Analysis of Factors Affecting Students' Academic Performance

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***Abstract* — In this paper, we examine the effects of factors directly influencing the cognitive abilities of students on academic performance. The study is based off of data collected through a questionnaire circulated throughout the campus of National University of Science and Technology, aimed towards all the students. Pearson's correlational coefficient analysis was utilized to determine the extent to which each factor influenced academic performance. According to our findings, the factors contributing most to academic performance are the variables surrounding the students as well as their mental wellbeing.**

Keywords — Academic Performance, Home Environment, Academic Approach, Cognitive Abilities, Academic Interactivity, Guildford's Rule of Thumb, Pearson's Correlation Coefficient

I. INTRODUCTION

In this paper, we investigated factors affecting university students' academic performance through Pearson's correlation analysis. Dominant factors that affect academic performance, such as academic approach, mental stability, environs & environment, and cognitive capabilities, were considered while carrying out this study. Our sampled clusters were limited to NUST (National University of Science and Technology) students, and students from all years and fields were considered to eliminate biases from the results. Our sample size consisted of 148 students. Using Pearson's coefficient analysis, we discovered that the variables associated with the environs & environment, as well as mental stability, had the biggest impact on students' academic performance.

The dominant measures of academic performance in relevant papers surrounding academic performance, are grades, and deriving from these grades, the Grade Point Average (GPA) [1]. The internal reliability of using GPAs to keep track of academic performance is relatively higher than other lesser used measures, specifically because they essentially converge to grade inflation when dealing with large sample sizes.

For the objective of this paper, we develop relations of academic performance with independent factors that influence it. The student's immediate surroundings and environment have the greatest impact on his or her academic performance. Home has a significant impact on a student's academic progress and has direct control over an individual's psychological and emotional behavior. Another factor that plays a major role in determining academic performance is the academic approach of the students. Poor study habits almost always lead to lower grades than those with better study habits.

Academic interactions play a vital role in determining students' academic performance. Arif Altun et al. [2] described academic performance as a direct function of academic interactions in a productive learning-based environment.

The issue of mental health is another factor that affects university students' academic performance. Depression and anxiety, which are prevalent in the subject of mental health, have a significant impact on academic performance in the long run.

II. Related Work

Many recent works have been conducted on academic performance of students in universities and the factors which influence them. Hanson [3] reported the factors influencing the academic performance of students and developed its relationship with certain factors upon which it is dependent.

Hassan Afzal et al. [4] concluded the significance of motivation behind a student's educational success. The study delineates that students' motivations, dimensions, extrinsic motivation, and intrinsic motivation have a positive impact on academic performance of students.

Kathleen Lynne Lane et al. [5] carried out a research-based analysis on the behavior of academic performance with emotional behavioral disorders. Findings also suggested that behavioral variables (e.g., school adjustment, externalizing, and internalizing) were predictive of broad reading and broad written expression scores, with school adjustment (a protective factor) accounting for the most variance in the three-variable model.

McKenzie and Schweitzer [6] conducted prospective research and explored the psychological and demographic predictors of first year students at Australian Universities.

Moreover, Waleed Muaghed Al-Rahmi and Mohd. Shahizan Othman [7] studied the impact of the use of social media on the academic performance of university students.

III. Methodology

A. Population

This study aims to assess the general academic performance of undergraduate students residing within Pakistan. For this purpose, our study was directed towards all the undergrad students currently studying in NUST. The size of this target population is 7197 students.

B. Sampling Technique

From common observation, students of different fields display different behavioral patterns and hence, varying academic performance. Cluster sampling was used where different institutions served as an individual cluster and random samples were selected from among these clusters.

Keeping in mind the time constraints, sample size was obtained using Cochran's [8] formula:

$$n = \frac{\frac{z^2 * p(1-p)}{e^2}}{1 + \left(\frac{z^2 * p(1-p)}{e^2 N}\right)}$$

Where N represents the population size and keeping e, the margin of error, a value of 0.08, the confidence level z at 0.95, and the standard deviation at 0.5, we calculate the ideal sample size for the present case to be 148 students.

C. Research Tool

The collection of data was accomplished through the conduct of a digital survey, created on Google Forms. The questionnaire was designed in such a way as to assess all the hypothesized dimensions having a substantial effect on the academic performance of students. The respondents were asked to indicate their degree of agreement with statements pertaining to these dimensions, scored on a five-point Likert-type scale [9]. For the analysis of data, Microsoft Excel was used and the in-built CORREL function was used to compute Pearson's coefficient of correlation.

D. Analyzing Data

After the collection of necessary data, appropriate analysis techniques should be utilized to get the best estimate of academic performance of a sample student, based on the factors discussed above. Since the dataset consists of both qualitative and quantitative data, each dimension hypothesized can be treated as an independent variable and the respondent's academic performance as a direct dependent variable, allowing for coefficient correlation analysis and Guildford's [10] Rule of Thumb to be applicable.

1) Coefficient Correlation

In the field of statistics, the most commonly used one is Pearson's correlation coefficient and it assesses the strength of a linear relationship between two variables. The value of correlation coefficient varies between -1.0 and 1.0, where the

negative end of the scale implies a perfect negative correlation whereas the positive end refers to the opposite. Values close or equal to 0.0 imply no relation.

Mathematically, it is computed by dividing the covariance by the product of the standard deviations of the two variables.

$$r_{xy} = \frac{Cov(x,y)}{\sigma_x \sigma_y}$$

Where r_{xy} is the correlation coefficient, $Cov(x,y)$ represents the covariance between the two variables, x and y, and σ represents their standard deviations, respectively.

IV. Results & Discussions

A. CORREL Table

Nominal scale helps quantize qualitative data and aids in applicability of in-built statistical functions present among different software. For this study, we used the CORREL function within excel to compute the Pearson's coefficient and deduced that factors pertaining to environmental variables as well as the mental welfare of student had the biggest effect on the academic performance of students.

B. Guildford's Rule of Thumb

Guildford's rule of thumb is able to denote the relational associativity given by Pearson's correlation coefficient r, between two variables, one independent and the other dependent, a degree and magnitude of strength. [11]

Table 1: Rule of Thumb for Interpreting the Size of a Correlation Coefficient

Correlation Coefficient r	Strength
r < 0.20	Very weak
0.20 ≤ r ≤ 0.40	Weak
0.40 ≤ r ≤ 0.70	Medium
0.70 ≤ r ≤ 0.90	Strong
0.90 < r	Very Strong

Figure 1 expresses the postulated dimensions affecting academic performance as a direct relation to academic performance as well as the correlation among the dimensions themselves.

C. Descriptive Statistics

Descriptive statistics explains the different features of all the data variables, and the short summary of them. Values, being on a nominal scale and derived directly from the 5-point Likert items.

The first section of our survey concerns the environment in which students can study, whether at home, in institutes, or in hostels. The lack of a peaceful and interactive environment to study is one of the most important factors that affects students' performance. Most hostilities mentioned that the home environment is better to study than the hostel, where no one is to disturb them, and the average value comes out to 3.06.

Similarly, students feel that group study is more effective than individual study, with an average value of 3.85, and likewise, group with an average value of 3.85, both of which are highly consistent with our hypothesis.

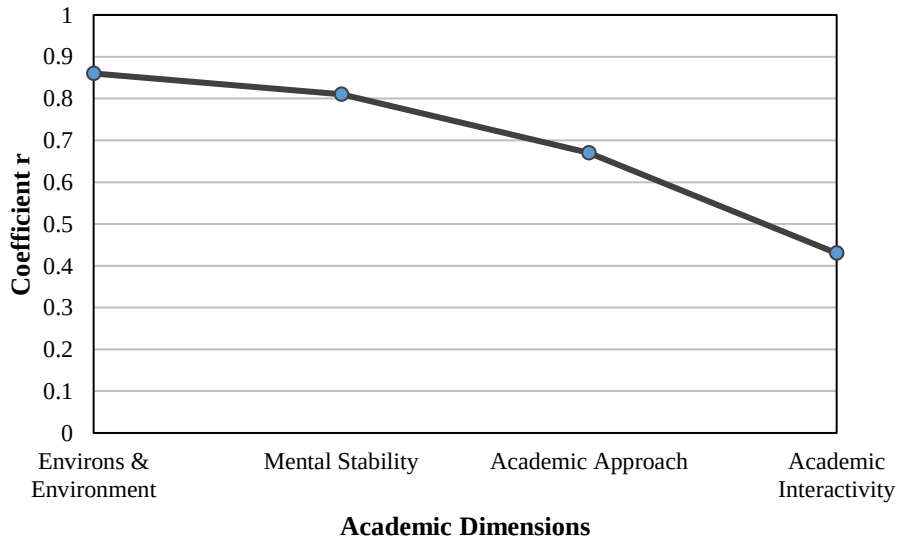

Figure 1: Pearson's Coefficient vs. Dimensions

The results show that mostly students seem to believe that grades are the important part of life (3.5 was the average response) and they believe it so as the educational system has made them believe that they will only succeed in life if they get high grades, and an average or a below average student is a failure. An average answer to the statement that family supports the students comes out to be 4.5, which is an important factor according to the hypothesis.

The mean value for the role of the institute and faculty in character development is 3.42, indicating that the respondents feel that the faculty and institute, to an extent, play a role in character development. Lastly, the average for the consistent revision of course contents come out to be 2.46 that shows students are less inclined towards revising the syllabus. All of this shows the effects of the environment on the academic performance of students.

Table 2: Pearson's Coefficient Value Against Postulated Dimensions

Dimension	Value r
Environs & Environment	0.86
Mental Stability	0.81
Structured Academic App.	0.67
Academic Interactivity	0.43
Academic Performance	0.00

The numerical values deduced of correlation coefficient from statistical analysis are tabulated in Table 2, along with their respective dimensions. Using Guildford's Rule of Thumb that was discussed earlier, we can conclude and infer that how and to what extent do the postulated factors affect the academic performance.

CONCLUSIONS

We investigated factors affecting university students' academic performance through Pearson's correlation analysis. By using this method, we discovered that the variables associated with the environs and environment, as well as mental stability, had the biggest impact on students' academic performance.

This research aimed to assess the factors that can improve students' academic performance. Our expectations were that the improvement of factors such as environmental variables surrounding students and focusing on their mental wellbeing improves their academic performance. After the collection of necessary data, appropriate analysis techniques were used to get the best estimate of academic performance of students.

The results proved to be consistent with our expectations. We obtained magnitudes of correlation coefficients of about 0.8 for environment and mental stability factors, suggesting that these dimensions had a substantially higher impact on students' academic achievement.

Based on these findings, we can conclude that the approach employed was extremely effective, given our sample size was 148 students and the outcomes were as expected. In addition, to better understand the implications of these results, future studies could address this by conducting experimental research by changing the factors affecting the academic performance for a specific group of students and determine the approach that can be taken to improve academic performance of students.

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