academic, social and background variables to predict the academic achievement of these students. The study found that the General Secondary School Certificate Examination (GSSE) scores prevailed as the best predictive measure of students' academic success.

Negi (1990) found that scores at JET (Joint Entrance Test) and marks obtained in Physics, Chemistry and Mathematics at +2 stage were positively and significantly related to B.E. 1st and 2nd semester examination marks [10]. .

A study was conducted by Abdul Salam (1997) among Engineering Diploma students, in which he found positive correlation between marks in Physics, Chemistry and Mathematics at +2 level and academic achievement in 3-year Diploma Courses [11].

Alias and Zain (2006) conducted studies on performance of 612 students of Masters in Technical and Vocational Education (MVTE) programme, belonging to five different disciplines [12].The data were based on students' academic records. Using Pearson product moment correlations method, they found that the overall correlations between undergraduate and graduate CPAs are weak but statistically significant. They concluded that both the undergraduate programme of study and Undergraduate Cumulative Point Average (UCPA) are predictors of Graduate Cumulative Point Average (GCPA) and the extent to which UCPA contributes towards CGPA varies across programmes of study.

Radhakrishnan, Lee and Young (2012) studied the influence of admission qualifications on the performance of first and second year medical students at The International Medical University (IMU) [13]. IMU accepts students from a wide range of pre-university entry qualifications for admission into the medical programme. The criteria for the various pre-university entry qualifications used by the IMU were agreed and accepted by the IMU Academic Council (AC). In this study, the various entry qualifications were first grouped into five categories based on the educational pedagogy. Then, this was aligned with the entry qualification data of all students who had been admitted into the IMU medical programme for the period of December 1993 to March 2000. The relationship between the five groups of pre-university entry qualifications and the students' academic achievement in three end-of-semester (EOS) examinations were analysed. Results showed that students with better grades in their pre-university examinations showed better performance in their EOS examinations, regardless of the subjects that they took at the pre-university level. Students who came in with certain pre-university qualifications generally performed poorly compared to students with more conventional qualifications. However, after their first year in medical school, there were no significant differences in the performance of the students. They conclude that students with better grades in their pre-university examinations showed better performance in their EOS examinations, regardless of the science subjects that they took at the pre-university level.

Aidoo-Buameh and Ayagre (2013) studied the correlation between entry grades and academic performance of Accounting students [14]. Results of the study confirmed that the grades obtained in Pre University Mathematics (or Core Mathematics) and Pre-university Accounting were found to be statistically significant in determining performances of accounting students in the university, while grade in English Language was not found to be statistically significant to students' performance at the university.

Wambugu and Emeke (2013) conducted research on the relationship between entry qualification and academic performance in undergraduate science courses at the University of Nairobi, Kenya [15]. They indicated that there was a significant positive correlation between entry qualification and academic performance in Chemistry and Biology. In Physics, there is almost no linear relationship. The finding from this study is similar to others which indicate that there is a correlation between entry qualification and academic performance. However, this is not the only variable that can predict performance. In other words, entry qualification alone may not be a good predictor of undergraduate performance. In cases where applicants have less than excellent mean grades, the contributions of other criteria such as age, work experience, past academic performances and participation in co-curricular activities at secondary level could be explored before an outright acceptance or rejection of students. Therefore entry qualification is not the best variable to predict academic performance though this parameter should not be ignored in admission exercises.

Khalid R.Murshid (2013) conducted study on the reliability of the selection criteria used at Taibah University College of Medicine, Saudi Arabia, for predicting academic performance, in order to determine those that are most reliable [16]. A retrospective cohort study was conducted on the 478 students in the first 4 years of a 6-year programme at the College of Medicine between February and April 2012. The variables examined were high-school grades, aptitude test scores, achievement test scores and the balanced percentage. The criterion was the college grade point average of the students at each academic level. Pearson correlation coefficient and regression analysis were used to assess the associations between scores.A significant positive relation ($p < 0.01$) was found between high-school grade and achievement test score and the college grade point average, high-school grade being the most predictive. No significant relation was found with aptitudetest score.

Jonathan Rasmus (2016) addressed the predictive validity of three common types ofselection methods used in student selection in Finland by examining their ability to predictone-year study performance at university [17]. The three predictors were the Finnish matriculation examination, entrance exam, and a fluid intelligence task. In order to tap various aspects of study performance, three outcomes were measured; grade point average, amount of credit, and a composite of the two. The sample consisted of 100 students from Åbo Akademi

University. Based on hierarchical multiple regression analyses, the matriculation examination scores significantly predicted grade point average, fluid intelligence showed only a weak positive relationship to grade point average, and the entrance exam failed to predict any of the outcome measures.

Shahid A.Akhund (2016) who studied the predictive value of Medical school entrance tests in Pakistan on academic and professional performance reported that entrance tests predict positively the academic performance in basic sciences and clinical sciences [18]. It also predicts positively the overall professional performance at the exit level.

### III.     Materials and Methods

Although the availability of seats for engineering degree programmes in our country has increased exponentially over the past few decades, the academic performance of students during the course of study has declined sharply. Even though there are various factors that affect the achievement of students in an educational programme, entry behaviour or entry qualification is one of the most important factors affecting the subsequent performance of students.

It was, therefore, proposed to undertake a study comparing the entry test ranks of students with their academic achievement in the First Year of the engineering degree programme.

The study covered students of selected self-financing engineering colleges affiliated to the Kerala University whose entry qualifications are:

1. Pass in the Higher Secondary Examination conducted by the Kerala State Board of Higher Secondary Education

2. Pass in the Higher Secondary Examination conducted by the Central Board of Secondary Education (CBSE)

The objective of the study was to compare the academic achievement of First Year engineering degree students of Kerala University in relation to their rank in Common Entrance Examination

The study was conducted to test the following null hypothesis:

There is no significant difference in the academic achievement of First Year Degree students of Biotechnology and Biochemical Engineering in relation to their rank in the common entrance examination.

All Fourth Semester (Direct Entry) students of B.Tech (Biotechnology and Biochemical Engineering) of the three colleges under Kerala University were covered in the study. Fourth Semester students were selected because the results of their First Year degree examinations are already available. Requisite data was collected from the students in regard to their academic achievement in First Year engineering. Information Sheet for collecting the requisite data was developed by the investigator.

Copies of the Information Sheet were administered to the students of the three colleges. Data regarding marks obtained in the qualifying examination and rank in the entrance test were also collected from records maintained in the colleges.

Spearman's Rank Correlation Coefficient was used to determine the correlation between Entrance Test Rank and First Year Engineering Rank. For this, the entrance test ranks were re-allocated to form a one-to-one correspondence with the ranks in the First Year Engineering Examination.

### IV. Results and Discussion

Findings of the study are recorded in two tables. The first table gives the ranks of students based on the Grade Point Average (GPA) score for the 1st Year Engineering Examination. The second table re-allocates the Entrance Test Ranks obtained on all Kerala level to sequential ranks such that the best rank in the Entry Test among the students in the sample is converted Rank 1 and the last rank corresponds to the total number of students securing full pass in the 1st Year examination. In this way, a correlation is made between the entrance rank and 1st Year examination rank.

The sample consisted of 107 students of B.Tech. (Biotechnology and Biochemical Engineering) studying at 3 Engineering Colleges under the Kerala University. Only 44 students secured full pass in the 1st Year Engineering Degree examination in their first attempt. Their academic ranking was determined on the basis of Grade Point Average (GPA) scores. The ranks of these students in the Engineering Entrance Test varied from 6329 to 50401 at the all Kerala level. These ranks were re-allocated from 1 to 44 to have a one-to-one correspondence with the academic ranking. Correlation between the two ranks was calculated using the Spearman's Rank Correlation Co-efficient. Value of the Co-efficient, r was obtained as 0.4797.

$\sigma_r$ value vas found to be 0.1525.From z table, value of z at 5% level of significance was obtained as 1.645.For 1% level of significance, the corresponding z value was 2.326. As the obtained value of r, 0.4797, was in the rejection zone for both the levels of significance, the null hypothesis was rejected and the alternative hypothesis given below was accepted, i.e.

there is significant direct correlation between the rank in the common entrance examination and academic achievement in their First Year Degree Examination in the case of students of Biotechnology and Biochemical Engineering.

The result establishes the predictive value of the Engineering Entrance Test Ranks with respect to their performance in the First Year Degree examination.
However, the study has the following limitations:

• The sample selected pertains to only one Branch of Engineering Degree programme.
• Performance beyond the First Year Degree level has not been studied.
• Other factors such as level of motivation, support from the Faculty members of the college and social environment of the students are also likely to affect the performance of students.

## V. Conclusion

The study points out the direct relationship between the Entrance Test rank and the performance of student in the Engineering Degree Programme. Even now, many Universities select students on the basis of their performance at entry level i.e.scores achieved in the Higher Secondary examination. Even in institutions where Entrance Test is conducted, only 50% weightage is given to the Entrance Test Rank and the remaining 50% is allocated for scores in the qualifying examination. It is evident that achievement at Higher Secondary level indicates grasp of the curriculum alone and does not throw light on the higher level intellectual capabilities of the student. In contrast, the Engineering Entrance tests are designed to examine the logical and intellectual capabilities of students in addition to their subject knowledge.
It can be safely concluded that selection of students through Entrance Test ranks will be helpful in identifying talented students and improving the standard of Engineering Degree Programmes.

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