Engineering Probability and Statistics (IE 6200)

Project Report

Student Stress Level Calculator and Coping Mechanisms

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Abstract

This research delves into the intricate landscape of stress levels experienced by international students, aiming to provide a comprehensive understanding of the various factors that contribute to their well-being in unfamiliar academic environments. Employing the survey method, this study explores the multifaceted nature of stressors encountered by international students throughout their educational journey. Among the key stressors under investigation are challenges related to financial pressures, academic pressures, and difficulties in the job market. It is grounded in the theoretical framework of international student stress, drawing on existing literature to inform the study's design and interpretation of results.

Through quantitative analysis of survey data and qualitative insights, the project endeavors to provide details about stressors that weigh heavily on international students. By exploring both the individual and collective dimensions of these stressors, the study seeks to unravel the complexities of the international student experience, contributing valuable knowledge to the broader discourse on student well-being. Furthermore, the study investigates the coping mechanisms adopted by international students in response to stress. The project also identifies potential support strategies and resources that institutions, educators, and policymakers can implement to create more inclusive and supportive environments for international students.

In conclusion, this study provides a detailed examination of stress levels among international students, offering a theoretical foundation, empirical insights, and practical recommendations for fostering a conducive academic environment. The implications of this study extend beyond the academic realm, reaching into the realms of student services, cultural awareness initiatives, and policy development to enhance the overall experience of international students in diverse educational settings.

Keywords: *Sample survey, Observational study, Sample size, Sampling frame, Method of randomization, Unbiased sample measures, Hypothesis Testing*

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Introduction

Pursuing higher education in a foreign country is an enriching experience that opens doors to new cultures, diverse perspectives, and unparalleled academic opportunities. But along with it comes challenges, and one significant aspect that grabs attention is the heightened stress levels experienced by international graduate students. As students navigate through unfamiliar academic environments, and expectations, the mix of stressors can impact their overall well-being and academic performance.

Understanding the unique stressors faced by international graduate students is crucial for creating supportive academic environments and developing effective coping mechanisms tailored to their specific needs. This introduction delves into the multifaceted nature of stress experienced by international graduate students and explores the various coping strategies that can mitigate the impact of stressors, fostering resilience and success in their academic endeavors.

By examining the sources of stress and delving into adaptive coping mechanisms, this exploration aims to contribute to a holistic understanding of the challenges faced by international graduate students and provide insights that can inform support systems within educational institutions. As we navigate this discussion, it becomes evident that recognizing and addressing stress among international graduate students is not only a matter of academic concern but a vital component of fostering their overall well-being and success in a foreign academic landscape.

Among the various challenges faced by international graduate students at Northeastern University, managing stress emerges as a critical aspect impacting both their well-being and academic performance. This project seeks to assess the stress levels and coping mechanisms employed by Northeastern University's international graduate students, offering valuable insights into the factors influencing their mental health.
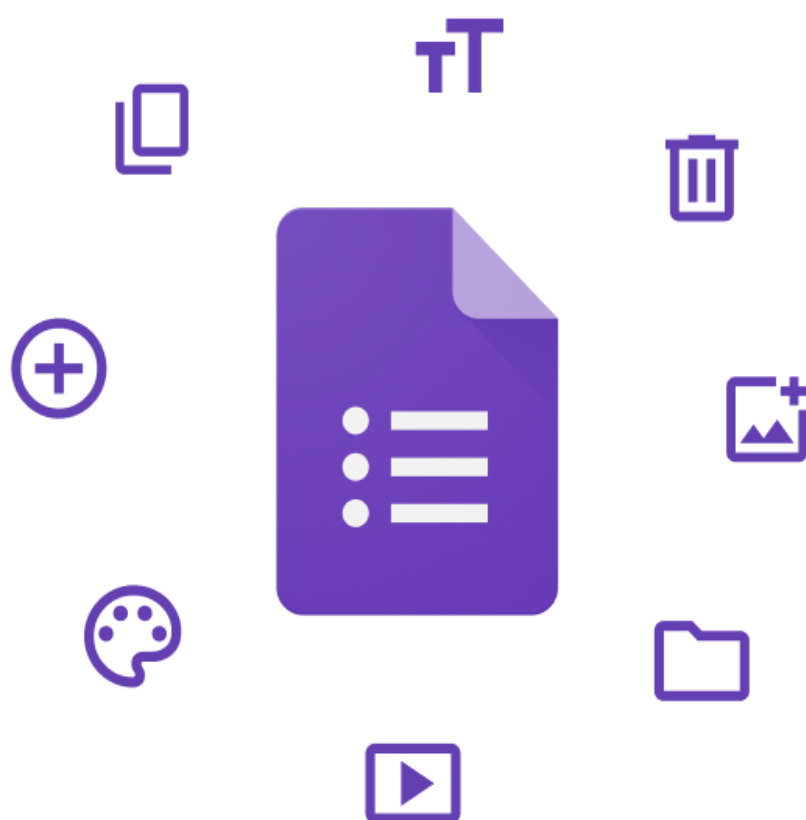
The basic outline of the project is collecting data from international graduate students through Google survey forms which is the image above. and then feeding the data to Google Looker for visualization and analysis. The last part of the project is conducting hypothesis testing using

The above image is of Google Looker which is the tool we have leveraged for visualization and calculation purposes. Google Looker is a robust and sophisticated business intelligence and data analytics platform that empowers organizations to explore, analyze, and visualize their data effectively. Acquired by Google in 2020, Looker provides a unified and intuitive interface for users to gain actionable insights from their data, fostering data-driven decision-making across various business domains. With its powerful analytics and reporting capabilities, Looker facilitates a seamless exploration of complex datasets, enabling users to uncover valuable patterns, trends, and correlations. The platform supports a variety of data sources, offering connectivity to diverse databases and applications. Looker's strength lies in its ability to centralize and harmonize data, making it accessible and understandable for users at all levels of an organization. Whether creating interactive dashboards, building custom reports, or conducting in-depth data analysis, Google Looker stands as a versatile tool for businesses seeking to harness the full potential of their data assets.

Problem Statement

The study aims to address the pressing issue of student stress among international graduate students at Northeastern University, recognizing the unique challenges this demographic faces in adapting to a new academic and cultural environment. The problem statement underscores the necessity of understanding the specific stressors encountered by international graduate students, encompassing academic pressures, cultural adjustment, language barriers, and financial concerns. Furthermore, the study seeks to investigate the coping mechanisms employed by these students to manage stress effectively. By examining the interplay between stressors and coping strategies, the project aims to contribute valuable insights that can inform the development of targeted support systems, interventions, and resources tailored to the distinct needs of international graduate students at Northeastern University. This sets the stage for a comprehensive exploration that aligns with the university's commitment to fostering an inclusive and supportive educational environment for its diverse student body.

Beyond the academic curiosity that such a topic naturally arouses, our personal experiences as students imbued this project with a deeply resonant significance. The personal encounters with stress, coupled with observations of friends and peers facing similar challenges, instilled in us a genuine curiosity about the broader phenomena of student stress and resilience.

As the project unfolded, we found ourselves reflecting on the coping mechanisms employed by individuals in my social circles. It became more than just a research endeavor—it evolved into an exploration of shared experiences, shedding light on the often unspoken struggles that students face. Moreover, the project took on a greater significance as it held the potential not only to uncover insights into the diverse ways students cope with stress but also to inform the development of support systems, policies, and interventions that could positively impact student mental health. The blend of academic curiosity, personal reflection, and the broader societal implications of the project rendered it an exceptionally compelling and meaningful endeavor, underscoring the inherent interconnectedness of research and lived experiences.

The interest in understanding stress levels and coping mechanisms among Northeastern University's international graduate students stems from the recognition of the unique stressors this demographic faces. These stressors may include academic pressures, financial concerns, and the demands of a competitive environment. By delving into these stress factors and examining how students cope, we aim to contribute not only to the academic discourse but also to the development of targeted support systems. The project's significance lies in its potential to identify patterns, trends, and variations in stress responses, ultimately allowing for the creation of tailored interventions and support services. By comprehensively understanding the stress landscape of international graduate students, Northeastern University can foster a more supportive and conducive academic environment, promoting both the mental well-being and academic success of its diverse student community.

Literature Survey

1. [**Risk factors associated with stress, anxiety, and depression among university undergraduate students' by Mohammad Mofatteh, AIMS Public Health. 2021; Published online 2020 Dec 25. doi: 10.3934/publichealth.2021004 PMCID: PMC7870388; PMID: 33575406**](#)

      This review aimed to explore the prevalence of stress, anxiety, and depression among university undergraduate students in both developed and developing countries. The study considered the diverse socioeconomic backgrounds of students entering university, recognizing the potential mental health risk factors associated with such diversity. The researcher identified and critically evaluated forty-one articles published between 2000 and 2020, focusing on risk factors linked to the mental health of undergraduate students. The analysis revealed six overarching themes of risk factors: psychological, academic, biological, lifestyle, social, and financial. Each theme was further divided into multiple subthemes. The findings underscored the importance of early identification of these risk factors to provide appropriate mental health support for university students, aiming to prevent the exacerbation of these factors over time.

2. [**'Academic Stress and Mental Well-Being in College Students: Correlations, Affected Groups, and COVID-19,' by Georgia Barbayannis, Mahindra Bandari, Xiang Zheng, Humberto Baquerizo, Keith W. Pecor, Xue Ming1, Front. Psychol., 23 May 2022, Sec. Educational Psychology, Volume 13 – 2022**](#)

      This study aimed to investigate the impact of academic stress on the mental well-being of college students, considering potential variations among different demographic groups and the influence of the COVID-19 pandemic. Surveying 843 college students, the researchers utilized the Perception of Academic Stress Scale (PAS) and the Short Warwick-Edinburgh Mental Well-Being Scale (SWEMWBS). The findings revealed a significant correlation between heightened academic stress and poor mental well-being across all students, with the pandemic exacerbating stress levels. Non-binary individuals exhibited the lowest mental health scores and the highest academic stress, while men showed the opposite trend. Women and non-binary students reported higher academic stress than men. These patterns persisted in response to COVID-19-related stress. Academic stress and pandemic responses varied by the year of study, emphasizing the need for tailored support for specific student groups. The study highlights the critical link between academic stress and psychological well-being, urging the provision of additional resources and support, particularly for vulnerable demographic groups.

Methodology

(a) Project Timeline

The project timeline for the student stress calculator and coping mechanism initiative unfolds in a structured manner over three months. In October, the focus lies on data collection, utilizing Google Surveys as the primary tool for gathering valuable information. This phase involves reaching out to a targeted audience to elicit responses that will serve as the foundation for the subsequent stages of the project. Moving into November, the emphasis shifts to the processing and visualization of the collected data. During this period, efforts are dedicated to the meticulous analysis of responses and the creation of a real-time dashboard using Google Looker Studio that will provide a comprehensive overview of stress-related trends and patterns.
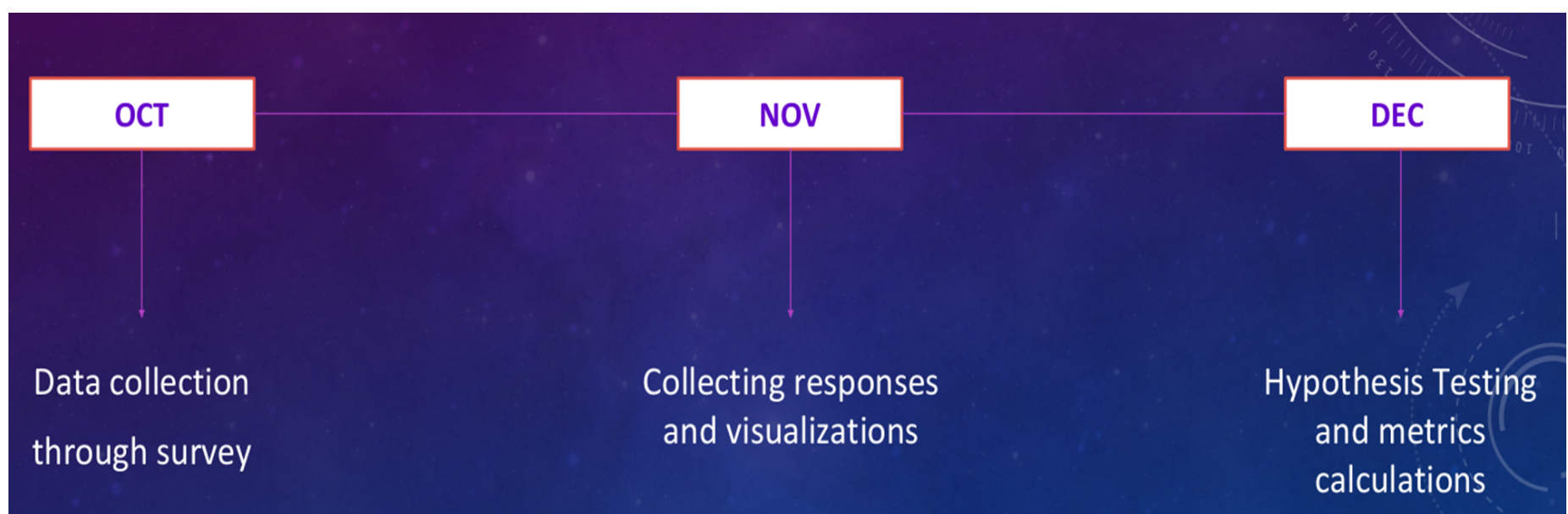

As December arrives, the project enters the hypothesis testing phase, where the insights derived from the data are subjected to rigorous examination and validation. This critical step ensures the accuracy and reliability of the stress calculator and coping mechanism. The overarching goal of the project is to develop a tool that not only accurately gauges stress levels but also offers effective coping strategies. By adhering to this well-structured timeline, the project aims to culminate in a robust and reliable solution to address stress-related challenges, providing individuals with valuable insights and practical coping mechanisms for better mental well-being.

(b) Data Collection

Our comprehensive survey targeted Northeastern Graduate students across diverse majors, encompassing both first and second-year students. The primary objective was to gain insights into the myriad stress factors affecting this demographic and to discern their coping mechanisms. Employing the Perceived Stress Scale (PSS), participants were prompted to assess their stress levels on a scale ranging from 1 (Never) to 5 (Often) across key domains such as academics, finances, career opportunities, competitive environment, health, and support systems. The survey instrument also included a set of demographic fields, capturing information on gender, city, age, field of study, and year of study.

Within the survey, participants were presented with five specific questions, each targeting stress levels in the domains of academics, finances, career, health, and support systems. Furthermore, respondents were asked to identify the most significant stressor among a set of four options in each category. In addition to gauging stress, the survey delved into coping mechanisms, with participants providing insights into the strategies they employ to alleviate stress. This comprehensive approach aims to paint a nuanced picture of the stress landscape among Northeastern Graduate students, offering valuable data to inform targeted interventions and support mechanisms.
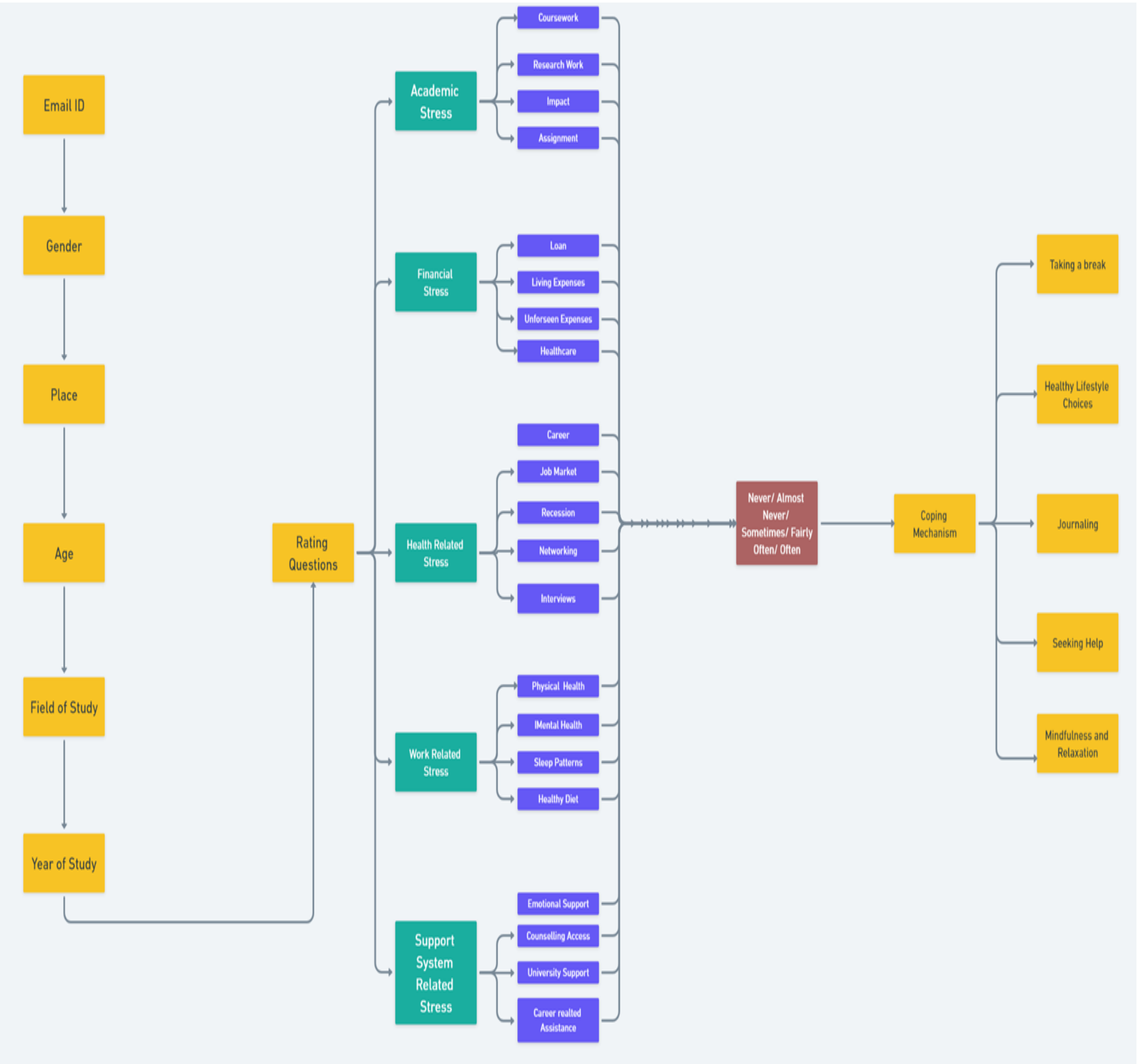
(c) Implementation - Metrics and Visualization ([Real-Time Dashboard](#))

Our Real-Time Dashboard offers a comprehensive assessment of stress levels among students, focusing on key factors such as Academics, Finances, Career Opportunities, Health, and Support Systems. The dashboard employs a user-friendly design that facilitates a nuanced understanding of the data.

- At the top, prominent indicators include the mean stress levels across all surveyed factors, providing an overall snapshot, along with the total sample size.
- On the left side of the dashboard, users can delve into demographic details, particularly gender and year of study, allowing for a tailored exploration of results based on these parameters.
- The central elements of the dashboard feature Donut charts, visually representing the proportions of students affected by each stress factor. Users can interactively select each segment on the chart to reveal the exact number of students experiencing stress in that particular category. This design ensures a dynamic and detailed exploration of stress distribution.
- Additionally, the dashboard incorporates bar graphs to the right, providing a breakdown of the count of students who have been assigned specific ratings (ranging from 1 - Never to 5 - Often) for each stress category. This visual representation allows for a quick and insightful analysis of the coping mechanisms adopted by students.
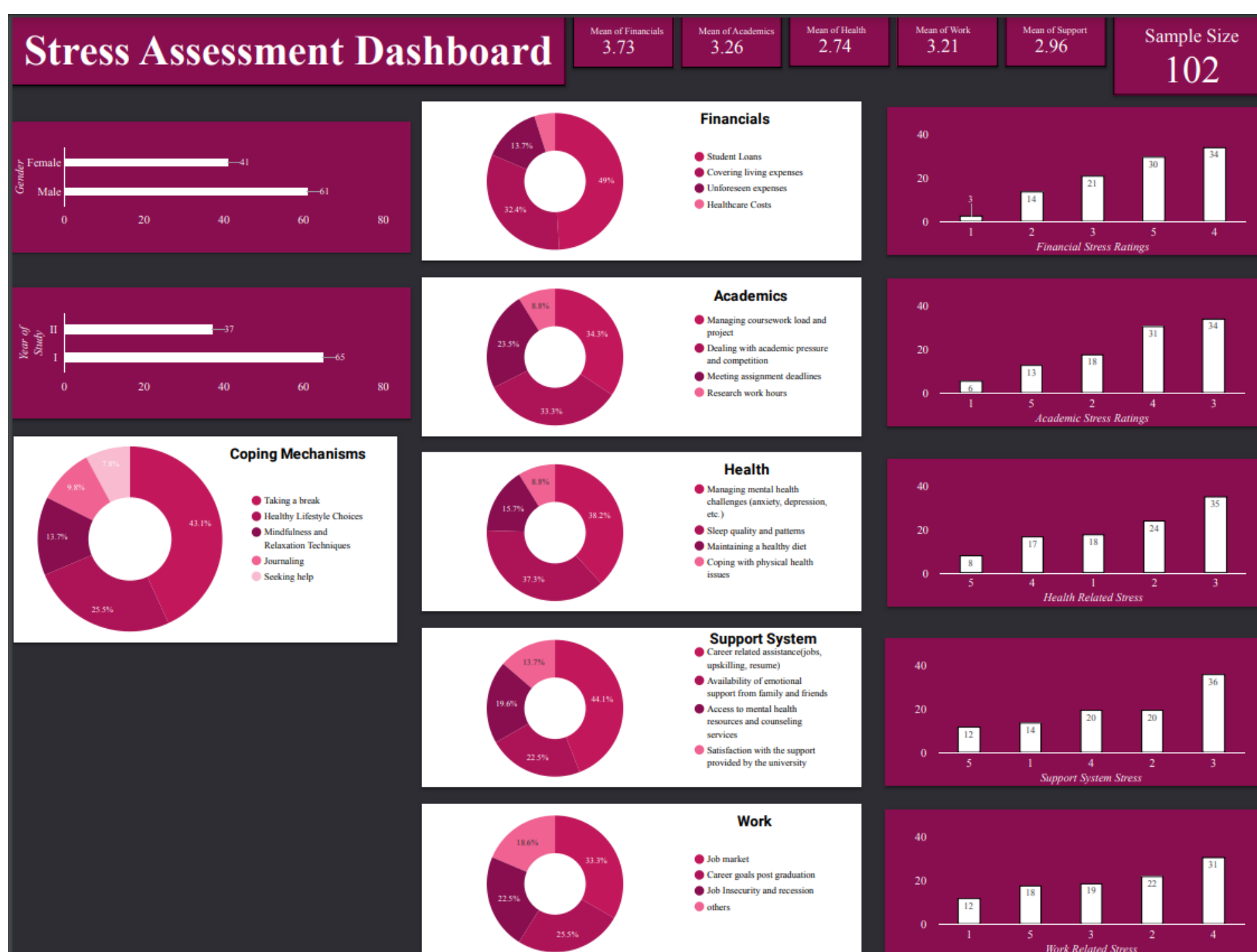
In summary, our Real-Time Dashboard offers a holistic view of stress dynamics among students, allowing stakeholders to explore variations based on demographics, understand the proportions affected by specific stressors, and assess the distribution of coping mechanisms across different stress categories.

(d) Implementation - Hypothesis Testing

In hypothesis testing, the null hypothesis (H0) represents a default or baseline assumption, while the alternative hypothesis (H1 or Ha) represents the opposing or research hypothesis. The null hypothesis often includes statements of no effect, no difference, or no association, and it is what you aim to test against. The alternative hypothesis, on the other hand, expresses what you hope to show evidence for.

In this case, we are performing hypothesis testing on all the factors of stress levels and considering the average stress levels for the same.

Consider the significance value to be alpha, α=0.05

Null Hypothesis (H0): There is no significant difference in mean stress levels among students, and the population mean stress level is equal to some hypothesized value.

Alternative Hypothesis (H1 or Ha): There is a significant difference in average stress levels among students, and the population mean stress level is not equal to the hypothesized value.

METHODOLOGY

Initially, the dataset is imported as a CSV file and the data is read. Perform a one-sample t-test to determine the hypothesis test suitable for our analysis. If the α>=value, then reject the null hypothesis or else fail to reject the null hypothesis.

One sample t-test for academic stress among students:

```python
import numpy as np
import pandas as pd
from scipy import stats

# Path to your CSV file
csv_file_path = 'Y:/Probability/survey.csv'

# Read the CSV file
data = pd.read_csv(csv_file_path)
# Let's say we're interested in a column named 'Academics'
sample_data = data['Academics']

# And we have a population mean
population_mean = 3.2647

Perform a one-sample t-test
t_statistic, p_value = stats.ttest_1samp(sample_data, population_mean)

print(f'The t-statistic is: {t_statistic}')
print(f'The p-value is: {p_value}')
alpha = 0.05
if p_value < alpha:
    print("Reject the null hypothesis")
else:
    print("Fail to reject the null hypothesis")
```

Result:

The t-statistic is: 5.499733414609501e-05

The p-value is: 0.999956226957768

Fail to reject the null hypothesis

One sample t-test for financial stress among students:

```python
import numpy as np
import pandas as pd
from scipy import stats

# Path to your CSV file
csv_file_path = 'Y:/Probability/survey.csv'

# Read the CSV file
data = pd.read_csv(csv_file_path)

# Let's say we're interested in a column named 'Finances'
sample_data = data['Finances']

# And we have a population mean
population_mean = 3.72

# Perform a one-sample t-test
t_statistic, p_value = stats.ttest_1samp(sample_data, population_mean)

print(f'The t-statistic is: {t_statistic}')
print(f'The p-value is: {p_value}')
alpha = 0.05
if p_value < alpha:
    print("Reject the null hypothesis")
else:
    print("Fail to reject the null hypothesis")
```

Result:

The t-statistic is: 0.04958192177377158
The p-value is: 0.9605534727544285
Fail to reject the null hypothesis

Finally, the hypothesis testing for each stress level indicates that the null hypothesis cannot be rejected which further implies that there is no significant difference in the academic and financial stress levels among the students.

Results

(I): What is the mean of a variable?

We will find the mean stress levels observed by the international graduate students at Northeastern University concerning their academics, finances, career, health, and support systems.

We have calculated the mean stress levels across each of these stress categories by adding the ratings given by students on a scale of 1-5 for the respective category and dividing it by the total sample size (102).

Mean of Financials	Mean of Academics	Mean of Health	Mean of Work	Mean of Support	Sample Size
3.73	3.26	2.74	3.21	2.96	102

The mean stress levels observed for the various stress categories are as follows:
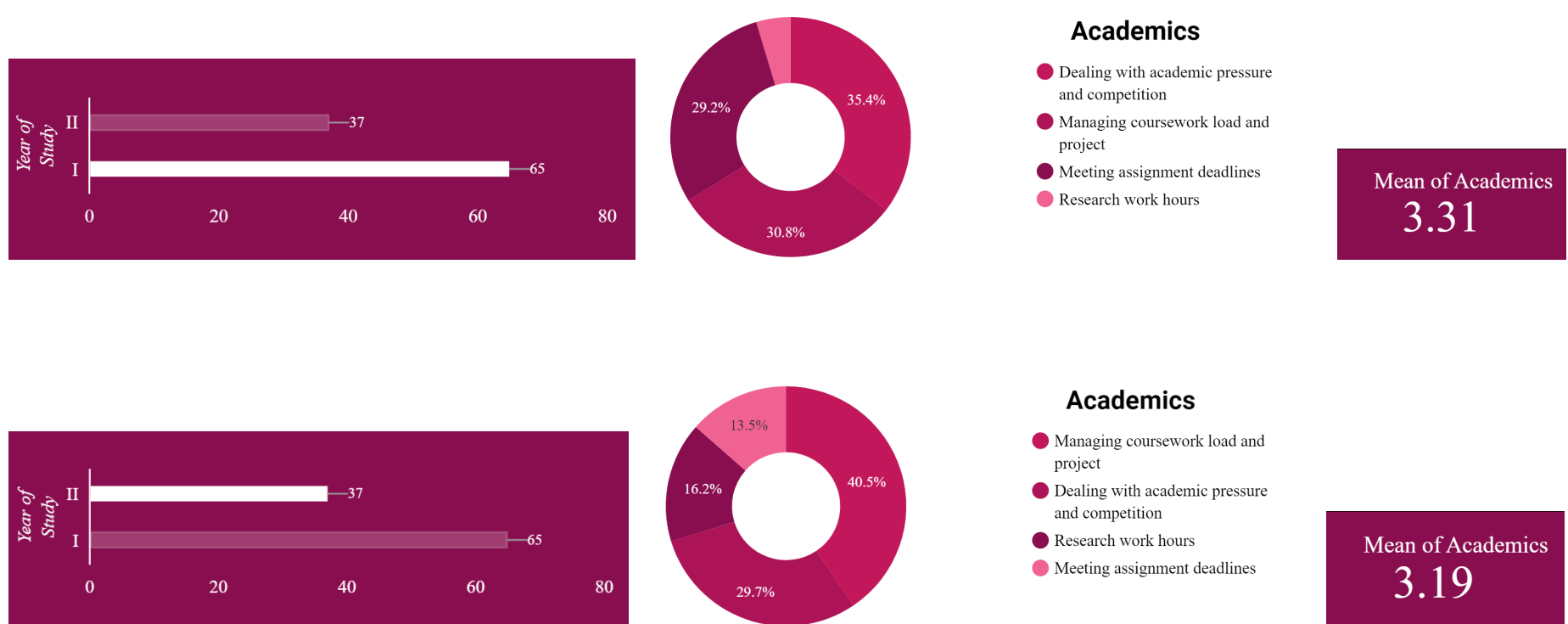- Academic stress: 3.26
- Financial stress: 3.73
- Health-related stress: 2.74
- Work-related stress: 3.21
- Support system-related stress: 2.96

Finally, the stress levels experienced by students in terms of their finances are higher (3.73)

(II): How do the two means compare?

To compare the two means, let us consider two populations i.e. first and second-year graduate students. We shall compare the mean stress levels of the first-year and second-year students concerning their academic stress.

From the dashboard the mean stress levels of the first-year students and the second-year students concerning their academics are


We can see that the mean stress level for first-year grad students (3.31) > mean stress level for second-year grad students (3.19), implying that first-year students experience higher academic stress when compared to second-year students.

(III): What is the proportion of a population with a certain characteristic?

In this context, we examine the incidence of support system-related stress among the female population. We calculate the proportion of female students being stressed by each of the factors concerning the support systems.
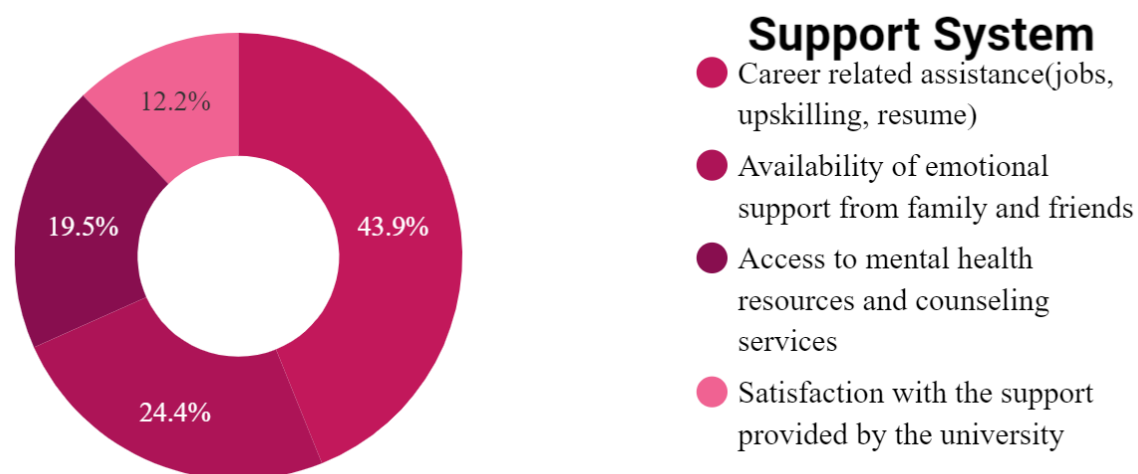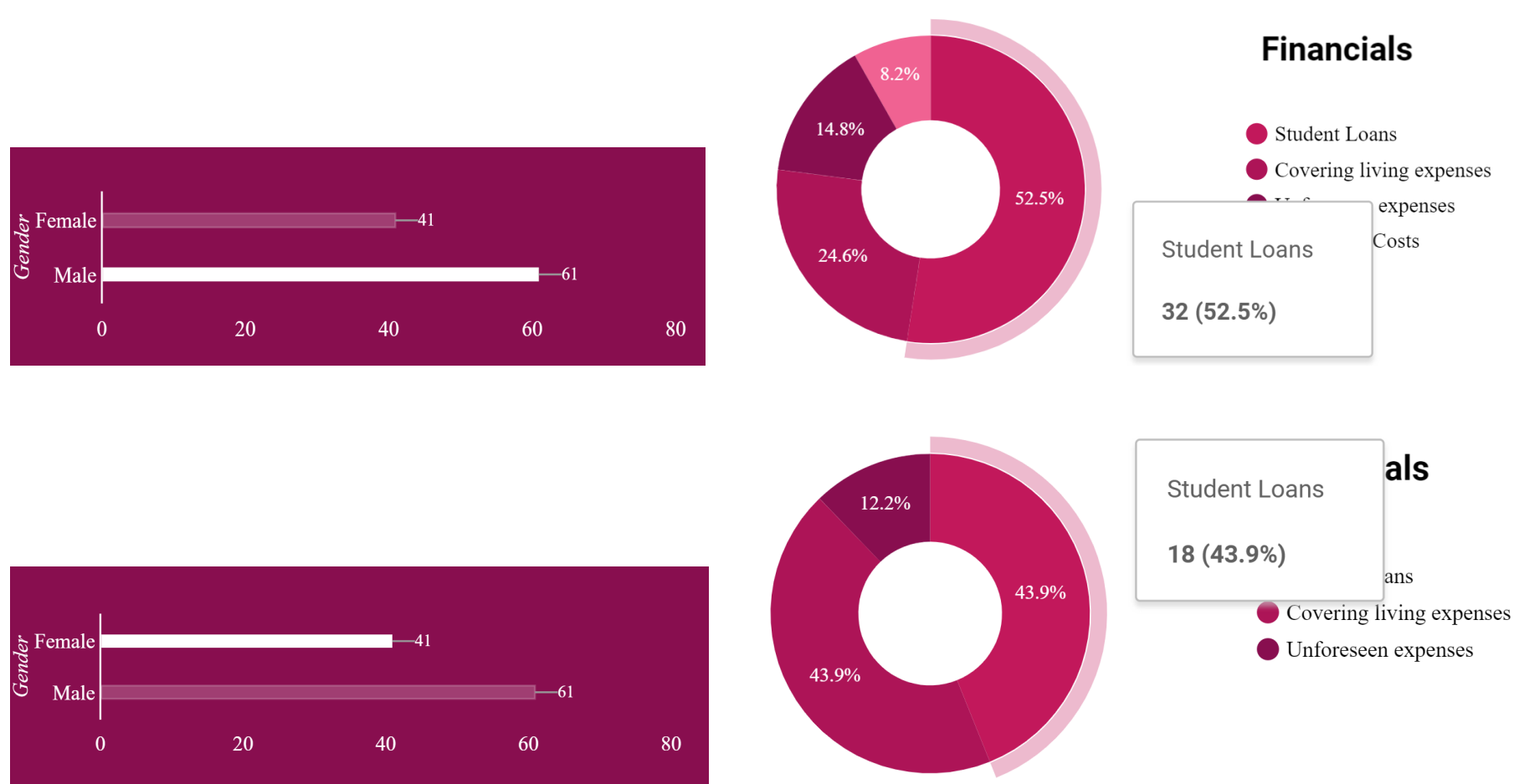

Out of 41 female students surveyed, 18 students (43.9%) report encountering stress related to Career-related assistance, 24.4% of females are stressed due to a lack of emotional support from family and friends, 19.5% of them are stressed regarding access to mental health resources and counseling services, and very fewer females are stressed concerning the support provided by the university. This suggests that the female population tends to experience elevated levels of stress associated with the support system.

(IV): How do the proportions of two populations having a certain characteristic compare?

Let the male and female graduate students be the two populations of interest.

We calculate the proportion of female and male students experiencing financial stress due to Student loans.

From the dashboard, we can see that, out of 61 male students, 32(52.5%) of them experience stress due to student loans, and out of 41 female students, 18(43.9%) students experience stress due to student loans. Thus, the male population faces higher stress levels due to student loans compared to the female population.

Now that we have assessed the stress levels of students across various stress categories and different student populations based on gender and year of study, let us also understand the coping mechanisms adopted by the students to overcome these stressors.

Let us identify the coping mechanism adopted by most of the male and female students.
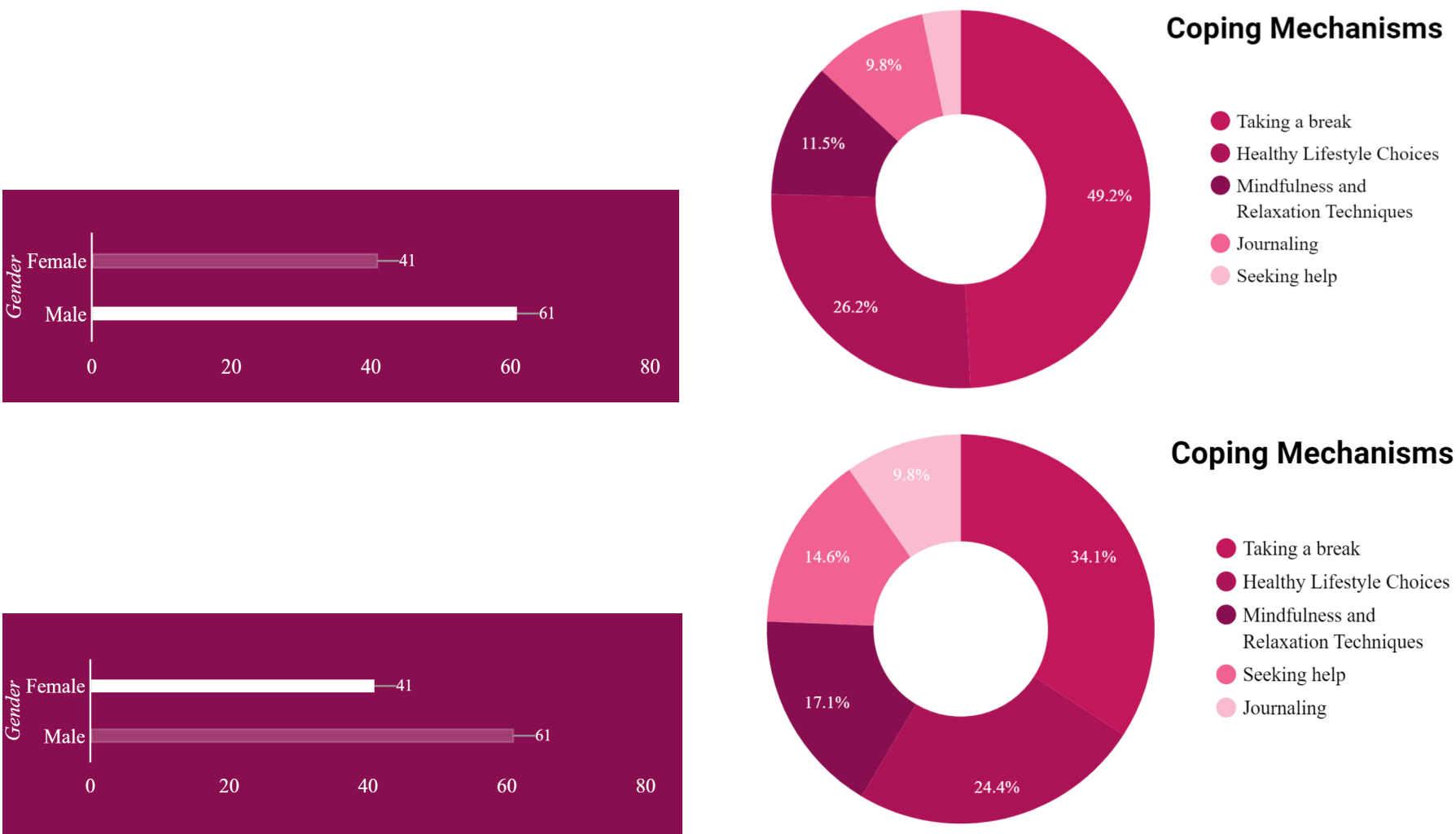
We can see that "Taking a break" is the most preferred coping mechanism by both male and female students, followed by Healthy Lifestyle choices, Mindfulness, and Relaxation techniques. While males prefer journaling to seeking help, female students prefer to seek help.

Inference

Building on the insights gained from the Real-Time Dashboard and complemented by hypothesis testing, it becomes evident that the stress landscape among Northeastern Graduate students is multifaceted and interconnected. The dashboard highlights the primary stressors, revealing that coursework load and project-related pressures in academics, as well as financial concerns, notably student loans, are significant challenges faced by students. However, the hypothesis testing results add an intriguing layer to this understanding, indicating that there is no significant difference in stress levels between academics and finances. This nuanced finding prompts a more intricate exploration into the interconnected nature of these stressors and suggests that interventions addressing both domains may need to be holistic and integrated. Meanwhile, mental health challenges take center stage as a key stressor in the health category, indicating a pressing need for mental health support services tailored to the unique challenges faced by graduate students.

In the realm of career and work-related stress, the dashboard signals a noteworthy concern about the job market and the need for career-related assistance. This insight suggests the importance of career counseling, networking opportunities, and professional development programs to empower students to navigate the competitive job market successfully. Support systems, encompassing the availability of guidance and assistance, emerge as a stressor in their own right, highlighting the importance of fostering a robust support network within the university community.

Turning to coping mechanisms, the dashboard underscores that taking a break is the most preferred strategy among students, implying the significance of promoting a healthy work-life balance. Healthy lifestyle choices and mindfulness techniques follow closely, suggesting that holistic well-being initiatives may resonate well with the student body. This insight calls for the integration of wellness programs and resources that encourage students to prioritize self-care and mental health practices.

In essence, the inferences drawn from the Real-Time Dashboard illuminate a roadmap for targeted interventions and initiatives. The academic arena requires strategies to alleviate the pressures of coursework and projects, financial counseling becomes imperative to address student loan concerns and mental health support must be tailored to the unique challenges faced by graduate students. Additionally, career-related assistance and the fortification of support systems emerge as critical focal points. By aligning interventions with these identified stressors and promoting preferred coping mechanisms, the university can take proactive steps to enhance the overall well-being and success of its graduate student community.

Conclusion

In culmination, this ambitious project, centered around the Real-Time Dashboard and the comprehensive survey conducted among Northeastern Graduate students, represents a significant stride toward understanding and addressing the multifaceted landscape of stress in higher education. By meticulously analyzing stress factors longitudinally, we aim to not only capture the current state of student well-being but also adapt our strategies to the evolving needs of the academic community over time. This temporal lens allows for a dynamic and responsive approach, positioning our project as a forward-thinking initiative that seeks to create lasting impacts on the mental health landscape of Northeastern Graduate students.

One pivotal outcome of our endeavor is the potential for tailored interventions based on identified stressors. Armed with insights into the consistent challenges faced by students, we can proactively develop and implement support programs that directly address these issues. This proactive stance aligns seamlessly with the broader ethos of holistic education, recognizing that academic success is intricately linked with the overall well-being of our student body. By integrating ongoing feedback loops, our Real-Time Dashboard ensures that it remains a relevant and effective tool, capable of adapting to the ever-changing needs and experiences of our diverse student community.

Looking ahead, the project's future scope encompasses a spectrum of initiatives, from a more detailed demographic analysis to the integration of a mobile application and collaboration with mental health professionals. These forward-looking strategies underscore our commitment to creating a supportive and adaptive educational environment. As we incorporate qualitative research methods to deepen our understanding of student experiences, we embark on a journey not just to monitor stress but to actively contribute to the holistic development and success of Northeastern Graduate students. This project symbolizes our dedication to fostering a campus culture that prioritizes mental health, resilience, and the overall well-being of our academic community.

Future Scope

The Real-Time Dashboard and the findings from the comprehensive survey of stress factors and coping mechanisms among Northeastern Graduate students present a robust foundation for an array of potential future endeavors. To begin with, an extended longitudinal analysis could provide invaluable insights into the evolving nature of stressors and coping mechanisms over multiple years. This extended timeframe allows for the identification of trends, patterns, and potential shifts in the stress landscape among students, offering a more nuanced understanding of their mental well-being dynamics.

Moreover, the data aggregated on the dashboard could serve as a powerful tool for the development and implementation of targeted intervention strategies. By identifying consistent stress factors affecting a substantial portion of students, proactive support programs and resources can be tailored to address these challenges directly, fostering a more resilient and mentally healthy student community.

Considering the broader context, integrating comparative analysis with data from other academic institutions or universities could yield insightful benchmarks. Understanding how stress factors differ across institutions provides a more comprehensive understanding of the unique challenges faced by Northeastern Graduate students and helps contextualize the observed trends.

To ensure the dashboard remains a dynamic and responsive tool, integrating feedback loops is crucial. By incorporating periodic surveys or feedback mechanisms, the platform can adapt to changing student needs, ensuring that the support services and resources provided remain relevant and effective over time.

Exploring additional demographic factors and correlating stress data with academic performance could offer a more nuanced understanding. Consideration of a mobile application could enhance accessibility to stress-related resources, and collaboration with mental health professionals can provide personalized support. Qualitative research methods, such as interviews, would complement quantitative data, offering deeper insights into the subjective experiences of students. Collectively, these future scope avenues have the potential to transform the project into a dynamic, adaptive platform that not only monitors stress trends but actively contributes to the well-being and success of Northeastern Graduate students.

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