

Exploring the Correlation between Academic Pressure and Mental Health: A Study of Anxiety, Stress, and Depression Levels among University Students in Bangladesh

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Abstract— By utilizing the scores of academic pressures and mental health indicators (anxiety, stress, depression levels) from different university students in Bangladesh. The present investigation aims to explore association between them. This study will determine if these mental health issues are more prevalent in certain universities and departments, by examining this dataset drawn from a diverse set of schools. These results provide useful information for the design of focused interventions that could help to improve well-being in students. **Methods:** Using data from this survey, we assessed mental health in a variety of ways. That all in entire system the interacting different universities, departments and academic year was implemented to figure out major factors that causes student towards anxiety stress or how much. The study's findings will help to identify the roots of poor mental health in students and inform interventions tailored for student well-being. It aims for meaningful meta-analytic conclusions and implications to policy makers as well university administrators regarding various student populations around the world; emphasizing specialized mental health support systems should be designed according to distinct issues met by students in each country.

Keywords— *Anxiety, stress, depression, mental health, correlation analysis.*

I. INTRODUCTION

As many students face daunting obstacles while making the jump to university life, both in terms of coursework and performance demands that negatively affect their mental health [1]. Studies from as recently as earlier this year illustrate departmental influence over these mental conditions [2]. As a result, students face anxiety and stress which ultimately results in depression impacting mental well-being as-well-as academic scores. Studies have well documented the existence of these problems within a university student population, with academic stress as one of its main precipitants [3]. Many of the problems, when not treated, further result in poor performance and high dropout rates. Stress among higher education students has grown steadily over the last decade, with academic pressures often being noted to play a significant role in this development [4]. It is, for instance, knowledge of the prevalence of these issues in

certain areas that helps to push appropriate support systems to where they are most needed. A university can only foster an enabling environment if mental health becomes a priority and the stigma attached to raising such issues is removed.

The present study does recommend researching the perceived academic pressure by students from different departments and levels of study, and its relation to manifestations of mental health such as anxiety, stress, and depression. While this study is a correlational study, it is recommended that subsequent studies be done to establish levels of causality. This study also investigates the influence of academic year on levels of stress, anxiety, and depression, and establishes why students give as reasons for the manifestation of these mental health challenges.

II. BACKGROUND

Fear, anxiety and depression are known to arise from complex matrix of biological, psychological and environmental factors. Although their exact biological etiologic remains unclear, we know that multiple mechanisms underlie the development and expression of these disorders.

Neurochemical imbalances, according to various research, involve chemicals such as serotonin, dopamine, and norepinephrine, which regulate mood and respond to stress, thereby stimulating the growth of anxiety and depression [5]. Changes in hormones-especially those related to the stress response, such as cortisol-can influence the body's response to stress and have important roles in mental disorders [6]. Another determining factor is genetics, as individuals with a family history concerning those disorders are more likely to develop them. Besides, brain structure and function play an important role, because changes have been observed in areas of the brain implicated in the regulation of emotion [7] and in pathways underlying cognitive control processes [8].

New evidence even indicates that there could be a relationship between inflammation and mood disorders, as chronic inflammation is capable of affect neurotransmitter function and neural circuitry, subsequently leading to worsening symptoms [9] [10].

While translating such biological factors into better understanding of anxiety, stress and depression is important it should not be taken in a vacuum; these conditions are complex comorbidities that involve bidirectional interactions between different life-style related environmental (psychosocial) actors and many other multiple genes. Insight to these intricacies is essential for well-judged prevention and treatment interventions.

The study in South Asia, more precisely in Bangladesh, shows that academic pressure emerges as the most important stressor for students, along with the uniqueness of cultural expectations and economic pressures in the region. Additionally, limited availability of mental health services contributes to increasing anxiety and depression among Bangladeshi students, which is discussed in more recent work. By including such voices, the added depth will be invaluable for helping to explain how local factors shape student mental health.

III. METHODOLOGY

The study follow the methodology as shown in Fig. 1.



Fig. 1. Methodology

A. Data Collection

The raw data are available at: <https://data.mendeley.com/datasets/s9zm8rkj6m/2/files/e25574d1-ccb4-4c8f-a37d-847421ecbf6b>. The responses pertain to university students in Bangladesh. The variables of the dataset describe university and department, academic year, levels of stress, degree of anxiety, and degree of depression experienced.

B. Data Preprocessing

- Checking for missing values is important because missing values might distort your analysis and render it incomplete and inaccurate [11]. Handling the missing values will ensure that data is reliable and valid conclusions have been drawn. There isn't any missing value; thus, we move for further processing.
- Missing value checking is of utmost priority because they badly skew an analysis which has a huge impact on the completeness of the results and accuracy as indicated by [12]. Cleaning the missing values presents data that is reliable and draws on valid conclusions as presented in Fig. 2.

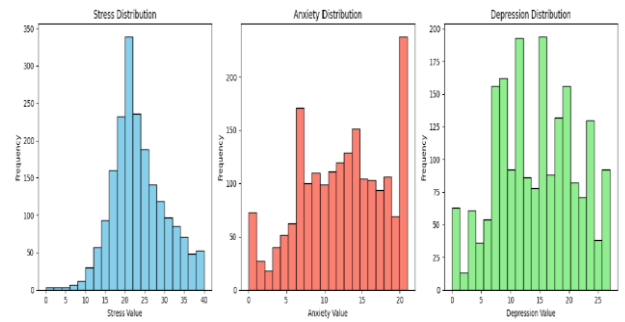


Fig. 2. Distribution of data

Concluding from Fig. 2, it can be found that the distribution of stress is positively skewed while anxiety and depression both have a slightly negatively skewed distribution. This reflects the fact that in cases of stress, large values are highly occurring and vice-versa in the case of anxiety and depression.

C. Correlation Analysis

Correlation analysis is, therefore, a statistical test conducted on two continuous variables to ascertain the strength and direction of the relationship between them [13]. It gives the proportion through which change in one variable is contributed by the change in another as indicated in Fig. 3.

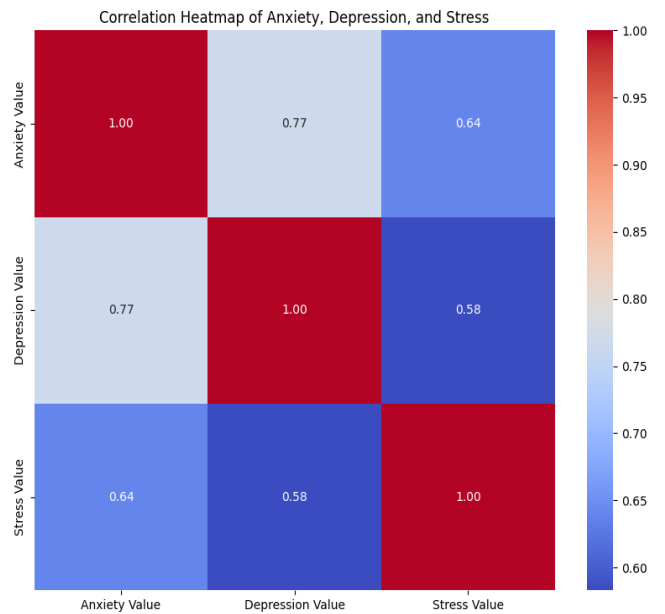


Fig. 3. Correlation analysis of Anxiety, Depression and Stress

From the above heat map, one can easily conclude that there is a strong positive relation between stress, anxiety, and depression. Next, we consider the universities with a high level of reported stress, anxiety, and depression as plotted in Fig. 4.

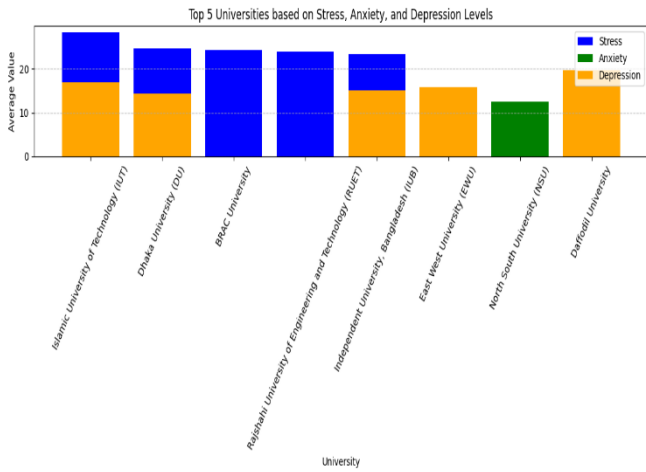


Fig. 4. Universities with Highest Value of Stress, Anxiety and Depression

As it has been shown in the above graph, most of the cases are from Islamic University of Technology, where students are mainly suffering from depression or stress. In the top five universities, students were found mainly suffering from either depression or stress, and few cases with anxiety symptoms. Anxiety symptoms were available for only one university among them, which is North South University.

In addition, we will demonstrate the percentage of the cases concerning stress, anxiety, and depression in the various departments, as shown in Fig. 5.

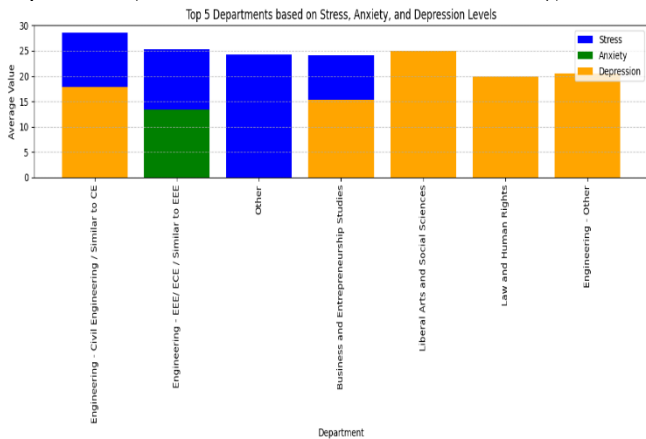


Fig. 5. Departments w.r.t. Stress, anxiety and Depression

The above chart shows that depression has the highest prevalence among all departments, with the highest proportion in Civil Engineering. In addition, stress comes second and anxiety is the least. A similar observation could be made as engineering streams show the highest values for Depression, Stress, and Anxiety. Generally, other streams such as Humanities and Business Studies lead to common depression.

In the following, we aim to interpret how academic advancement relates to shifts in the degree of distress among students reflected in Fig. 6.

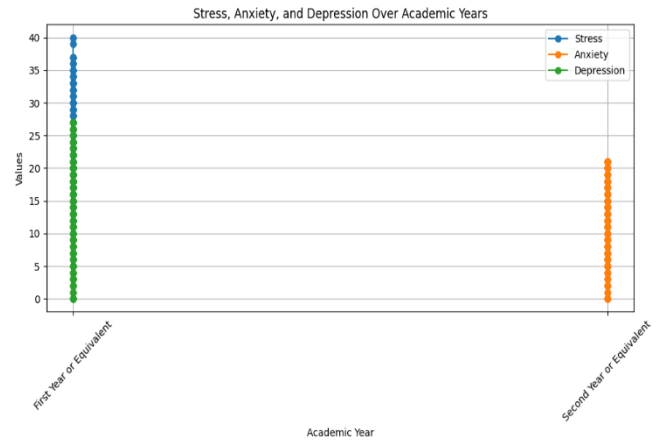


Fig. 6. Academic Years w.r.t. Distress

This graph illustrates that first-year students are most depressed and stressed. However, regarding anxiety, it is highly concentrated in second-year students compared to other year levels. This trend shows that the psychological stress varies at different years of study.

D. Model Development

The Random Forest Regression model was used for the prediction of depression levels of the students based on the current CGPA, stress, and anxiety values. This is represented in Fig. 7. In this model, the independent variables were CGPA, stress, and anxiety levels, while the dependent variable was depression. Then, the model has been trained on handling missing values and converting CGPA ranges into numerical values of the preprocessed dataset and tested through a test set. By using the model, I reached an MSE of 19.99 and an R-squared score of 0.58. The MSE is simply the average of the squared difference between the real and predicted values of depression. The smaller this number is, the better the model. The R-squared value explains the proportion of variance in depression explained by independent variables. The larger the number, the stronger the predictive power. These metrics collectively suggest that the model captures a good deal of variance in depression level [14], but there is certainly room for improvement over.

```

import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestRegressor
from sklearn.metrics import mean_squared_error, r2_score

# Load the dataset
df = pd.read_csv("Raw Data.csv")

# Data Preprocessing
def impute_cgpa(cgpa):
    if '-' in cgpa:
        start, end = cgpa.split('- ')
        return (float(start) + float(end)) / 2 # Calculate the average of the range
    elif cgpa.startswith('Below'):
        return 2.25 # Assuming 'Below 2.50' corresponds to the value 2.25
    elif cgpa == 'Other':
        return None # Return None for 'Other' value
    else:
        return float(cgpa)

df['6. Current CGPA'] = df['6. Current CGPA'].apply(impute_cgpa)

# Dropping rows with missing values
df = df.dropna(subset=['6. Current CGPA', 'Stress Value', 'Anxiety Value', 'Depression Value'])

# Features and target variable
X = df[['6. Current CGPA', 'Stress Value', 'Anxiety Value']]
y = df['Depression Value']

# Train-test split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Model training
model = RandomForestRegressor(n_estimators=100, random_state=42)
model.fit(X_train, y_train)

# Model evaluation
y_pred = model.predict(X_test)
mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)
print("Mean Squared Error:", mse)
print("R^2 Score:", r2)

```

Fig. 7. Model Development

IV. RESULTS

There is another worrisome pattern when the distress levels are examined about universities where particularly students of Islamic University of Technology prominent with direct number cases such as depression and stress. This means mental problems affect a significant section of students in such institutions. There are also a few cases in North South University, with lower rates of anxiety. Science and engineering disciplines had the highest levels of depression symptoms, stress-related issues these conditions that can create substantial academic challenges. On the other hand, subjects like Humanities and Business Studies have a higher incidence of depression. In addition, a look at distress levels by academic year reveals that first-year students experience significantly more depression and just slightly less stress than their peers. Second years, on the other hand have 60 per cent more anxiety than first years pointing to unique psychological stressors one faces when they reach different steps of their academic journey. This observation emphasizes the need for direct, discipline-specific mental health support which recognizes that students in various academic disciplines are subjected to types of stress very different from those faced by their peers at other stages.

In addressing such findings, Bangladeshi universities should make sure that focused, mental health support programs are available for the specific needs of students entering different academic disciplines. Workshops on stress management and counselling services, for example, would facilitate easy transition among freshmen students. Academic advising systems should also ensure involvement of mental health professionals in proactively dealing with stress and anxiety among students. In this regard, the onus is on the policy framers to work towards increasing access to mental health resources on campuses, especially at the engineering and business departments where the academic pressure on students is higher.

Further, the stress among Bangladeshi students is fueled by achievement expectations from society for academic success, especially in engineering and business streams. Additionally, there is a lot of pressure from family members for success, and a lack of mental health support from their respective educational institutions amplifies the situation. These cultural factors may contribute to the alarmingly high levels of anxiety and depression observed, underlining the call for culturally sensitive mental health interventions.

V. DISCUSSION

This analysis of distress levels among university students speaks to earlier research with fresh perspectives on the complexity. Consistent with the extant literature, these results illustrate just how ubiquitous mental health difficulties are within HE [15]. More recently, depression and stress among students was verified by studies conducted in numerous universities [2]. But what positions this examination from others is an interest in drawing out distress patterns across fields and years, providing a comparative lens rarer to prior research.

We next provide a comparative analysis with existing studies and discuss the many parallels, as well as some interesting disparities. Depression and stress are often the rule no matter where you go (depressing) - but one could explain it differently by saying that academic disciplines place different strains on students. The comparatively high levels of distress seemed to be consistent with the results reported by existing studies that suggested engineering-related disciplines involve harsh academic pressures, such as workload pressure and competitive stress [10].

On the other hand, there is a new issue associated with the high prevalence rate of depression cases in departments such as Humanities and Business Studies showing that universities will have to develop intervention programs for assisting students studying these disciplines because they are facing different academic stressors.

The exceptionally high distress rates amongst first-year students are consistent with the concept of "transition shock, which refers to difficulty in adjusting to university life and academic requirements. Second-year students are also understandably more anxious, as the sources of stress for rising second years advance and change from first year.

Ultimately, this review supports the expanding evidence base in student mental health literature and emphasizes a call for discipline-specific or academic stage-differentiated interventions. Beyond the fulfilment of this research agenda, which not only indirectly reproduces existing knowledge but also offers new perspectives and comparative data especially to advance our understanding on varied forms of student distress. - as such it points toward a need for multi-faceted support intended in evidence-informed ways

VI. PREDICTION APP

This Python script will create a Machine Learning model through the Tkinter library for GUI applications. This application predicts depression with input values like CGPA, stress, and anxiety. The idea is as explained in Fig. 8. It starts off by loading the dataset. Data Pre-processing This is where

the dataset pre-processing is done; in this section, we drop NaN values in columns Current CGPA, Stress Value, Anxiety value, and Depression Value. Further, there is a function to clean entries containing data in different formats and return the formatted one.

This application uses a Random Forest Regressor from the scikit-learn library to make predictions of depression. The model is trained with features such as CGPA, stress, and anxiety values, after which it predicts the depression levels. Once the user has entered their CGPA, stress value, and anxiety value in the fields provided under the "Input" tab, click on predict. The application will then evaluate that based on our trained model to give an approximated depression. A predicted behavior like this is shown to the user in an alert window.

This GUI has labels and entry widgets to input the values of CGPA, Stress & Anxiety, and it also has a button that, upon being clicked, triggers the prediction process. The event loop in Tkinter keeps the application active and interactive; in general, this script gives a practical way to provide the people with an idea about their level of depression when some input is fed to it, and then it calculates the severity.

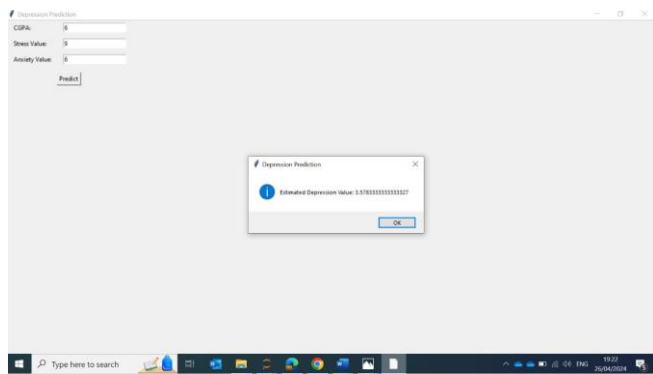


Fig. 8. App for depression prediction

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