Depression and Academic Performance in FUNAAB

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DEPRESSION AND ACADEMIC PERFORMANCE IN FUNAAB

Abstract :

Depression has become a prevalent mental illness that affects one out of every twenty persons at one point in their lifetime, a major health issue among university student, it varies among undergraduate students of different countries and cultures and is influenced by sociodemographic, intrapersonal, interpersonal and environmental factors. The aim of this research is to evaluate the effect of depression on student academic performance in FUNAAB using R shiny and Quarto to bridge the existing gap in dedicated websites for sharing scientific research insights with others across the world. Previous studies have examined the influence of sociodemographic, intrapersonal, interpersonal and environmental factors on depression, but this study improved on these by predicting Academic performance from factors influencing depression. A well-structured questionnaire was develop to source for the data, exploratory factor analysis was used to describe the data and identify underlying factors, multivariate assumptions were screened, outliers were removed, a three-factor model was tested based on theory and reliability was calculated for each factor, and the ordinal logistic regression model built had prediction accuracy of 50% with a misclassification rate of 50% and a predictive dashboard website app using Shiny and Quarto packages in R and Rstudio was developed with the findings. A good academic performance will reduce the effect and chances that a student will be depressed. Hence, effort should be made to help cushion the effect of the independent factors on academic performance.

1.0 INTRODUCTION

One out of every twenty persons at one point in their lifetime suffers depression, mankind is currently battling with one of the most challenging health hazards called Depression (Wale Orojo et al). It is a common mental health illness that negatively affects how a person thinks, feels and act, it involve low mood and loss of interest in activities.

Mental health issues have been on the increase among Nigerian students, and this is evident in the rate of increase in suicide among the Nigerian youths foremost among these are the Nigerian students. Nigeria suicide rate ranked 15th in the world in 2016 (WHO, 2021), and the major cause of the increase in suicide is Depression.

Studies have showed that depression was more common among first-year and married students, economically disadvantaged students, those living off-campus, and students from poor families and has significant impact on academic performance (Bayam et all. .2008), (Rao, A & Chen, J .2020). (Calvete, et al. 2019)., with a large youth population facing rising unemployment rates, it is important to address the gap in mental health awareness among undergraduates in Nigeria. Currently there is a limited availability of standalone websites dedicated to sharing insights in Nigeria.

This study aim to bridge the existing gap in dedicated platforms for sharing insights utilising the R shiny and Quarto packages to build an interactive web dashboard app in R to predict student's academic performance (G.P.A) and educate the university community and the world.

2.0 METHODOLOGY

2.1 Study population

The study group consist of undergraduate students from the Federal University of Agriculture, Abeokuta (FUNAAB) south-western Nigeria, The students are from various ethnic and religious groups in the country with each of the 10 colleges offering a Bsc degree course in one of Applied Science, Business, Construction and Environment, Engineering, Animal Health and Production, Management Science, Agriculture and Wildlife, Hotel and Tourism Management and Veterinary Medicine.

2.2 Study Variable

The study aimed to measure, understand and group variables together into the following factors structure based on high correlations between pattern of answers and how these factors influence academic performance measured in GPA.

a. **Intrapersonal factor**: change in sleeping and eating habit, financial difficulties, death of a friend or family member, change in religious believe, divorce of parent, major personal injury or illness, change in course of study, trouble with parent etc.

b. **Interpersonal factors**: change in social activities, room-mate conflict, working with new people, fight with boy/girlfriend, new boy/girlfriend, unwanted pregnancy, sex problem, serious argument with close friend, marriage etc.

c. **Environmental factor**: messy living condition (hostel), electricity shortage (black out), computer problem, transportation problem, water shortage, wait in long queue, first year in school etc.

2.3 Sampling Technique and Sample Size

A simple random sampling technique was used to select respondents in the study area (FUNAAB) and stratified by gender, students from each stratum was further sampled using simple random sampling without replacement, the equation below (Ankoye, 2020) was used to determine the sample size of 118 needed for the study.

$$\text{Sample size, } n = N * \frac{\frac{Z^2 * p * (1-p)}{e^2}}{[N - 1 + \frac{Z^2 * p * (1-p)}{e^2}]}$$

Where Confidence level (Z) = 95%, Margin of error (e) = 6.20%, Population proportion = 60%,

Population size (N) = 18517, Sample size (n) = 236.

2.4 Data Collection

The Student Depression Survey questionnaire was created based on the Student Stress Scale (Insel and Ruth 2008). New York, (McGraw-Hill, et al 2019). Manifest Anxiety Scale,(Hudd, et al 2000).

The questionnaire was divided into three parts, the first part captured the student's demographic information such as age, department, college, sex, religion, ethnicity, GPA. The second part is a stress

assessment scale which consists of 30 potentially stressful situations that may occur in the life of a student which can trigger depression, it was designed using Life Change Units to measure the amount and sources of stress a student experienced and readjusted to in the previous 12 months. The third section consisted of 30 questions which include change in sleeping and eating habits, financial difficulties, death of a friend or family member, change in religious belief, divorce of parent, major personal injury or illness e.t.c.

This was used to know the degree to which each respondent agreed or disagreed with the effect of these events on their academic performance based on personal experience in the past twelve months. Collecting the data, a validated online questionnaire was utilised (Geldsetzer, 2020).

The questionnaire's link was distributed through social media platforms like WhatsApp and Telegram to various college student presidents, HOCs of departments, and other student union platforms in FUNAAB, participants were encouraged to forward the questionnaire to their colleagues, and the study was voluntary and anonymous. Respondents were assured that their answers would be kept confidential and used solely for research purposes.

2.5 Analysis

Descriptive and demographic statistics were calculated in the forms of frequencies, means, exploratory factor analysis (EFA) was used to determine the number of factors in the depression assessment questionnaire for FUNAAB students. Multivariate assumptions (Additivity, Linearity, Homogeneity and Homoscedasticity) were screened, outliers were removed, and Bartlett's and KMO tests were used to confirm correlation adequacy and sampling adequacy. A three-factor model was tested based on theory, and reliability was calculated for each factor. A model was built for predicting academic performance based on the three factors identified in the EFA, and the odds ratio with 95% confidence and prediction intervals were reported.

2.6 Ordinal Logistic Model and Estimation of Parameter

In ordered logit model, there is an observed ordinal variable, Y. which in turn, is a function of another variable, Y*, that is not measured. This continuous, unmeasured latent variable Y*, whose values determine what the observed ordinal variable Y equals has various threshold points k. (κ is the Greek small letter, Kappa.) value on the observed variable Y depends on whether or not we have crossed a particular threshold. When $\beta 0 = 0$, X_i = independent variables, k_i is the threshold and Y = 3. We have

$Y_i = 1$ if $Y_i^* \leq k_1$

$Y_i = 2$ if $k_1 \leq Y_i^* \leq k_2$

$Y_i = 3$ if $Y_i^* \geq k_3$

In the population, the continuous latent variable Y* is equal to

$$Y_i^* = \sum_{k=1}^{k} \beta_k X_{ki} + \epsilon_i = Z_i + \epsilon_i$$

The Ordered Logit Model estimates part of the above:

$$Z_i = \sum_{k=1}^{k} \beta_k X_{ki} + \epsilon_i = E(Y_i^*)$$

The K βs and the M-1 κs are parameters that need to be estimated, using the corresponding sample estimates for each case we compute

$$Z_i = \sum_{k=1}^{k} \beta_k X_k \quad \text{Where k = cutoff points, β = coefficient of independent variable}$$

Hence, using the estimated value of Z and the assumed logistic distribution of the error term, the ordered logit model can be used to estimate the probability that the unobserved variable Y* falls within the various threshold limits.

In the case of this research work, our latent variable is the measure of G.P.A. Which consist of five categories, we measure Y = 5 alternative model for k = 4 cutoff points

$$\text{where } Z_i = \sum_{k=1}^{4} \beta_k X_k$$

Y	Y^* (G.P.A)	X_1(Intrapersonal stress)	X_2(Interpersonal stress)	X_3(Environmental stress)
1	First class (4.5 – 5.0)	Strongly Agree	Strongly Agree	Strongly Agree
2	Second class upper (3.5 – 4.4)	Agree	Agree	Agree
3	Second class lower (2.5 – 3.4)	Neutral	Neutral	Neutral
4	Third class (1.5 – 2.4)	Disagree	Disagree	Disagree
5	Pass (1.5 below)	Strongly Disagree	Strongly Disagree	Strongly Disagree

Table 1: Variable level

Statistic $Z_i = \sum_{k=1}^{4} \beta_k X_k$ i = 1,2,3…n where n is the sample size

Using the estimated value of Z and the assumed logistic distribution of the error term, the ordered logit model can be used to estimate the probability that the unobserved variable Y* falls within the various threshold limits

$Y_i = 1$ if $Y_i^* \leq k_1$

$Y_i = 2$ if $k_1 \leq Y_i^* \leq k_2$

$Y_i = 3$ if $k_2 \leq Y_i^* \leq k_3$

$Y_i = 4$ if $k_3 \leq Y_i^* \leq k_4$

$Y_i = 4$ if $Y_i^* \geq k_4$

Ordinal Logistic Model

$$P(Y = 1) = \frac{1}{1 + exp(Z_i - k_1)}$$

$$P(Y = 2) = \frac{1}{1 + exp(Z_i - k_2)} - \frac{1}{1 + exp(Z_i - k_1)}$$

$$P(Y = 3) = \frac{1}{1 + exp(Z_i - k_3)} - \frac{1}{1 + exp(Z_i - k_2)} - \frac{1}{1 + exp(Z_i - k_1)}$$

$$P(Y = 4) = \frac{1}{1 + exp(Z_i - k_4)} - \frac{1}{1 + exp(Z_i - k_3)} - \frac{1}{1 + exp(Z_i - k_2)} - \frac{1}{1 + exp(Z_i - k_1)}$$

$$P(Y = 5) = 1 - \frac{1}{1 + exp(Z_i - k_4)}$$

2.7.0 The R Shiny Quarto Website

2.7.1 R Shiny

Shiny is an R package that makes it easy to build Interactive web applications (apps) straight from R without using any web application language such as HTML, CSS, or JavaScript knowledge.

To install package in Rstudio, open an R session, connect to the internet and run the code below.

```
install.packages("shiny")   (Rstudio Team. 2021)
```

Shiny apps are contained in a single script called app.R. The script lives in a directory (for example, newdir/ and the app can be run with runApp("newdir"). app,R has three components:

- **a user interface object :** controls the layout and appearance of the app

    ```
    # Define UI for the Dashboard tab in the Quarto website
    ```

- **a server function :** contains instructions that your computer needs to build your app.

    ```
    # Define serer logic required to build charts and models
    ```

- **a call to the** shinyApp **function :** create shinyApp app object from an explicit UI.sever pair.

    ```
    library(shiny)   (Witson chang et al, 2021)

    @ See above for the definitions of ui and server

    ui <- ...

    server <- ...

    shinyApp(ui = ui, server = server)
    ```

You can run the app by giving the name of its directory to the function runApp

```
library(shiny)
runApp("app,R")
```

2.7.1 Quarto Website

Quarto R package is an open source technical publishing system for creating technical reports. beautiful articles, websites, blogs, books, slides, and more it also supports Python, R, Julia etc.

Quarto Websites are a convenient way to publish groups of documents. Documents published as part of a website share navigational elements, rendering options, and visual style. It can be published to a wide variety of destinations including GitHub Pages, Netlify, Posit Connect, or any other static hosting service or intranet web server.

- To create a new website project within RStudio, use the **New Project** command and select **Quarto Website**: (Wickham, H et al, 2022)
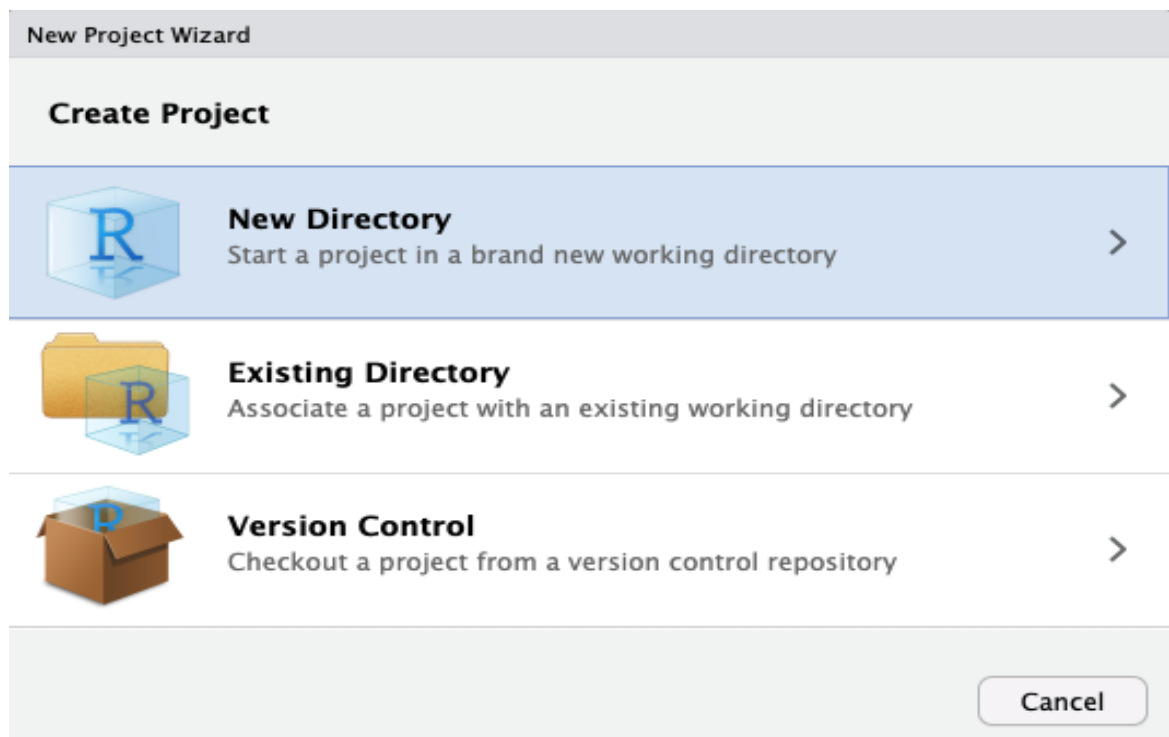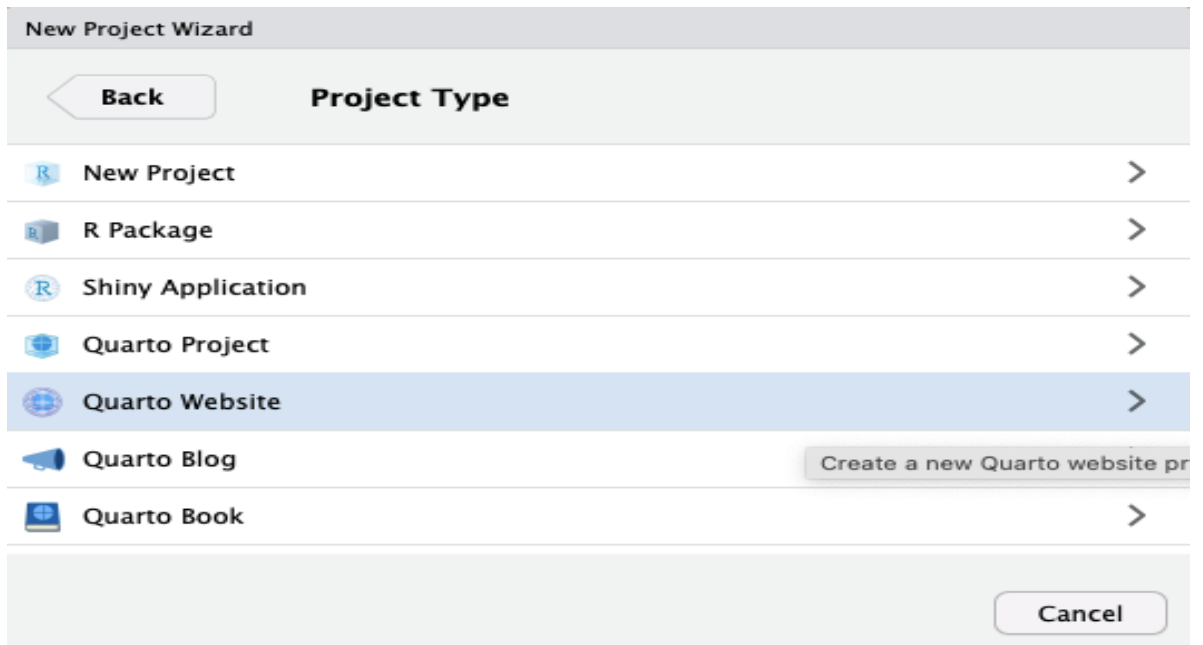

Figure 3 : Quarto project

Figure 4 : Quarto website

- Then, provide a directory name and other relevant options for the website: e.g `Survey-Project`
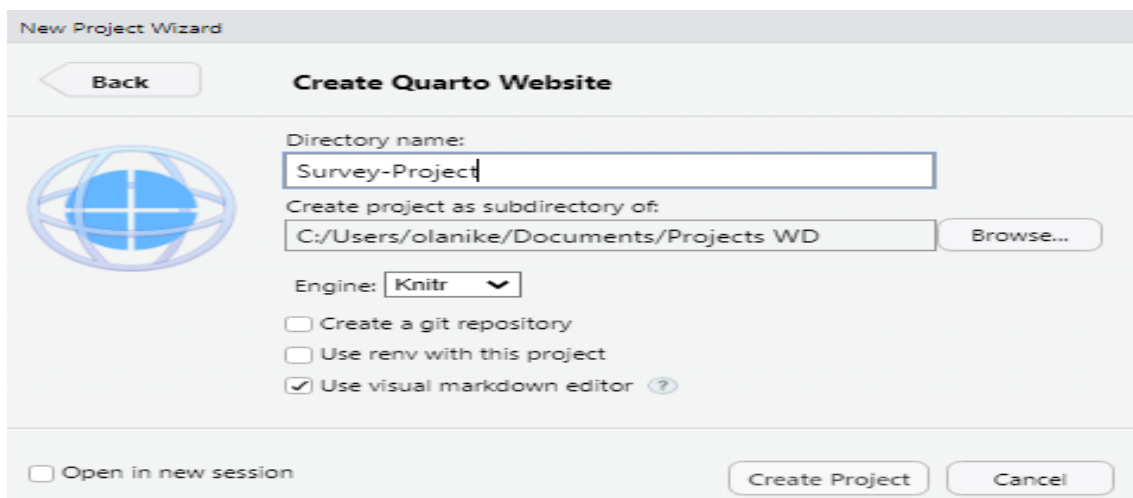

Figure 5 : Create Quarto Website

- Every website has a _quarto.yml config file that provides website options as well as defaults for HTML documents created within the site. For example, here is the default config file for the this research work

```
project:
  type: website
website:
```

```yaml
  title: "Bsc Project"

  page-footer:
   center: |
    <span class="container"><strong>Application built by [Victor
Arowolo](mailto:iamvictorthrive@gmail.com){target="_blank"}</strong></span>
   left: |
    <span class="container"><strong>Made with [Posit
Quarto](https://quarto.org/){target="_blank"}</strong></span>
   right: |
    <span class="container"><strong>[Github
Repo](https://github.com/){target="_blank"}</strong></span>
   background: "#474747"

  navbar:
   background: "#474747"
   foreground: "white"
   search: false
   left:
     - text: "Home"
       file: index.qmd
     - text: "Introduction"
       file: introduction.qmd
     - text: "Dashboard"
       file: dashboard.qmd
     - text: "About Supervisor"
       file: about supervisor.qmd
     - text: "About me"
       file: about me.qmd
     - text: "Project Documentation"
       file: documentation.qmd
   right:
     - icon: whatsapp
       href: https://whatsapp.com
     - icon: twitter
       href: https://twitter.com/Thrive_001?t=pBpBmsHHMreN2Bj-ulKo7w&
     - icon: github
       href: https://github.com
     - icon: linkedin
       href: https://www.linkedin.com/in/victor-arowolo-472010219

format:
  html:
    theme:
      light: [cosmo, theme_light_custom.scss]
      dark: [cosmo, theme_dark_custom.scss]
    css: styles.css
    citations-hover: true
    code-link: true
    code-fold: show
    code-tools: false
    code-block-border-left: "#004E4F"
```

- Click the **Render** button to render and preview the website:
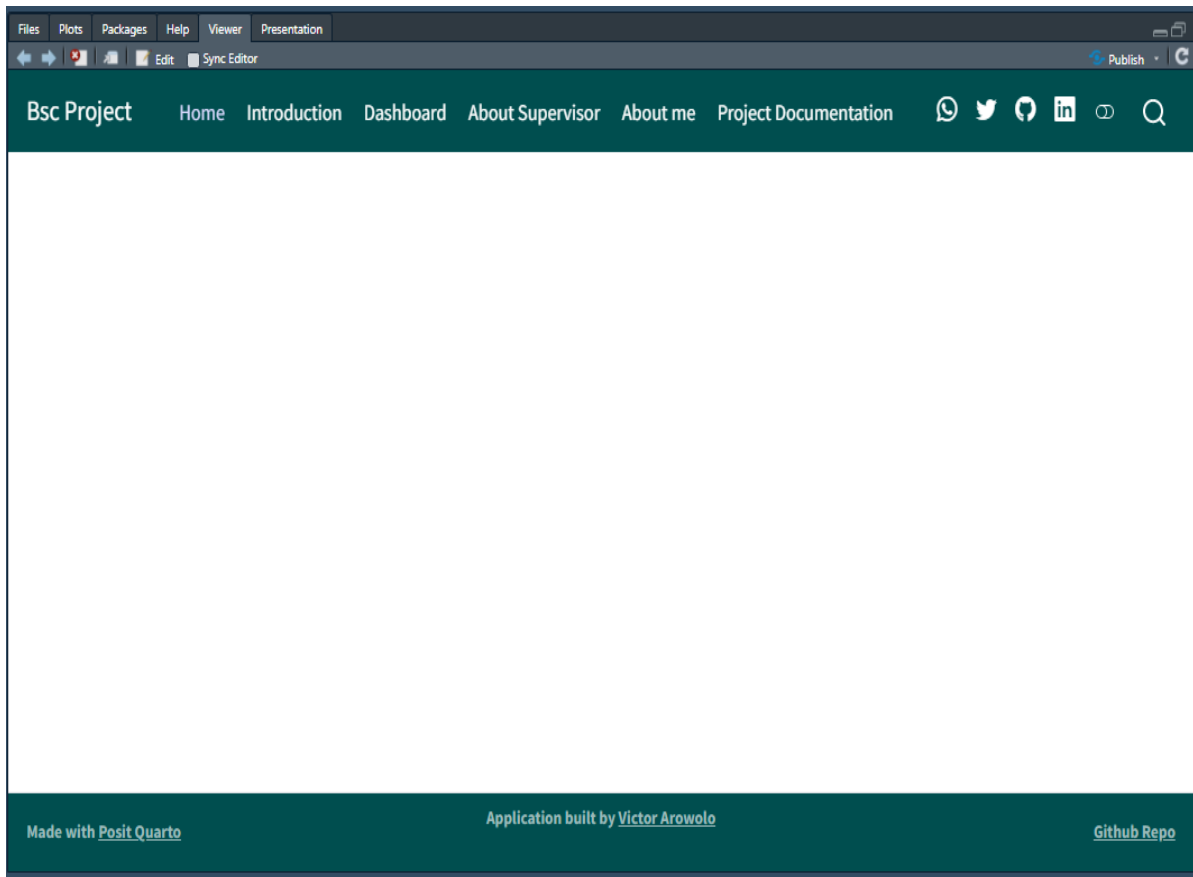
This is the output below.

Figure 6 : Preview Quarto Website

3.0 RESULT AND DISCUSSION

3.1.1 Demographic information

```
##     AGE            GENDER          COLLEGE          DEPARTMENT        LEVEL
## 18 - 23: 165    Female: 104     COLPHYS :87       STS : 33          100: 29
## 24 - 29:  72    Male  : 135     COLPLANT:39       CPT : 18          200: 48
## 30 - 35:   2                    COLANIM :27       CSC : 18          300: 77
##                                 COLBIOS :21       CHM : 15          400: 68
##                                 COLPHEC :21       MTS : 15          500: 16
##                                 COLERM  :17       FST : 14          600:  1
##                                 (Other) :27       (Other):126
##      RELIGION        G.P.A          C.G.P             STATUS
## Christianity:202   1.5- 2.4 :  8   1.5- 2.4 :  8    Cohabiting:  2
## Islamic    : 36    2.5 - 3.4: 71   2.5 -3.4 : 92    Married   :  2
## Other      :  1    3.5 - 4.4:125   3.5 -4.4 :116    Single    :235
##                    4.5 - 5.0: 35   4.5- 5.0 : 23
##
##
##    SPONSOR          SCORE            STRESS
## Guardian: 12     Min.   :  0.0    Major     :59
## Other   :  6     1st Qu.:137.0    Mild      :43
```

```
##  Parent  :208        Median :208.0        Moderate    :32
##  Self    : 13        Mean   :222.0        Serious     :34
##                      3rd Qu.:297.5        Very little:71
##                      Max.   :513.0
```
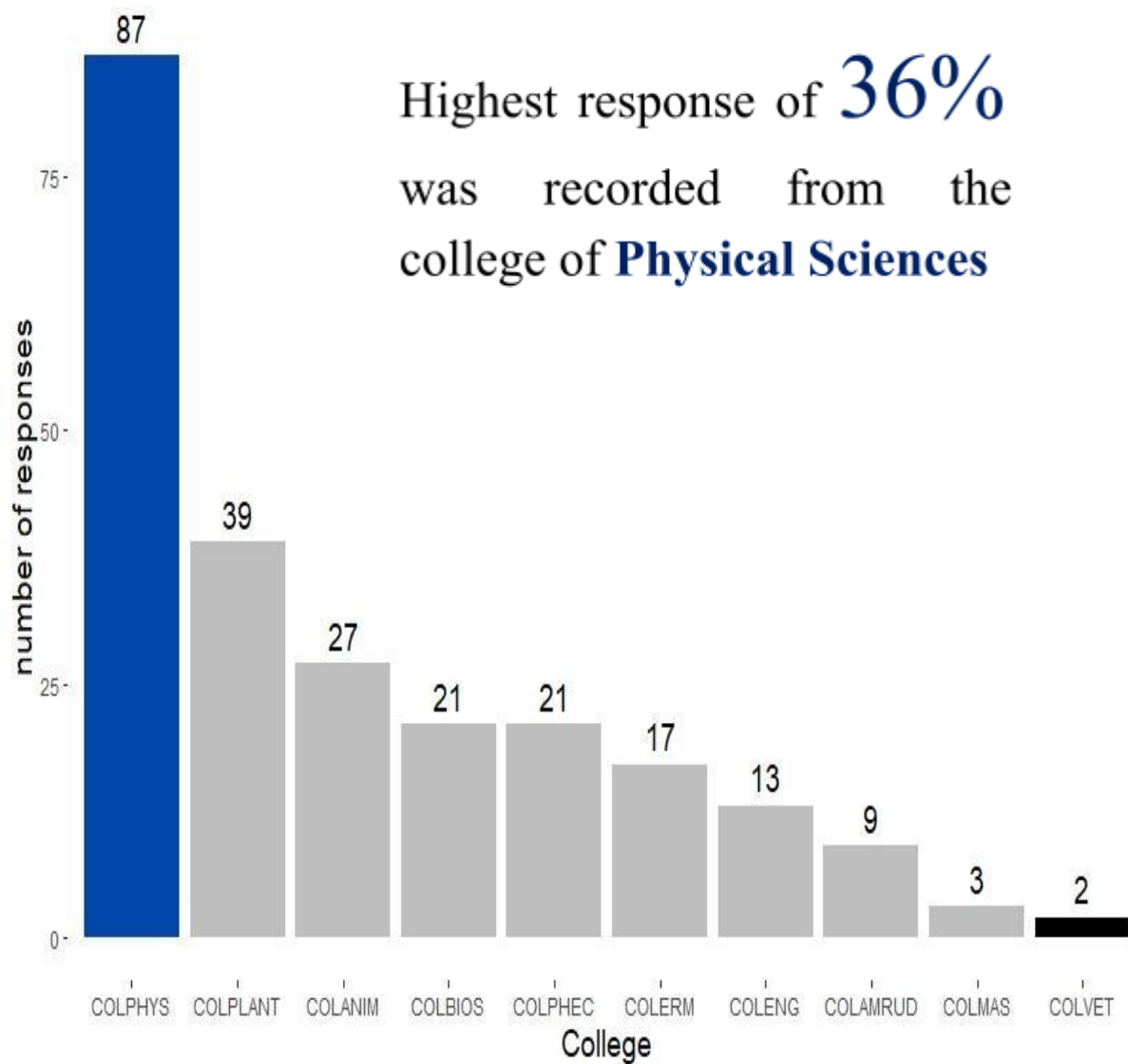
3.1.2 **Distribution of response**

DISTRIBUTION OF RESPONSE BY COLLEGE

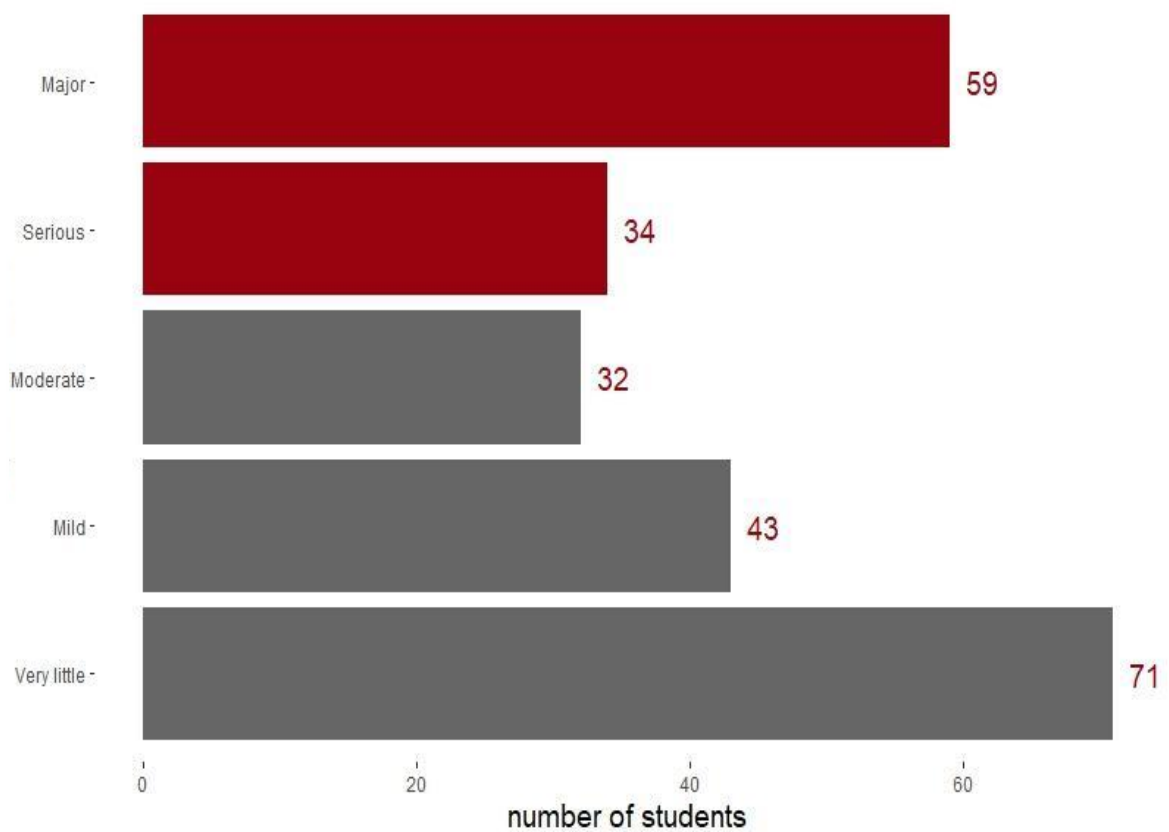## 39% of the student suffers Major and Serious Depression

Figure 9 : Distribution of stress level

	Very little	Mild	Moderate	Serious	Major
Female	30	14	13	16	**31**
Male	41	29	19	18	**28**

Table 2 : Student stress level

3.1.3 Test of Assumptions and scree plot
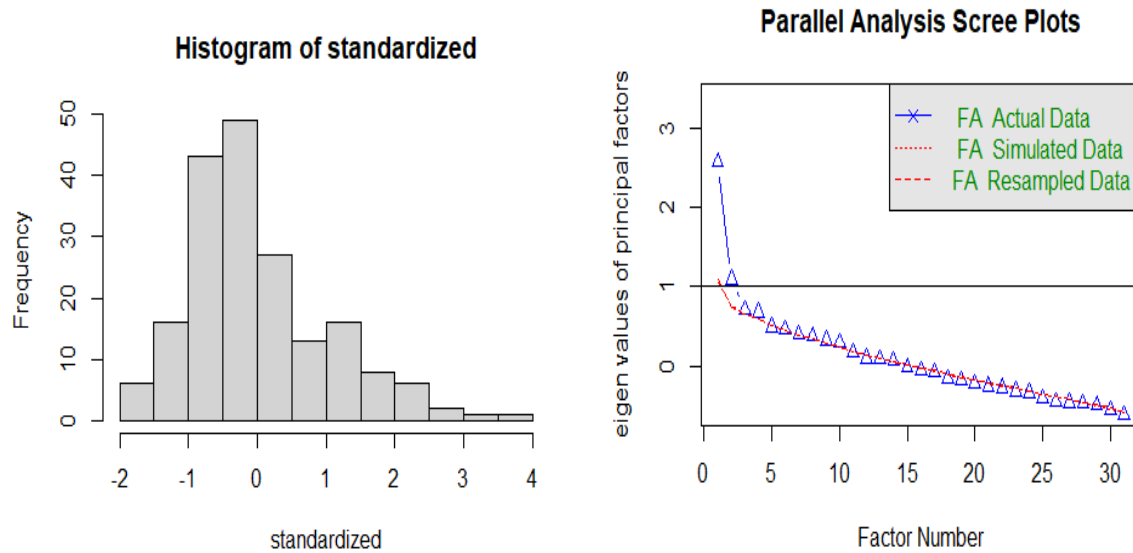
Figure 10 : Normality Test

Linearity   **Homogeneity**

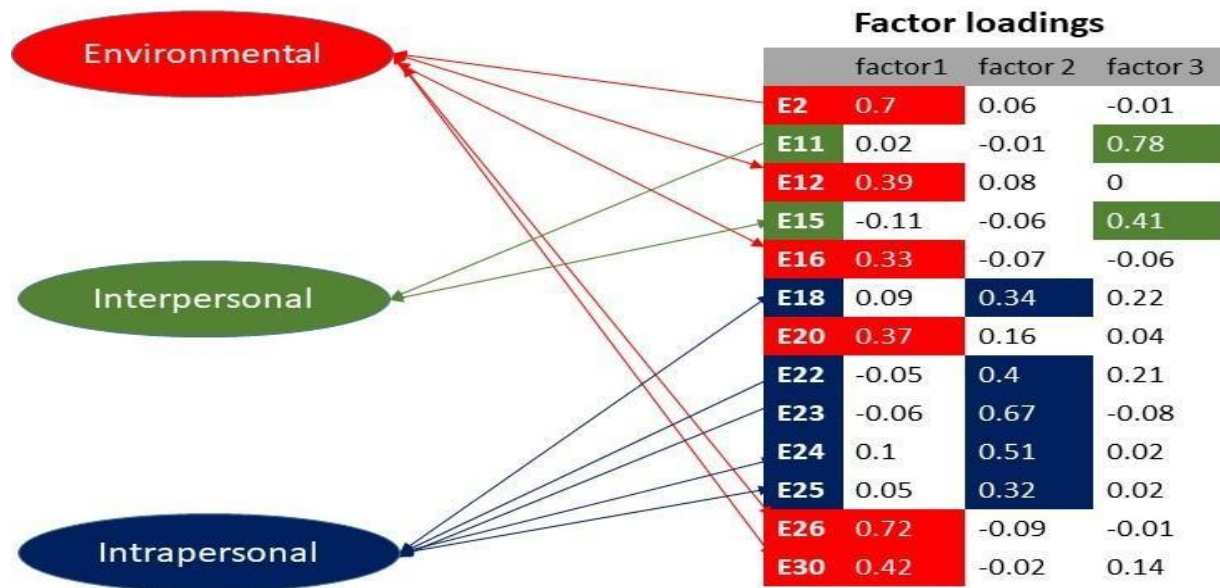**Normal Q-Q Plot**

:
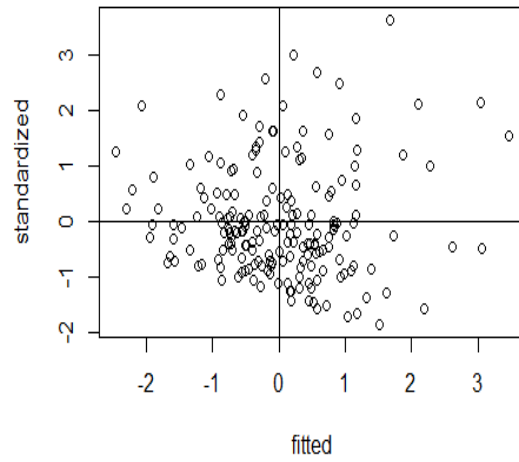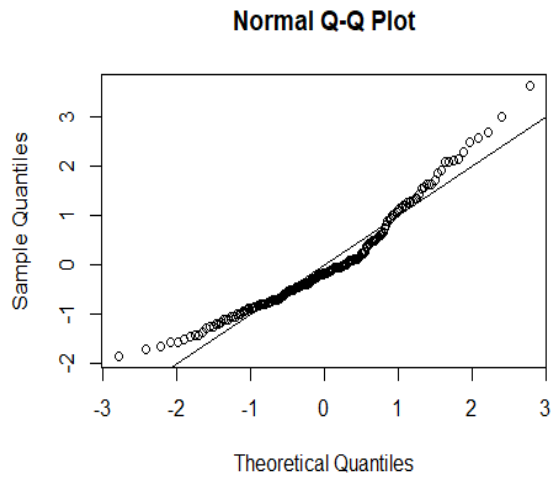
3.1.4 **Number of Factors**

The theoretical number of factors suggested was 3, but parallel analysis and the new Kaiser criteria suggested 4 and 3 factors respectively. The data had moderate sampling adequacy (KMO = 0.58) and Bartlett's test indicated a significant correlation adequacy. The factor analysis resulted in three factors with good fit indices (CFI = 0.9547, RMSEA = 0.032, BIC = -1407.89) and reliable factor scores (Tucker Lewis Index = 0.767). The summary statistics of the new factors showed mean scores ranging from 0.7778 to 2.847, with standard deviations ranging from 1.0534 to 1.1711 showing how much the items bind together

Factor Loadings

Factor loadings

	factor1	factor 2	factor 3
E2	0.7	0.06	-0.01
E11	0.02	-0.01	0.78
E12	0.39	0.08	0
E15	-0.11	-0.06	0.41
E16	0.33	-0.07	-0.06
E18	0.09	0.34	0.22
E20	0.37	0.16	0.04
E22	-0.05	0.4	0.21
E23	-0.06	0.67	-0.08
E24	0.1	0.51	0.02
E25	0.05	0.32	0.02
E26	0.72	-0.09	-0.01
E30	0.42	-0.02	0.14

3.1.5 **Ordinal Logistic Regression Model**

Several model was trained with different factors combinations and their prediction performance

records below;

- model1 with f1, f2 and f3 predicts 50% C.G.P correctly
- model2 with stress predict 41% C.G.P correctly
- model3 with f1, f2 ,f3 and stress predicts C.G.P 41% correctly
- model4 with f1, f2 ,f3, stress and gender predicts C.G.P 41% correctly
- model5 with f1, f2 ,f3 and gender predicts 47% C.G.P correctly
- model6 with f2 predict 48% C.G.P correctly
- model7 with f1 predicts 41% C.G.P correctly
- model8 with f3 predicts 47% C.G.P correctly
- The best model in this case is model 1 with 0.5 error classification rate

-

4.0 SUMMARY OF FINDINGS

Out of all the 246 students who participated in the study, 93 students suffers major and serious depression while 153 students show no sign of major depression, the result also confirms that intrapersonal, interpersonal and environmental stress factors does affect students academic performance in FUNAAB, which is supported by the fact that model1 using f1, f2 and f3 as predictors captures important patterns and dependencies between the predictors and the response variable and also having the least prediction error rate which indicates strong evidence against the null hypothesis of no association. Therefore, we can conclude that FUNAAB students academic performance is a function of three main factor which are interpersonal, intrapersonal and environmental stress factor.

5.0 CONCLUSION AND RECOMMENDATION

There is need for creating a self care routine and prioritise schedule activities that assess student mental health like one on one anonymous online counselling, psychotherapy and also increase awareness on the usefulness of Quarto and Shiny R packages for the development of effective knowledge-sharing platforms that can ultimately foster collaboration, accessibility and insights across various domain in Nigeria and across the world. These open source materials are highly recommended as a teaching tool for all statistics related and research work at all tertiary levels. The website built from this research work can be accessed via this link [Depression and academic performance in FUNAAB](#).

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