

# Impact of Personality Traits, Mental Health, and Behavior on Student's Academic Performance

GroupName- LeZitAnBi

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## Abstract

College students face numerous stressors that can negatively impact student's academic performance. Personality traits and mental health have been found to be associated with academic achievement in previous research. However, the complex interaction between these factors remains unclear. This study aims to investigate the impact of personality traits and mental health on academic performance using machine learning techniques like Random Forest, Linear Regression and Neural Network on the data collected from 49 college students over a 10-week period by the Dartmouth College. Results suggest that stress, mood, and big five personality traits were significant predictors of academic performance. These findings highlight the importance of addressing mental health concerns in efforts to improve academic success among college students

## 1 Introduction

### 1.1 What:

College students face a variety of stressors, including academic workload, social pressures and personal responsibilities. These stressors can have a negative impact on students' academic performance. In recent years, researchers have been investigating the role of personality traits and mental health in the prediction of academic performance. Traits like conscientiousness and neuroticism have been found to be related to academic performance. Psychological factors, including stress, anxiety and depression, also play an important role in academic achievement.

## 1.2 Why:

An understanding of the relationship between personality traits, mental health and academic performance is crucial to the development of effective interventions that can support the success of students. Past research has demonstrated that personality and mental health factors has a major impact on academic achievement. For example, a study by Poropat (2009) found that conscientiousness was the most consistent predictor of academic achievement. Another study by Storrie, Ahern and Tuckett (2010) found that depression and anxiety were negatively associated with academic achievement. A more recent study by Kudrna and Horecky (2021) also found that higher levels of neuroticism had an association with lower academic achievement.

## 1.3 How:

Dartmouth College’s *StudentLife dataset*<sup>1</sup> is a valuable resource for exploring this relationship, containing self-reported survey responses on mental health factors and personality traits, as well as EMA data collected from each student on a daily basis. In this paper, our aim is to build on previous research studies and analyze the StudentLife data using machine learning techniques to investigate the complex interaction between personality traits, mental health and academic achievement among college students. Specifically, we will develop predictive models identifying key predictors of academic performance. Previous studies have used correlation analysis, regression analysis and support vector regression to investigate this relationship. Our study will use machine learning algorithms such as random forest, linear regression and neural networks to develop predictive models that accurately identify key predictors of academic achievement. The results of this study will provide valuable insights into the factors that contribute to student success. These insights can be used to develop targeted interventions aimed at improving academic performance and well-being.

# 2 Proposed methodology

We will develop predictive models to identify the most significant predictors of academic performance. The dataset contains both static and dynamic variables. Static variables include personality traits collected through the Big Five personality survey, while dynamic variables include stress, mood, behavior, and other EMA data collected over a period of 10 weeks for 49 students.

Here is a proposed methodology for this project work:

### 1. Data Preprocessing:

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<sup>1</sup>Available at <https://studentlife.cs.dartmouth.edu/dataset.html>

- Cleaning the data to remove any missing values or outliers.
  - Combining all the static and dynamic variables of interest into a single dataset
  - Encoding categorical variables (if any)
2. Feature Engineering:
- Identifying important features through exploratory data analysis
  - Feature selection techniques such as correlation analysis or Lasso regression to remove irrelevant or redundant features
  - To handle the dynamic variables, we will use time series analysis techniques, such as autoregression and moving averages, to capture the temporal dependencies of the data.
3. Splitting the dataset:
- Split the dataset into training, validation, and testing sets
  - Since the data involves multiple individuals, group the data by the individual to ensure that the data for each individual is not spread across different subsets.
  - Check that each subset (training, validation, and test) contains a representative sample of individuals from the population.
4. Building the Model:
- Train the machine learning models on the training dataset using techniques such as random forest, support vector regression, linear regression, or neural network
5. Model Evaluation:
- Evaluate the performance of the model using the validation dataset
  - Compare the performance of different models using metrics such as mean squared error, root mean squared error or coefficient of determination (R-squared)
  - Once the best model is selected, evaluate its performance on the test dataset to assess its generalizability to new data
6. Interpretation:
- Identify the most important predictors of academic performance based on the model's feature importances
  - Interpret the results in the context of previous research on the relationship between mental health, personality, and academic performance.

### 3 Work plan and timeline

To track changes and timeline for our project work please follow This Link

| TASKS                                       | ASSIGNEE        | DEADLINE       | STATUS      |
|---|-----------------|----------------|-------------|
| Data Collection                             | Both            | March 22, 2023 | Completed   |
| Literature Review                           | Bidit Sadhukhan | March 22, 2023 | Completed   |
| Creating a Planning                         | Bidit Sadhukhan | March 22, 2023 | Completed   |
| Submit Project Proposal                     | Anirban Dey     | March 23,2023  | Completed   |
| Reviewing literature for methodology        | Bidit Sadhukhan | March 31,2023  | Not Started |
| Data Filtering and cleaning                 | Anirban Dey     | April 7,2023   | Not Started |
| Feature Engineering                         | Bidit Sadhukhan | April 1, 2023  | Not Started |
| Writing Code to train Data                  | Bidit Sadhukhan | April 15,2023  | Not Started |
| Testing The Model Parameter with Validation | Anirban Dey     | April 12,2023  | Not Started |
| Finding a Suitable Model                    | Bidit Sadhukhan | April 21, 2023 | Not Started |
| Prediction of Areas and Identification      | Anirban Dey     | May 6, 2023    | Not Started |
| Writing the Final Report                    | Both            | May 11, 2023   | Not Started |

Table 1: Work Plan Table (Updated)

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## 4 Appendix

All the codes and the data sets of our work can be accessed in the Github link.