



MonChitro: Unveiling The Stress and Depression About Future Among Undergraduate Students

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Abstract

Depression, a serious mental health condition, profoundly impacts various aspects of life and is increasingly observed among university students. The transition to university life, coupled with academic pressures, financial challenges, and social concerns, often exacerbates or triggers depression. Concerns about future uncertainties are closely linked to depression in this group. This study adopts a human-computer interaction (HCI) perspective to explore how interactive and reflective tasks can alleviate mental health challenges. We utilized the PHQ-9 depression scale, a widely used tool, to assess and analyze depression levels among undergraduate students at multiple universities in Bangladesh. Data was collected from participants twice, with a 14-day interval between assessments. A unique aspect of this study involved leveraging non-verbal communication through free-hand sketches on the theme of "Life Goals," paired with the NASA Task Load Index questionnaire to evaluate stress levels post-drawing activity. Students subsequently completed the PHQ-9 questionnaire. Our findings reveal that engaging in reflective, goal-oriented tasks designed within the framework of HCI systems significantly reduced both task load and depression levels among the students. This research underscores the importance of integrating HCI principles into the design of interactive systems to support mental well-being, providing a foundation for future applications targeting student populations.

CCS Concepts

• **Human-centered computing** → **Empirical studies in HCI**; • **Social and professional topics** → Cultural characteristics.

Keywords

undergraduate students, PHQ-9, NASA task load index, correlation, future, life goal

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1 Introduction

In the global realm of higher education, the pressure of future expectations frequently collides with the desire for knowledge and personal development [32]. The impending uncertainty of the future can harm university students' mental health as they work to achieve academic success and pave a route toward their career goals. The journey through university, with its myriad challenges and complexities, presents a fertile ground for the emergence and exacerbation of depressive symptoms among students. University students are an exceptional group going through a difficult transformative stage as they transition from adolescence to adulthood. This phase can be one of the most stressful times in a person's life. Many students experience stress due to the pressure to fit in, keep up their academics, make plans for the future, and live away from home [3].

Besides, undergraduate university students' anxiety about the future includes the stress and pressure they feel about their academic and professional prospects. Various social factors like career and job market pressures, uncertainty about career paths, academic performance and its impact on the future, financial concerns, and constant comparison can lead a student to extreme stress regarding the future [26]. Numerous scientific factors can affect this stress, which can ultimately cause the onset or worsening of depression. Students' level of stress is greatly influenced by how they perceive and interpret events and outcomes that will occur in the future. Evaluating the importance and possible effects of future occurrences is a component of cognitive appraisals. Students are more likely to feel higher stress levels, which can aid in the onset of depression if they continually perceive the future as overwhelming, unpredictable, or full of unfavorable consequences [29].

Another prevalent trait among university students is the quest for perfection and having unreasonably high standards for oneself. The pressure to achieve academic excellence and establish lucrative job prospects may be particularly acute for students with perfectionistic tendencies. Because students may worry that they will not live up to their or others' expectations, this relentless pursuit of perfection can raise stress levels in the future. Perfectionism's

long-term stress can cause depressive symptoms to emerge or intensify [22]. Several studies show that the term "cognitive distortions" refers to skewed and unfavorable mental processes that play a role in stress and depressive symptoms [33]. Catastrophizing (exaggerating the negative consequences of future events), overgeneralization (drawing general negative conclusions about the future based on limited experiences), and selective abstraction (focusing only on negative aspects of the future) are future-related cognitive distortions that are frequently observed among university students [19]. These distortions can potentially increase anxiety, prolong stress, and hasten the emergence of depression. The stress of the future among university undergraduate students can lead to depression through a complex interplay of these scientific, social, and academic factors.

Chronic stress and major depressive disorder can lead to suicidal ideation, as depicted in the statistics of student suicide in Bangladesh [6, 28]. Nearly 600 students from all over Bangladesh committed suicide in 2022; a significant portion of these were undergraduates from various universities [11, 18]. Undoubtedly, the factors mentioned above can be highly related to this alarming rate of suicide among students.

In this study, we adopt a Human-Computer Interaction (HCI) perspective to explore how interactive, reflective tasks can mitigate mental health challenges among undergraduate students. Specifically, the research emphasizes the design and application of tasks like Life Goal-themed free-hand sketches, which aim to help students articulate and prioritize their future goals while reducing cognitive stress. HCI principles were employed to design and analyze these interactive systems, highlighting their potential to enhance student well-being and inform future mental health interventions.

To investigate these dynamics, we examined the relationship between future-related stress and depression among 43 undergraduate students through two surveys conducted over a 14-day interval. These surveys utilized the NASA Task Load Index and PHQ-9 to evaluate task load and depression levels [9, 34]. The integration of reflective tasks designed within the HCI framework provided students the opportunity to reevaluate and organize their life goals, resulting in measurable reductions in depression levels.

This study contributes to the growing field of HCI by demonstrating how thoughtful system design can address complex mental health challenges. It is the first to explore this topic in the Bangladeshi context, providing critical insights for future HCI applications targeting university students' well-being.

To address this issue, we formulated the following research questions:

- RQ1:** How does the stress related to future expectations impact the depression levels of undergraduate students in Bangladesh?
- RQ2:** Can engaging in reflective tasks, such as Life Goal-themed free-hand sketches, combined with the NASA Task Load Index, help reduce depression levels among university students over time?

These questions aim to deepen our understanding of the connection between future-related stress and depression, while also examining the potential benefits of reflective interventions in reducing depressive symptoms.

2 Related Work

The rise of student depression can be linked to a lack of clear goals. Goals provide students with direction, purpose, and motivation. Without defined objectives, students may feel lost, anxious, and unfulfilled in both their academic and personal lives [17].

Research by Pritchard and Gregory examines the impact of emotional well-being on educational achievements [26]. They explore the intricate relationship between students' emotional states and their academic performance, highlighting the critical role of emotional factors in predicting student success. Their findings indicate that students with higher levels of intrinsic motivation and engagement tend to outperform their peers academically. Furthermore, the study emphasizes the importance of self-efficacy, revealing that students who possess a strong sense of self-worth and confidence in their academic abilities are more likely to succeed in their studies and future endeavours [26].

Another study investigates the prevalence and causes of depression, anxiety, and stress among Bangladeshi undergraduates [26]. This study examining Bangladeshi undergraduates reveals a significant prevalence of depression, anxiety, and stress, primarily driven by worries about the future. Many participants reported experiencing moderate to severe emotional distress due to various stressors, including academic pressures, career uncertainties, fear of unemployment, financial issues, and societal expectations. These factors contribute to heightened stress and depressive symptoms among students. The research highlights the urgent need for effective interventions and support systems to address mental health challenges in this population, emphasizing the importance of raising awareness, providing accessible counseling services, and fostering a supportive educational environment.

Additionally, various studies highlight the importance of identifying and addressing depression among college students [25, 26]. These studies indicate that untreated depression can hinder academic success, damage social relationships, and diminish the overall college experience. The findings suggest that if left unaddressed, depression may lead to long-term mental and physical health issues. Early identification and treatment of depression are crucial for ensuring academic achievement, student well-being, and the prevention of future challenges. Consequently, educational institutions should prioritize mental health by providing accessible counseling services and fostering a supportive environment [23].

The NASA Task Load Index (NASA TLX) is a widely recognized tool for measuring subjective workload across various domains, including education, cognitive psychology, and human factors research. Developed by Hart and Staveland, the NASA TLX evaluates perceived workload based on six dimensions: mental demand, physical demand, temporal demand, performance, effort, and frustration [1, 12, 15]. In academic contexts, it has been used to assess cognitive workload related to task complexity and mental stress during learning and problem-solving activities [5]. A 20-year review of the NASA TLX demonstrates its versatility across different fields, originally designed for aviation but now integral to education, where it aids in understanding cognitive demands and stress. The review highlights its sustained relevance and effectiveness in workload

assessment, suggesting its broader impact on developing interventions that mitigate workload-induced stress, thus enhancing performance and well-being in academic settings [4, 14, 21].

Research indicates that increased cognitive demands, as measured by the NASA TLX, significantly contribute to heightened stress and decreased student performance, particularly when managing academic expectations and future-oriented tasks [10]. Furthermore, studies have found a strong correlation between perceived workload and mental health outcomes, with higher task load scores associated with increased stress and burnout among students [24]. Although the NASA TLX has primarily assessed workload in operational or cognitive tasks, its application in this study bridges the gap between workload perception and future-related stress within an educational context. By employing the NASA TLX, we gain a deeper understanding of how mental workload impacts students' stress and depression as they navigate academic pressures and uncertainties about their futures.

In our research, we integrate the PHQ-9 questionnaire with the NASA TLX to adopt a comprehensive approach to studying the impact of workload and stress on student depression. The PHQ-9 effectively measures the severity of depressive symptoms [20], while the NASA TLX evaluates subjective workload across dimensions such as mental, physical, and temporal demands. This combination offers a holistic view of how work pressure and perceived stress contribute to mental health outcomes, enabling the development of targeted interventions aimed at enhancing the well-being of young people [13].

The aforementioned research papers primarily examined depression among university students, underscoring the importance of addressing this issue for students to envision a brighter future. However, there is a lack of prior studies specifically exploring the relationship between future-related stress and the prevalence of depression among Bangladeshi university students.

3 Research Context and Contributions

In this study, we explored the use of free-hand sketches as a complementary tool alongside traditional questionnaires to examine the relationship between future-related stress and depression among university students. By leveraging the non-verbal communication medium of art, we aimed to visually represent the students' emotions and correlate these representations with their stress and depression levels, measured through the PHQ-9 and NASA TLX questionnaires. The study sought to understand how students' focus on their future goals, expressed through their sketches, might influence their mental workload and depression levels over time.

We opted to use free-hand sketching due to its distinct ability to reflect inner emotions and experiences visually. Sketching is simple, inexpensive, and provides a unique, non-verbal approach to assessing depression, bypassing the need for explicit verbal disclosures that students may find uncomfortable. This method has been applied in clinical settings to evaluate various cognitive conditions, including amnesia, Alzheimer's disease, dementia, and PTSD. By asking students to sketch their future or life goals, we provided them an opportunity to reflect on their aspirations without confronting them with direct or intrusive questions, aligning with the

goal of exploring how future-related stress might contribute to depressive symptoms.

The second step of the study is to fill out a questionnaire called the NASA Task Load Index, which measures and conducts the subjective mental workload. It enables the researcher to ascertain a participant's mental workload while engaged in a task. In order to generate an overall workload rating, performance is rated across six dimensions. Although the NASA TLX primarily evaluates workload, stress levels can be correlated. Increased stress can be caused by a heavy workload, especially if an individual feels overburdened or unable to handle the demands of a task. A task's cognitive load and mental stress can be captured by the TLX's mental demand dimension in particular. In addition, the frustration dimension might reflect the emotional tension or discontent felt while performing the activity [8]. Therefore, we associated the NASA TLX tool with determining the mental workload of sketching the life goal of a student to examine to assess the mental workload. All of this depicts the mental stress condition regarding their life goal.

The PHQ-9 questionnaire was used to assess students' depression levels at two points, with a 14-day interval. This allowed us to track changes in depression after they had time to reflect on their life goals. By combining the sketching process with these assessments, we explored whether focusing on the future could reduce stress and depression. The data showed that this reflective process significantly lowered both mental workload and depression levels, reinforcing that future-related stress plays a key role in the mental health challenges faced by university students.

The key contributions of this study are as follows:

- This approach introduces free-hand sketches as a unique and accessible tool to assess students' mental health without requiring direct verbal communication. It allows for the exploration of emotions that students may find difficult to articulate.
- We combined the visual data from sketches with two established tools, PHQ-9 and NASA TLX, to investigate the complex relationship between future-related stress and depression levels among students.
- We explored how focusing on future goals through free-hand sketches could reduce depression over time. This reflective exercise, allowing students to contemplate their aspirations non-intrusively, showed that engaging in such sketching significantly reduced mental workload and depression levels, as evidenced by data collected at two points with a 14-day interval. This demonstrates the intervention's effectiveness in enhancing student mental well-being.

Overall, this study presents significant contributions by introducing free-hand sketching as a non-verbal tool for depression assessment, applying the NASA TLX in a novel context, and demonstrating the potential of reflective thinking to reduce future-related stress and improve mental health among university students.

4 Methodology

4.1 Data Collection Materials

To collect relevant data for the study, we provided participants with a set of documents and tasks. These materials were designed to gather demographic information, assess workload, capture creative

input, and evaluate mental health, all while maintaining participant anonymity. No personal identifiers, such as names, were collected at any stage of the process. Each participant received the following items, arranged in a specific sequence to ensure smooth completion:

- **Consent Form:** Participants began by reviewing and signing a consent form. This form clearly explained the purpose of the study, the voluntary nature of participation, and the confidentiality of their responses. By signing, participants confirmed their willingness to take part in the research.
- **Demographic Questionnaire:** Following the consent form, participants were asked to fill out a simple questionnaire to provide basic demographic information, such as their age and gender. This data helped us understand the composition of the participant pool without collecting sensitive personal information.
- **A4 Sheet for Sketching:** Participants were then given an A4 sheet where they could create a sketch. This activity allowed them to visually express their ideas, thoughts, or perspectives related to the study's focus. It added a creative, non-verbal dimension to the data collection process.
- **NASA-TLX Questionnaire:** Next, participants completed the NASA Task Load Index (NASA-TLX) questionnaire. This tool was used to assess the workload experienced by participants during specific tasks. It provided valuable insights into their perceptions of mental, physical, and temporal demands, as well as their performance, effort, and frustration levels.
- **PHQ-9 Scale Questionnaire:** Finally, participants filled out the PHQ-9 (Patient Health Questionnaire-9) scale. This widely used tool helped evaluate participants' mental health by measuring the severity of depressive symptoms. Including this scale provided a deeper understanding of the participants' overall well-being.

This structured and step-by-step approach ensured that participants could complete the materials efficiently while allowing us to collect comprehensive and meaningful data. Each component served a specific purpose, contributing to the overall objectives of the research.

4.2 Study Population and Sample

Undergraduate students from Bangladeshi universities took part in this study. Although we only managed to get data from 43 of the 130 participants, we had planned to interview them. Additionally, we contacted students at different districts engineering and science and technology universities. We needed more time to reach our predicted sample size. 19 male and 24 female students comprised the total number of participants, making the male-to-female student ratio in proportion 44.19% to 55.81%.

4.3 Data Collection and Analysis

We deployed the pre-test/post-test design method in this investigation. Additionally, we established a 14-day gap between the two tests. Each participant received a consent document before the data was collected, outlining the study's goals and the steps that would be taken. Additionally, taking part in the study is entirely optional. The confidentiality of the study and the participant's right to withdraw participation were disclosed in the consent form. After

giving their informed consent, the participants were required to do an instant sketch activity, which consisted of sketching an image of their ultimate aim on a blank A4 paper. The sketch's central idea was "Your Life Goal." The participants were told they could take as much time as needed to create the sketch and depict their life objectives in any way they chose. The researcher gave the drawing no additional direction or criticism throughout this stage.

Participants must complete the NASA-TLX questionnaire to finish the sketch since this self-reported questionnaire can gauge six performance task subscales, including mental and physical demands, timing demands, performance effort, and frustration [31]. After the sketches were completed, we attempted to assess the stress level by calculating the workload associated with that particular task. Using this questionnaire scale, we can determine where a student's burden needs to be reduced to improve their learning experience.

The Patient Health Questionnaire-9 (PHQ-9) was given to the subjects after the sketch and NASA TLX were finished to evaluate their depression symptoms. There are nine questions in the commonly used PHQ-9 self-administered questionnaire, each aligned with the diagnostic criteria for major depressive disorder. Higher scores on the PHQ-9 indicate more severe depression; the total score goes from 0 to 27 [16]. The PHQ-9 has been shown to have high reliability and validity in various populations, which includes university students [27]. Each participant's second data collection session occurred precisely 14 days after the first session, and the same protocols were used.

4.4 Data Processing

The data processing started with converting the participants' responses from the NASA-TLX and PHQ-9 questionnaires into digital format. To do this, one of the researchers manually entered all the responses into CSV files, creating a well-structured dataset. To ensure the data was accurate, another team member double-checked the entries, identifying and fixing any mistakes. This careful two-step process helped minimize errors and ensured the data was clean and ready for analysis.

Once the data was prepared, we used Python to dive into the analysis. Tools like pandas made it easy to organize and work with the data, while numpy helped with calculations, such as finding correlations between variables. For visualizing the results, we turned to seaborn and matplotlib, which allowed us to create heatmaps and other informative graphics. When we needed more advanced statistical tests, we used scipy to explore the data further.

By taking this thoughtful and structured approach, we were able to build a strong foundation for uncovering meaningful connections between the participants' workload experiences and their mental health.

4.5 Ethical Considerations

This study followed the ethical principles outlined by the American Psychological Association's Ethical Principles of Psychologists and Code of Conduct [30]. Informed consent was obtained from all participants, and they were assured of the confidentiality and anonymity of their data. Participants were also provided contact

information for mental health resources on campus and in the community if they needed further support.

The study was approved by the Institutional Review Board (IRB) of a university in Bangladesh. The IRB ensured that the study design and protocol complied with all applicable regulations and ethical guidelines and that the potential risks and benefits of participating in the study were carefully considered. The IRB also reviewed the informed consent process and ensured it was clearly explained to participants. The IRB promptly addressed any concerns or complaints raised by participants during the study.

5 Findings

Addressing our research questions, the findings from our study suggest a nuanced relationship between stress related to future expectations and depression among undergraduate students. The demographic distribution across different undergraduate levels, primarily final-year students, provided a broad basis for assessing depressive symptoms through the PHQ-9 scale. Notably, the reduction in depression levels from the first to the second assessment period indicates that focusing on life goals potentially alleviates depressive symptoms.

A student from the capital city university expressed concern about the gap between industrial work and the university curriculum, saying,

"We are stuck in a tough spot, unsure of what the future holds because what we learn and what the industry demands seem worlds apart."

Meanwhile, a student from a more rural setting shared a different perspective,

"Living a bit away from the hustle and bustle has its perks for studying, but we're a bit in the dark about the latest technologies. It's tough when the seniors, who could fill us in, leave for jobs and rarely come back to share their experiences."

Despite challenges, students value the knowledge-sharing sessions about higher studies led by our academically experienced faculties. However, the absence of faculty with industry experience leaves a gap in our practical understanding of the job sector, akin to navigating without a complete map. Additionally, students living in dorms regularly face issues that disrupt their schedules. One of the students said,

"My every morning starts with the same dilemma: do I skip breakfast to catch an extra 15 minutes of sleep, or rush out without eating because my classes start so early?"

In overcrowded dorms, students struggle for peace due to more roommates than space allows, compounding the stress of maintaining high GPAs. Balancing academic demands feels like walking a tightrope to avoid probation, adding to their physical and mental exhaustion. Furthermore, dealing with personal issues without a usual support system intensifies their challenges, making it difficult to keep up with classes. There are days when getting out of bed feels like the biggest achievement. One of the private university students said,

"Every semester, it is the same story: the struggle to register for classes that fit into a sane schedule. It's like playing a twisted game of Tetris, trying to fit classes, work, and a semblance of social life into my week."

In the midst of these struggles, the resilience and determination of students shine through. They are navigating through their academic journey, striving to bridge the gap between their education and the demands of the real world, all while managing personal and academic pressures. Their stories highlight the need for a more integrated approach to education, one that prepares them not just for exams but for life beyond the classroom.

5.1 Impact of Future Expectations on Depression Levels

Table 1 lists the demographic information of all the participants. Here, we assessed students from different levels of Undergraduate study, where the majority are final-year students. Moreover, among the 43 participants, there were 44.19% male and 55.81% female participants. Table 2 depicts the percentage of the severity of student depression on the scale of PHQ-9. According to the questionnaire score, the data shows the scale of normal, mild, moderate, severe, and very severe. We can see a significant difference between the 1st and 2nd Tests. The depression level decreased significantly in the 2nd Test of PHQ-9. This indicates that students tried to sort their thinking regarding their life goals, which helped reduce their depressive symptoms.

Table 1: Demographic information of participants

Characteristics	Frequency (n)	Percentage (%)
i) Gender		
Male	19	44.19%
Female	24	55.81%
ii) Levels of Undergraduate Study		
1st Year	6	13.95%
2nd Year	8	18.60%
3rd Year	10	23.26%
4th Year	19	44.19%

Table 2: Comparison of the level of depression among 1st phase test and 2nd phase test (based on PHQ-9 scale)

Depression Scale	1st Test		2nd Test	
	Count	Percentage	Count	Percentage
Normal	3	6.98%	7	16.28%
Mild	7	16.28%	3	30.23%
Moderate	5	11.63%	9	20.93%
Severe	12	27.91%	8	18.60%
Very Severe	16	37.21%	6	13.95%

The statistical analysis conducted as shown in figure Figure 3, utilizing NASA-TLX datasets, highlighted significant differences in

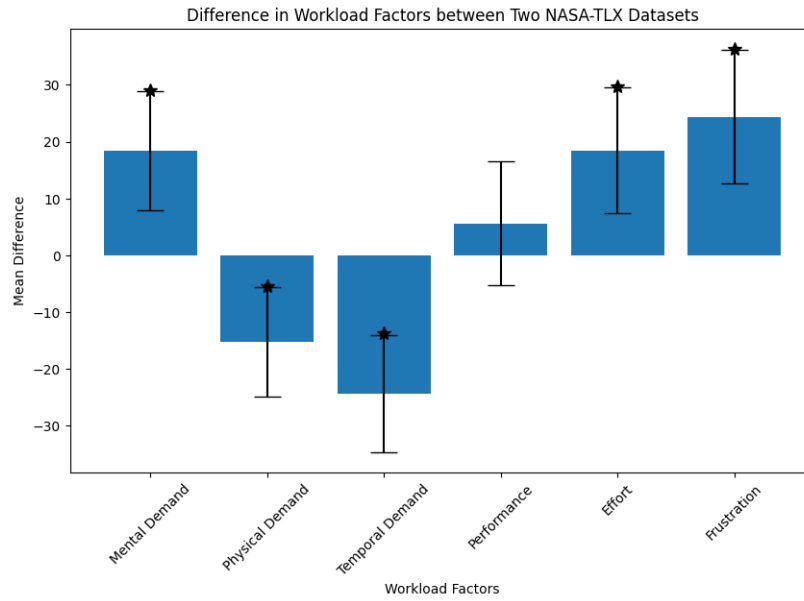


Figure 1: Comparison of workload factors among both NASA-TLX Dataset

several workload factors between the two Datasets. In particular, mental demand, physical demand, temporal demand, and frustration all showed statistically significant variations as per the t-test. Also, as evidenced by p-values is less than 0.05. However, another remaining factor, performance, shows little difference, and the p-value is more than or equal to 0.05.

5.2 Reflective Tasks and Mitigating Depression

Further, the Python analysis of these datasets revealed distinct trends in workload factors. The mean and standard deviation of six workload factors (Mental Demand, Physical Demand, Temporal Demand, Performance, Effort, and Frustration) among two datasets, it is found that dataset 1 has a larger mean score of Mental Demand, Effort, and Frustration compared to Dataset 2. In comparison, Dataset 2 has a larger mean score for Physical Demand, Temporal Demand, and Performance. The standard deviation values show that the scores for these factors are more variable in Dataset 2 than in Dataset 1. This variability and the differences in mean scores provide a nuanced understanding of how workload factors may shift over time or between different conditions within the study.

Here, a correlation heatmap is generated between the PHQ-9 dataset and the NASA-TLX dataset, collected from students in the initial data collection phase. The heatmap shows a minor correlation between mental workload and depression. Other than that, there is no notable correlation between other factors. As correlation does not necessarily imply causation, it is impossible to conclude with the statement that mental demand can solely cause depression. However, from this heat map, it shows that mental demand is one of the minor reasons for depression.

From the correlation coefficient comparison Table 3, it is visible that the most severe level is low to moderate level. It is noted that the correlation coefficient with an absolute value is considered

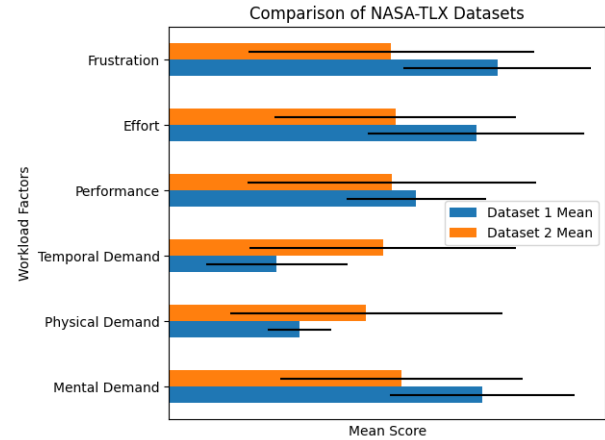


Figure 2: Comparison of workload factors among both NASA-TLX Dataset

weak for values less than 0.3, between 0.3 and 0.7 is moderate, and greater than 0.7 is strong. Which denotes that, none of the aspects made any significant effect on depression level.

We assembled a multidisciplinary team of interviewers, a psychologist, and two computer science undergraduates to analyze the sketches qualitatively using Rose's proposed framework for critical visual analysis. According to Rose, the meanings of a visual image are created from three different perspectives: how an image is made, what it looks like, and how it is seen. To help us with our study, we occasionally incorporated written remarks or descriptions that the participants offered.

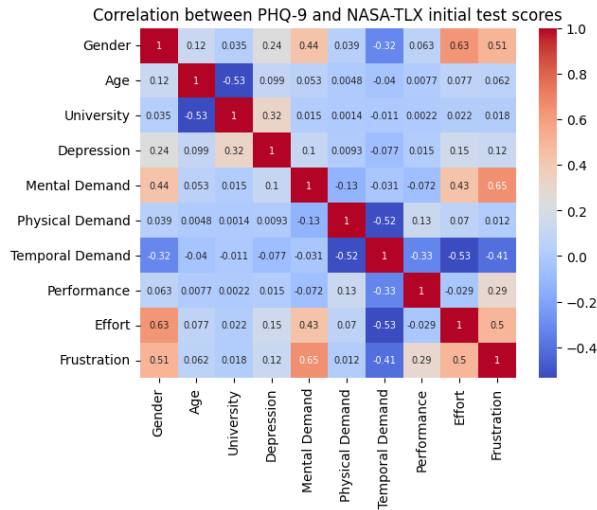


Figure 3: Correlation heatmap among initial PHQ-9 Dataset and NASA-TLX dataset

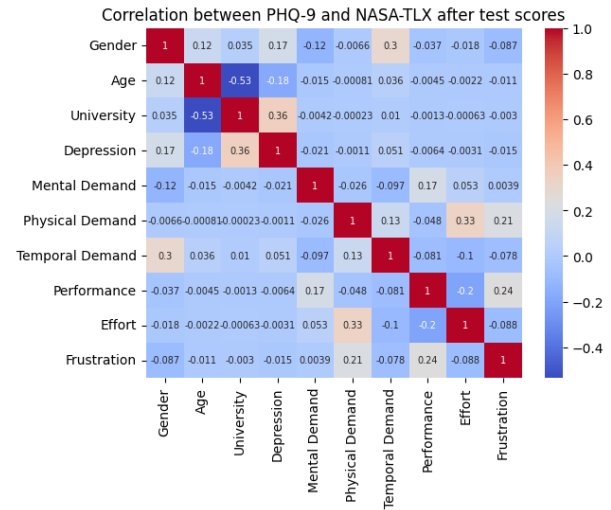


Figure 4: Correlation heatmap among 2nd PHQ-9 Dataset and NASA-TLX dataset

Table 3: Correlation comparison heatmap among 2nd PHQ-9 Dataset and NASA-TLX dataset

Aspect of Mental Workload	Test 1 Correlation Coefficient	Test 2 Correlation Coefficient	Correlation Coefficient Severity Level
Mental Demand	0.103811	-0.020657	Low to Moderate
Physical Demand	0.009339	-0.001129	Very Low
Temporal Demand	-0.077328	0.050636	Low to Moderate
Performance	0.015032	-0.006373	Very Low
Effort	0.149868	-0.00309	Low to Moderate
Frustration	0.120783	-0.014887	Low to Moderate

We observed from the participants' art that drawing for the first time made them very conscious and tense, and most participants took a long time to decide on the drawing topic. However, while drawing for the second phase after 14 days, participants seemed more relaxed and conscious about their drawing. Most participants drew a sad, worrisome, and uncertain picture while sketching for the first time. Meanwhile, in the second phase, they were confident and reflected a happy and sorted picture. Many participants changed their Life goals entirely while drawing for the second phase.

6 Discussion

Our study's analysis utilizing the PHQ-9 and NASA-TLX datasets reveals a complex interplay between stress related to future expectations and depression among undergraduate students, particularly highlighting the role of reflective tasks. We observed that depression rates were notably higher among students, especially seniors, who voiced significant anxiety regarding their uncertain futures. To enhance our analysis, we segmented the collected data into four datasets—two corresponding to the PHQ-9 scale and the other two to the NASA-TLX datasets, based on our test results. Using the Python Pandas library for data analysis, we found a gender distribution of 44.19% male and 55.81% female among the 43 participants. Notably, final-year students represented the largest segment

at 44.19% (as shown in Table 1). Our comparison of the two PHQ-9 test results indicated a significant reduction in reported depression levels, with 28 students initially categorized as severely depressed, decreasing by 14 students in the second assessment.

Further insights emerged from the NASA-TLX questionnaire, which measures stress levels and assesses factors that may influence depression [5]. In Figure 1, we explored mean differences based on workload but found no clear significant differences among the factors. We then performed additional tests using both datasets, focusing on standard deviation and mean values. Figure 2 illustrates that the first test case indicated a higher workload across most factors, though notable distinctions were observed in temporal and physical demand. Moreover, in Table 3, we utilized Python to investigate the correlation between PHQ-9 depression rates and the NASA-TLX scale, revealing that the only common factor between the two datasets was gender, while other factors varied. Our analysis indicated that no individual factor significantly influenced changes in depression levels.

From an HCI perspective, our findings contribute to the understanding of how stress and depression affect student experiences and can inform the design of interactive systems aimed at supporting mental health [2, 7]. The insights gathered from this study emphasize the importance of integrating reflective practices into

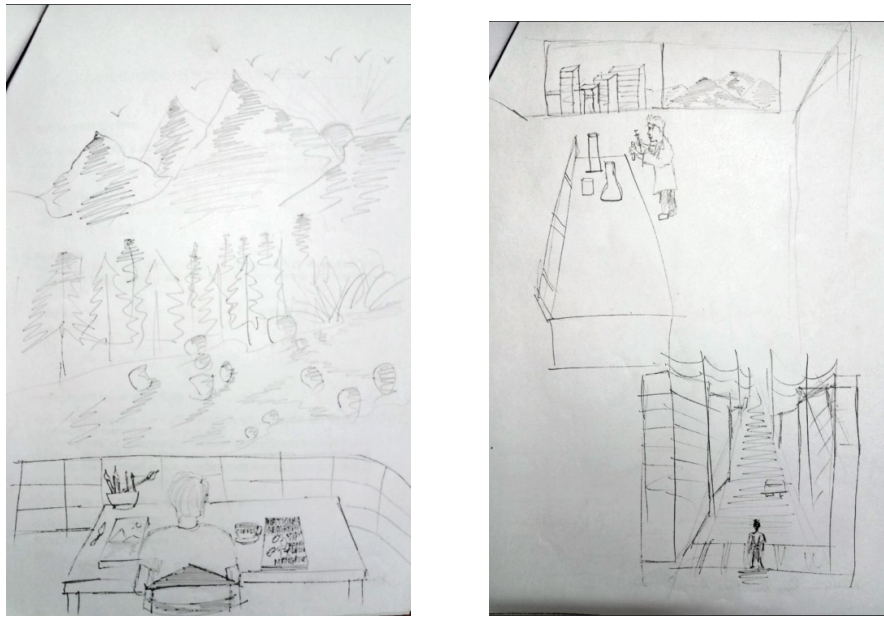


Figure 5: These two sketches, from a microbiology student, represent two different life goals expressed by the subject, which significantly impacted the study results

user-centered design processes. By recognizing the nuanced relationships between stressors, reflective tasks, and mental health outcomes [1, 5, 20], we can better design tools that facilitate self-reflection and provide timely support to students facing academic pressures.

Notably, no existing literature has addressed this specific combination of stress related to future expectations and depression using the PHQ-9 and NASA-TLX datasets in this way. This research aligns with and advances HCI literature by illustrating how data-driven approaches can enhance user experiences in educational contexts, ultimately leading to improved well-being and engagement among students.

7 Limitations and Future Directions

This study, while providing valuable insights into the impact of reflective tasks on depression among undergraduates, has several limitations that warrant consideration. Firstly, the sample size consisted of only 43 students, which restricts the generalizability of the findings to a broader population. Furthermore, technological constraints limited our ability to deeply analyze the sketches, which could have offered richer qualitative data on the student's emotional and mental states.

The reliance on self-reported measures such as the PHQ-9 and NASA-TLX for assessing stress and depression introduces potential biases, as these methods depend heavily on the participants' perceptions and honesty. Additionally, our analysis did not fully capitalize on the sketches due to the diversity in artistic expression and the limitations of our current technology, which prevented a detailed examination of the nuances in the sketches.

The cultural context of Bangladesh, where the study was conducted, may also limit the applicability of the findings to other

settings, as cultural factors can significantly influence how stress and depression are experienced and expressed.

For future research, it would be beneficial to include a larger and more diverse sample size to enhance the robustness and applicability of the findings. Employing advanced technological tools for a more comprehensive analysis of visual data and incorporating longitudinal study designs could provide deeper insights into the long-term effects of reflective tasks on mental health. Additionally, expanding the study to include multiple cultural contexts could help in understanding the cultural dynamics that influence depression and stress in university students.

8 Conclusion

This study explores the relationship between future-related stress and depression among Bangladeshi undergraduates, employing methods like free-hand sketches, the NASA Task Load Index, and the PHQ-9 Scale to assess mental health. It finds a significant correlation between future stress and depressive symptoms. The analysis of sketches reveals students' emotional concerns about the future, while structured tools measure stress and depression levels. The findings suggest that universities should develop support systems, including counselling and career advice, to enhance student well-being and academic success. This study has broad-ranging ramifications. Educational institutions should prioritize creating and implementing comprehensive support systems in light of the negative effects of future-related stress on students' mental health. Targeted treatments like counselling services, stress management initiatives, and career advising programs may be part of this. Universities may foster an environment that encourages resilience, well-being, and academic performance among undergraduate students by addressing future stress.

References

- [1] Ahmad Hassan Afridi and Hanan Abdullah Mengash. 2022. NASA-TLX-based workload assessment for academic resource recommender system. *Pers. Ubiquitous Comput.* 26, 3 (2022), 881–899.
- [2] Saba Asif, Azka Mudassar, Talala Zainab Shahzad, Mobeen Raouf, and Tehmina Pervaiz. 2020. Frequency of depression, anxiety and stress among university students. *Pak. J. Med. Sci. Q.* 36, 5 (2020), 971–976.
- [3] Jenna L Buchanan. 2012. Prevention of depression in the college student population: a review of the literature. *Arch. Psychiatr. Nurs.* 26, 1 (2012), 21–42.
- [4] Alex Cao, Keshav K Chintamani, Abhilash K Pandya, and R Darin Ellis. 2009. NASA TLX: Software for assessing subjective mental workload. *Behav. Res. Methods* 41, 1 (2009), 113–117.
- [5] Subha Sankar Chakraborty, Subashis Karmakar, Aniruddha Sinha, Sanjoy Kumar Saha, Papiya Mukherjee, Vandana Sharma, Mamata Dalui Chakraborty, Parag Kumar Guhathakurta, Chiranjib Koley, and Tandra Pal. 2023. NASA-TLX based workload assessment of learning tasks for primary school children. In *Lecture Notes in Networks and Systems*. Springer Nature Switzerland, Cham, 473–486.
- [6] Bo-Ram Choi and Sung-Man Bae. 2020. Suicide ideation and suicide attempts of undergraduate students in South Korea: Based on the interpersonal psychological theory of suicide. *Child. Youth Serv. Rev.* 117, 105282 (2020), 105282.
- [7] Upama Chowdhury, Md Ahsan Habib Suvro, Syed MD Farhan, and Md Jamal Uddin. 2022. Depression and stress regarding future career among university students during COVID-19 pandemic. *PLoS one* 17, 4 (2022), e0266686.
- [8] Upama Chowdhury, Md Ahsan Habib Suvro, Syed MD Farhan, and Md Jamal Uddin. 2022. Depression and stress regarding future career among university students during COVID-19 pandemic. *PLoS One* 17, 4 (2022), e0266686.
- [9] Mahboubeh Dadfar, David Lester, Agha Fatemeh Hosseini, and Monireh Eslami. 2021. The Patient Health Questionnaire-9 (PHQ-9) as a brief screening tool for depression: a study of Iranian college students. *Ment. Health Relig. Cult.* 24, 8 (2021), 850–861.
- [10] J C F de Winter. 2014. Controversy in human factors constructs and the explosive use of the NASA-TLX: a measurement perspective. *Cogn. Technol. Work* 16, 3 (2014), 289–297.
- [11] Ryan D Duffy, Blake A Allan, and Elizabeth M Bott. 2012. Calling and life satisfaction among undergraduate students: Investigating mediators and moderators. *J. Happiness Stud.* 13, 3 (2012), 469–479.
- [12] Rieska Ernawati, Bambang Suhardi, and Eko Pujiyanto. 2019. Using the NASA task load index and heart rate to evaluate vocational student's mental and physical workload. In *AIP Conference Proceedings*, Vol. 2097. Author(s), Surakarta, Indonesia, 030057.
- [13] M A Ghrab, I Sellami, A Feki, H Daoud, A Abbes, A Haddar, K Jmal Hammami, M Hajjaji, and M L Masmoudi. 2024. Back pain and its association with mental health issues in young doctors. *Eur. Psychiatry* 67, S1 (2024), S651–S651.
- [14] Sandra G Hart. 2006. Nasa-task load index (NASA-TLX); 20 years later. *Proc. Hum. Factors Ergon. Soc. Annu. Meet.* 50, 9 (2006), 904–908.
- [15] Sandra G Hart and Lowell E Staveland. 1988. Development of NASA-TLX (task load index): Results of empirical and theoretical research. In *Advances in Psychology*. Elsevier, USA, 139–183.
- [16] Pfizer Inc. 2023. https://med.stanford.edu/fastlab/research/imapp/msrs/_jcr_content/main/accordion/accordion_content3/download_256324296/file.res/PHQ9%20id%20date%2008.03.pdf. Accessed: 2023-05-02.
- [17] Neil P Jones, Alison A Papadakis, Caroline A Orr, and Timothy J Strauman. 2013. Cognitive processes in response to goal failure: A study of ruminative thought and its affective consequences. *J. Soc. Clin. Psychol.* 32, 5 (2013), 482–503.
- [18] Md. Kamruzzaman. 2023. Nearly 600 students in Bangladesh committed suicide in 2022: Report. <https://www.aa.com.tr/en/asia-pacific/nearly-600-students-in-bangladesh-committed-suicide-in-2022-report/2799845>. Accessed: 2023-5-2.
- [19] Julie Newman Kingery, Travis I Schneider, Jamie S Bodenlos, Jack S Peltz, Molly D Moore, and Katherine J Brown. 2024. Cognitive distortions as a mediator of the relationship between dispositional mindfulness and psychological distress among college students. *J Am. Coll. Health* 1 (2024), 1–9.
- [20] K Kroenke, R L Spitzer, and J B Williams. 2001. The PHQ-9: validity of a brief depression severity measure. *J. Gen. Intern. Med.* 16, 9 (2001), 606–613.
- [21] Luca Longo, Christopher D Wickens, Gabriella Hancock, and P A Hancock. 2022. Human mental workload: A survey and a novel inclusive definition. *Front. Psychol.* 13 (2022), 883321.
- [22] Margaret S. Hill, Lincoln University. 2017. Impact of perfectionism on students: The good, the bad, and the indifferent. <https://nacada.ksu.edu/Resources/Academic-Advising-Today/View-Articles/Impact-of-Perfectionism-on-Students-The-Good-the-Bad-and-the-Indifferent.aspx>. Accessed: 2024-10-1.
- [23] Paola Pedrelli, Maren Nyer, Albert Yeung, Courtney Zulauf, and Timothy Wilens. 2015. College students: Mental health problems and treatment considerations. *Acad. Psychiatry* 39, 5 (2015), 503–511.
- [24] Sima Pourteimour, Safura Yaghmaei, and Hassan Babamohamadi. 2021. The relationship between mental workload and job performance among Iranian nurses providing care to COVID-19 patients: A cross-sectional study. *J. Nurs. Manag.* 29, 6 (2021), 1723–1732.
- [25] Heru Prastawa, Novie Susanto, and Try Nofri. 2018. Mental workload of undergraduate student (a case study in Industrial Engineering Department of Diponegoro University). *SHS Web Conf.* 49 (2018), 02017.
- [26] Mary E Pritchard and Gregory S (gregory Scott) Wilson. 2003. Using emotional and social factors to predict student success. *J. Coll. Stud. Dev.* 44, 1 (2003), 18–28.
- [27] Mahir A Rahman, Tahia Anan Dhira, Abdur Razzaque Sarker, and Jeenat Meha-reen. 2022. Validity and reliability of the Patient Health Questionnaire scale (PHQ-9) among university students of Bangladesh. *PLoS One* 17, 6 (2022), e0269634.
- [28] Anna Rosiek, Aleksandra Rosiek-Kryszewska, Łukasz Leksowski, and Krzysztof Leksowski. 2016. Chronic stress and suicidal thinking among medical students. *Int. J. Environ. Res. Public Health* 13, 2 (2016), 212.
- [29] Tatiana Rovira, Silvia Edo, and Jordi Fernandez-Castro. 2010. How does cognitive appraisal lead to perceived stress in academic examinations? *Stud. Psychol. (Bratisl.)* 52, 3 (2010), 179–192.
- [30] John J Shaughnessy, Eugene B Zechmeister, and Jeanne S Zechmeister. 2000. *Research methods in psychology*. McGraw-Hill, USA.
- [31] Walker G Stanton N, Salmon P. 2005. NASA task load index. <https://digital.ahrq.gov/health-it-tools-and-resources/evaluation-resources/workflow-assessment-health-it-toolkit/all-workflow-tools/nasa-task-load-index>. Accessed: 2023-5-2.
- [32] UNESCO Institute for Lifelong Learning (UIL) (Germany). 2015. *The role of higher education in promoting lifelong learning. UIL publication series on lifelong learning policies and strategies*. Hamburg [Germany] : Unesco, Institute for Lifelong Learning, 2015, USA.
- [33] Bichen Wang, Yanyan Zhao, Xin Lu, and Bing Qin. 2023. Cognitive distortion based explainable depression detection and analysis technologies for the adolescent internet users on social media. *Front. Public Health* 10 (2023), 1045777.
- [34] John Wilding and Bernice Andrews. 2006. Life goals, approaches to study and performance in an undergraduate cohort. *Br. J. Educ. Psychol.* 76, 1 (2006), 171–182.