Factors of Test Anxiety and Its Prediction Model

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1 Background review

Anxiety is always a concern for people in their social lives. It happens under various situations and is resulted by different reasons. Many people become nervous and worry when there are important events going to take place. For students, the final exam is one of the major businesses in their school life. According to the American College Health Association in 2018, 63% of college students in the US felt overwhelming anxiety in the past year. The level of their psychological distress rises steadily (LeBlanc, Marques, 2019). Therefore, anxiety of students is one of the primary issues we need to work on.

Our purpose of the project is to increase understanding of the relationship between anxiety level and potential factors. The factors are categorized into two parts, personal traits and exam-related factors. Personal traits include self-efficacy, academic resilience, and procrastination. Exam-related factors involve perceived test difficulty, previous tests ranking, and the amount of average time of reviewing per day. These factors could have positive or negative relation with the level of anxiety. For example, one predictor of academic resilience in a 5-C model includes composure (low anxiety) demonstrates the correlation of low anxiety level and academic resilience and illustrates that the lower anxiety level indicates better academic resilience. (Martin, Marsh, 2006). Eunsook Hong and LewisKatstensson (2001) also published that self-perceived course difficulty would affect students' self-perceived test difficulty, which affects students' test anxiety and emotionality. And anxiety and procrastination are crucial correlated factors that greatly impact on student outcome, like what Marjan (2021)'s research discovered on dental students.

Based on the results of this project, we will understand more about distinct influences of factors on students' anxiety levels during final week periods. Furthermore, we would like to help students who are experiencing anxiety issues during their studies, in particular, at the time of final weeks by solving their problems from the aspects that we find are negatively impactful and encouraging them from the methods that improve their lives.

2 Data collection

2.1 Participants and procedure

The current project plans to collect data from about 300 students in Columbia University. The data will be collected with questionnaires. The scales of potential predictors that were validated by previous research will be collected and integrated into an integral questionnaire. The questionnaire will be uploaded on Qualtrics, which is an online questionnaire platform, and released with the help of professors or via social media platforms. Participants are required to complete an online questionnaire during one week before the final exam.

2.3 Materials

The questionnaire includes background information (gender, age, program, number of registered courses), personal traits (self-efficacy, academic resilience, procrastination), and test-related questions (testing type, form, perceived test difficulty, previous ranking, reviewing time), and anxiety. The scales of these measures are described as follow:

2.3.1 Personal traits.

Self-efficacy. Self-efficacy is measured by an 8 item New General Self-Efficacy Scale (NGSE) validated by Chen, Gully, and Eden (2001). It is a 5-point Likert scale from strongly disagree(1) to strongly agree (5). One of the example statements is "I will be able to achieve most of the goals that I have set for myself".

Academic resilience. 6 items measuring students' ability to figure out difficulties, experience adversity, and cope with pressure in the academic setting on a 5-point Likert scale (e.g., "I believe I'm mentally tough when it comes to exams").

Procrastination. Procrastination Scale (Lay, 1986) measures students' procrastination with 20 items on a 5-point Likert scale ranging from 1 to 5 (e.g., "I often find myself performing tasks that I had intended to do days before").

2.3.2 Test-related questions.

Participants are required to answer the test-related questions based on one of the courses that make them feel most anxious.

Testing type. Participants select the testing type, whether they are required to take an exam, write an essay, do a presentation, or it is an integrated form including two or more types.

Test form. Participants select the form of final test, whether it is an individual work, or a group work.

Perceived test difficulty. Participants are required to rate their perceived test difficulty of the final test on a 4-point scale: Not at all, Somewhat, Moderately so, and Very much so. There are 4 items, one of the examples is "I think this exam will be a difficult one for me."

Previous ranking. Participants report the previous ranking of the course on: below average, average, above average.

Reviewing time. Participants report the amount of average time (hours) they spent on reviewing/preparing for the final test per day during the two weeks before the final test.

2.3.3 Anxiety.

The Beck Anxiety inventory (Beck, Epstein, Brown, & Steer, 1988) will be used to measure common somatic and cognitive symptoms of anxiety. It consists of 21 items with a Likert scale ranging from 0 to 3, the anxiety level can be classified as minimal anxiety (0-7), mild anxiety (8-15), moderate anxiety (16-25), and severe anxiety (26-63) based on the total BAI scores.

3 Data analysis

The data will be downloaded from Qualtrics, and the results will be transformed into a csv. file. The whole analysis process is planned to be completed in Python by importing the data set.

3.1 Data preparation

3.1.1 data cleaning

Before processing the data, firstly check if there is any missing value. There may be issues of missing data through downloading or transforming processes, find the missing value if possible or drop the whole line to prevent the effect of misleading the prediction.

Possible codes used in the section: .isnull().sum()

3.1.2 data processing

Two types of data need to be transformed in the data set.

First are the results of different scales. According to their different calculation rules, we need to create new variables to record each single score for each scale, which are continuous variables for representing individual differences of different variables that the questionnaires investigate. After creating score variables, useless columns (items for questionnaires) will be dropped.

Second is the categorical data. Some variables like TestType (1=essay; 2=presentation, 3=exam; 4=integration) and TestForm (1=individual work; 2=group work) will be transformed into binary variables (e.g. Essay: 1=Yes; 2=No). After transformation, the overlapped columns will be dropped.

Possible codes used in the section: .drop; .concat; get_dummies;

3.2 Analytical methods

3.2.1 descriptive statistics

To get an overview of the basic information of the data set, all variables will be included and analyzed.

Boxplots will also be depicted in this section to see if there is any outlier. If so, look for details of the strange value to decide if it should be excluded or remain.

Possible codes used in the section: .describe; plt.boxplot

3.2.2 correlation analysis

Considering the collection methods, there may be students from various programs and courses, so the program and course variable will be excluded in the section.

The correlation analysis will be used to explore the potential relationships among these variables and select features. If some variables' correlation coefficients are very small, they will be excluded to refine the model.

Possible codes used in the section:.corr

3.2.3 multiple regression

Features selected by correlation analysis will be applied in multiple regression. The regression model can indicate the influences of different factors on test anxiety.

Possible codes used in the section: LinearRegression

3.2.4 classifier model

According to research of BAI scale, the total score of 26-63 is recorded as severe anxiety, so the threshold of the BAI score variable will be set at 26. Those students who score 26 or above on BAI scale will be classified as “1”, while those students who score below 26 will be classified as “0”. Thus the dependent variable will be transformed into a new binary variable.

Different methods of training models will be applied in this section.

Possible codes used in the section: LogisticRegression; statsmodels; DecisionTreeClassifier; GaussianNB

3.2.5 model evaluation

To evaluate the models built by different methods. K-fold cross validation will be used in this section to compare the results from different classifiers. The most successful prediction model will be selected

Possible codes used in the section: KFold

4 Discussion

Based on the current studies and the findings in our models, we expect results to be that four factors of self-efficacy, procrastination, perceived test difficulty and the amount of average time of reviewing per day have a positive relationship with test anxiety. While Academic resilience and Previous tests ranking are negatively correlated with test anxiety. Our results will support the previous research conclusion that test anxiety was influenced by multiple factors and the effects are statistically significant.

Because of the restriction on our methods of collecting data, some biases may exist regarding small sample sizes and background restrictions. Collecting the data from hundreds of participants may be not enough for building an accurate model. Data mainly collected from Columbia University may also diminish the possibility for our model to predict other students from different regions or with various backgrounds. Considering possible regional differences and cultural differences our result may not apply to students in all categories.

Another problem is that our results are mainly based on students' self-report, which is subjective and could be influenced by many uncontrollable influences at the moment they are filling the questions. College students' life includes not only studies but many life struggles. Thus, students' stress level may not come directly from the test. Any other variables not mentioned in our study may also have an impact on students' anxiety level and test result. Also, students' impression and interpretation of the Likert scales could be very different based on individuality, which makes the result rather subjective and may not be able to apply to a broader student community.

In summary, the findings from our current model demonstrate what might influence and how they influence student's test anxiety. However, the variables selected and combined from previous research may still not be comprehensive enough. Other potential variables that we have not taken into consideration may still be worth testing in the future study. Furthermore, the restricted region in the Columbia University will possibly produce bias for the data and results. If possible, future studies can focus more on different types of Universities and colleges. In the end, the accuracy of these measures is unknown because of the uncertainty of the questionnaire. For example, the expected number of hours spent studying before the final exam were self-reported, which we cannot certain the answer is precisely from each student.

Despite the shortcomings of our studies, we still expect that our correlation and regression results will be consistent with the results concluded from previous studies. According to regression results, teachers can adjust their teaching styles and test types to relieve students' test anxiety and improve the learning experience. The prediction model would be helpful for teachers to detect students that need help, then find methods to ease their tension based on personal traits or test traits.

Considering personal traits like self-efficacy and resilience, teachers could provide more specific guidance to assignments or exams and notify students in advance before deadlines to better prepare students mentally. Teachers could also provide encouraging feedback more frequently and consider using successful student examples as reference to provide helpful tips for passing the class. Assigning group activities that engage students to

work together may potentially help reduce the chances for procrastination and distraction. And less distraction could help students be more focused on their work and possibly spend more time studying.

Regarding exam-related factors, teachers could ask for student feedback on exams and assignments and adjust test types depending on an overall evaluation from both student feedback and test results. Teachers could also provide access and suggestions for study resources and access for help if students faced challenges in study. The adaptation for exam types could depend on the course needs of the classes. Overall, our regression result and students feedback could be important considerations for teachers to make the changes to their test type.

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