

The Digital Bridge: using Digital Intervention to Understand Psychosocial Correlation between COVID-19 Stress and Sleep Quality in Undergraduate Students Before and After COVID-19



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Abstract:

Introduction: With the onset of the pandemic and the reopening of institutions, we are all undergoing a new normal, and educators and students are attempting to adjust to keep close ties to the core principles of the educational system. Existing studies have limited analysis on temporal dynamics and causal links between psychosocial factors, COVID-19-related stress, and sleep quality. Moreover, the studies rely on self-reported data, which introduces potential biases. Therefore, the current study employs a mixed-method approach that combines thematic analysis with both inferential and descriptive statistics.

Methods: The first part of this study, which is split into two phases, focuses on identifying the stress that COVID-19 students experience and how it affects other behavioural, psychological, and social factors, as well as sleep. It then examined the significance of these factors for students' academic performance during the current transition from offline to online teaching and hybrid modes. Understanding the importance of Digital technology and, using AI-based intervention to address underlying problems, and determining the impact of chatbots on underlying causes is discussed in the second phase of the study.

Results: The information was gathered from 214 undergraduate students enrolled in different programmes in the University of Delhi using a self-designed, extensive questionnaire that included demographic questions, the Pittsburgh Sleep Index, and the COVID-19 Student Stress Questionnaire (CSSQ). To assess and forecast a student's academic performance based on psychosocial indicators, the data was examined using techniques such as feature selection, regression, neural networks, the Naïve Bayes machine learning algorithm, and multi-dimensional analysis. To determine the link between the variables before and after the intervention, statistical tools, including SPSS, were used to calculate mean, SD, t, and correlation.

Conclusion: The results of the present study show that stress associated with COVID-19 was affecting undergraduate students' sleep, as well as their psychological, behavioural, social, and cognitive functioning. Additionally, research indicated that AI-based intervention chatbots significantly improved undergraduate students' general learning capacity, reduced stress connected to COVID-19, and improved sleep.

Keywords: Psychosocial correlates, COVID-19 stress, Sleep quality, Digital technology, Chatbot, Students.

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1. INTRODUCTION

The stage of emerging adulthood comprises transition and several opportunities and challenges, especially for undergraduate students. They are a unique group of people emerging from one of the most significant stages of their lives and dealing with several difficult situations. Since it was originally identified as a public health issue in December 2019 and had begun to spread slowly over the world, COVID-19 had not shown any signs of slowing down at the time this article was written [1]. The COVID-19 pandemic escalated the burden of sickness and severely strained global health care. In addition to its direct consequences on physical health, it had a considerable negative influence on people's psychological health because of the factors like social isolation, lockdowns, uncertainty, dread, and the "infodemic"—the overabundance of news via social media and other outlets [2].

Students were under extreme academic stress because of numerous colleges closing their physical classrooms and implementing online learning [3]. The negative psychological effects had worsened for kids who were already experiencing more distress. Mental health deteriorated by loneliness and a lack of perceived social support [4]. During the COVID-19 epidemic, 71% of respondents to a mixed-methods study conducted at a public college in the United States reported having greater levels of stress and anxiety, along with associated stressors, including concern, fear, lack of concentration, and disturbed sleep [5]. Unfortunately, these vital attempts to manage the virus may obstruct traditional coping mechanisms by restricting access to social support and outdoor leisure activities. COVID-19 has hurt physical and mental health all over the world [6, 7].

Emerging adulthood is one of the most stressful phases of life, as a lot of stressful things are going on during this period of significant change. In addition to the apparent pressure of academics as there is a shift in the education system from school to college, it is a period in which decisions are made about career, pressure to do well and obtain a job, a lot of people move out of their parent's house to pursue further education and live alone for the first time. The pressure on students to juggle tests, homework, exams, and a host of other activities has increased during the past few years. In addition to these, parents and teachers place a great deal of pressure on pupils to get good grades. Students experience more stress because of having to work so hard to meet these expectations.

Until additional directives from the government, all offices, schools, retail centers, and movie theatres were closed [8]. All that remained open were hospitals and executive agencies of the government. Because of this situation, people's lives became monotonous. Some initially appreciated the lockdown, particularly the students who received unexpected vacation time. However, after more than a month of lockdown, the euphoria gave way to sibling rivalry, helplessness, loneliness, insomnia, and other issues. Even though they were taking classes online,

their problems persisted. A few common stressors were identified by Brooks [9] in a review of the psychological effects of quarantine, which comprised of extended periods of quarantine, fear of infection, grief and financial loss, inadequate information, frustration, and boredom from missing regular activities, and fewer social contacts. Lazarus and Folkman [10] defined psychological stress as "a specific relationship between the person and the environment that the person perceives as taxing or exceeding his or her resources and posing a threat to his or her well-being." In other words, stress arises from the perception that one cannot manage the demands imposed by external events. Coping and stress are closely related notions that have been investigated for a long time [11, 12]. In contrast to earlier studies on stress and coping, the COVID-19 pandemic is a unique global stressful phenomenon on which this study has collected data and how digital technology has come to the rescue and played a crucial role in helping people cope with stress and connect with others during this global health crisis. Digital technology during this crisis has provided access to information, support systems, and even virtual healthcare services, which have been essential for mental and physical well-being during this time.

In light of the recent novel coronavirus (COVID-19) epidemic, public health campaigns have shown a great deal of interest in a new digital platform called chatbots [13]. Chatbots are computer programs that converse with users *via* text or voice using natural language. They have been heavily utilized for both business and pleasure [14]. Early commercial chatbots would frequently utilize pattern matching to figure out the appropriate response to a user's input. More modern chatbots are responding with large language models, which are neural networks pre-trained on billion-scale conversation data sets. Modern chatbots store previous conversations and build long-term memory in an effort to personalize the user experience. Some go so far as to develop an expanding topic list for web searches, allowing users to have conversations with chatbots about a wide range of topics that they are not trained on. Chatbots are superior to other online services and human interaction partners in several ways.

Natural language processing (NLP) and machine learning techniques are used by chatbots to comprehend, interpret, and reply to user inquiries. The foundation of chatbots is Natural Language Processing (NLP), which permits a computer to comprehend human language by segmenting input (text or speech) into more manageable chunks. Consequently, NLP algorithms are used for tokenization (dividing text into words or phrases), syntactic analysis (interpreting sentence structure), and semantic analysis (extracting meaning). Additionally, chatbots use dialogue management system concepts to keep the discussion flowing and produce more organic and interesting encounters. In order to do this, it must choose how to react in a dialogue based on the input it has received, the context of the exchange, a predetermined set of rules, and the patterns it has learnt. Chatbots also feature a well-defined user interface to make information retrieval simple for users, as well as backend integrations or APIs to retrieve data for task

completion. For the chatbot to be useful, it also features a feedback loop that lets it pick up knowledge from user interactions. The loop gathers information on customer satisfaction, recognizes instances in which the chatbot did not respond accurately, and works to make improvements to its responses over time.

During COVID-19, chatbots were employed by the World Health Organization [15] and the US Centers for Disease Control and Prevention (CDC). Research has explored the distinct features of every digital platform to gain a deeper comprehension of how users engage with health information, as this can differ based on the platform [16]. Past studies on pandemics examined online conversations on social media sites like Reddit, Facebook, and Twitter. The literature on chatbots that are now in use and how they might be adapted for the pandemic has been evaluated, and a study on developing COVID-19 chatbots using artificial intelligence (AI) techniques has been the extent of research.

The present study was carried out in two phases, keeping in mind the current situation and objectives of the study. The initial research was carried out from November 2022 to February 2023. Based on the findings of the study, chatbot as an intervention technique was implemented and its effectiveness was studied on psychological cognitive, social and sleep patterns of undergraduate students. For the first phase of the study, the authors formed a questionnaire that dealt with various factors which could impact the academic performance of college students. The questionnaire was divided into various major dimensions: socio-demographic, Online Teaching -Learning Process, Cognitive component, Physical Health, Mental Health, Social Health and vocational dimension. Under these dimensions, the questionnaire consisted of a few demographic questions like age, gender, socio-economic status, place of residence, staying with family / hostel / PG and the course and stream students were pursuing. These questions were related to student's habits, number of close friends, optimism, level of satisfaction, emotional quotient, state of mind, consuming hukka/ alcohol, smoking habits, shopping patterns, time spent on social media, being a consistent learner, mood swings affect the academic performance of the student, online teaching, teacher and student interaction and role of technology in learning. Apart from this, the COVID-19 Student Stress Questionnaire (CSSQ) Zurlo, Cattaneo Della Volta and Vallone in 2020 to measure the perceived stress during the COVID-19 pandemic in university students and The Pittsburgh Sleep Quality Index were used. The reason to undertake this research was twofold, one was to identify the psychosocial correlates and sleep quality Index of undergraduate students of India during the pandemic situation when teaching was taking place in online mode and later in hybrid mode. Secondly, there is a shortage of research on chatbot-based interventions' usefulness in the setting of psychosocial correlates, COVID-19 stress and sleep quality Index in the area of higher education in the Indian context [21].

In our work, we introduced digital intervention to help students leverage technology as a powerful tool to support them in overcoming mental health challenges. We framed multiple research questions that were answered by students prior to and after using the chatbot.

The chatbot helped students manage anxiety and improve mental health by offering immediate, nonjudgmental support at any time. It used Cognitive Behavioral Therapy (CBT) and mindfulness exercises to guide students to deal with stress or anxiety. Students could now express their feelings in a safe, anonymous space, reducing the stigma often associated with seeking help. Their 24/7 availability ensures that support is always within reach, particularly during times when human counselors may not be accessible.

Therefore, this study uniquely integrates digital interventions to monitor psychosocial factors, stress, and sleep quality in undergraduate students over time. Combining longitudinal data with digital tools provides a more dynamic and accurate understanding of changes before and after the COVID-19 pandemic, addressing gaps in traditional self-reported methods. Furthermore, the best part of this innovative approach is that it takes into account the cultural background and social norms while making any recommendation [17-20, 22].

2. METHODOLOGY

The objective of our research is to:

1. examine the COVID-19 stress and sleep quality index of undergraduate students.
2. study the psychological, cognitive behavioral aspects of undergraduate students during the pandemic.
3. investigate the impact of chatbot as an intervention on COVID-19 stress and sleep pattern index of undergraduate students.
4. analyze the impact of AI chatbot as an intervention on psychological, cognitive-behavioural aspects, COVID-19 stress, and sleep quality of undergraduate students.

For this, our study followed a mixed-method design. Further, the design of the study was adopted before and after the design. The present study was carried out in two phases, keeping in mind the current situation and objectives of the study. The initial research was carried out from November 2022 to February 2023. Based on the findings of the study chatbot as an intervention technique was implemented and its effectiveness was studied on COVID-19 stress, psychological, cognitive, social and sleep patterns of undergraduate students. For the present study self-designed questionnaire, COVID-19 student stress questionnaire (CSSQ) and The Pittsburgh Sleep Quality Index were used. These measures were administered again to undergraduate students after the introduction of the chatbot as an intervention technique.

Research questions were specific, concise, and well-defined.

- What are the experiences of undergraduate students during the pandemic and after the pandemic on psychosocial correlates, COVID-19 stress and sleep quality?
- Analyzing stress and sleep pattern Index before and after digital intervention
- Comparing learning capabilities of students during pandemic and post-pandemic
- Do digital interventions improve mental health outcomes

by enhancing social connections, providing emotional support, or promoting healthy behaviours in undergraduate students?

- How does digital intervention (chatbot) help in providing emotional support and promoting healthy behaviour and social interactions among UG students

These questions were asked from students of Delhi University pursuing any under graduation course. The criteria used to filter students were the student should not be diagnosed with psychological disorders, have access to digital technology already using and be well-versed in technology. The research was exploratory thus, it was determined to drop the research hypotheses in this study.

The demographic details of the sample are underlined in Table 1.

Table 1. Demographic details of students.

Variable	-	Frequency (N)	Percentage
Gender	Male	50	23.36%
	Female	164	76.63%
Undergraduate (Year)	1 st year	51	23.83%
	II nd year	88	41.12%
	III rd yr	75	35.04%
Course	Science	84	39.25%
	commerce	66	30.8%
	Humanities	64	29.9%
Home /PG /Hostel	Home	146	68.22%
	PG/Hostel	68	31.77%
Total	-	214	-

The following measures were considered while framing the questionnaire.

2.1. COVID-19 Student Stress Questionnaire (CSSQ)

COVID-19 Student Stress Questionnaire (CSSQ) is developed by Zurlo, Cattaneo Della Volta and Vallone in 2020 to measure the perceived stress during the Covid-19 pandemic in university students. The total Global Stress score on this scale ranges from 0-28. The CSSQ also has three sub-dimensions based on potential stressors, that are: 1) Relationships and Academic Life, 2) Isolation and 3) Fear of Contagion. The global score for the CSSQ was calculated by adding the score for each item and obtaining a total score. The norms for the global scoring of CSSQ states:

6 /below: low levels of perceived COVID-19-related Global stress.

7-15: average levels of perceived COVID-19-related Global stress

16 /Above: High level of perceived COVID-19-related Global stress

For analysis, standard questionnaires were used and for the interview, open-ended questions were asked to make the respondent feel comfortable while answering them.

2.2. The Pittsburgh Sleep Quality Index

The Pittsburgh Sleep Quality Index developed by Buysse and his colleagues, is a self-report questionnaire that assesses sleep quality over 1-month time interval. The measure

consists of 19 individual items, creating 7 components that produce one global score. The Global PSQI score is then calculated by totalling the seven components score, providing an overall score ranging from 0 to 21, where lower scores denote a healthier sleep quality.

The Self-Designed Questionnaire was divided into various dimensions, which consisted of the sociodemographic characteristics of participants. The socio-demographic characteristics consisted of the course under study, year in which studying, age, gender, and staying in Home / PG/Hostel. The other dimensions comprised Online teaching-learning process, cognitive component, physical health, mental health, social health and vocational dimension. The other questions dealt with various aspects which are related to the academic performance and well-being of the students. These questions were related to Student's habits, number of close friends, optimism, level of satisfaction, emotional quotient, state of mind, consuming hukka/alcohol, smoking habits, shopping patterns, time spent on social media, being a consistent learner, mood swings affect the academic performance of the student, online teaching, teacher and student interaction and role of technology in learning. To get in-depth information few questions were open-ended in nature and a semi-structured interview was carried out after the introduction of the chatbot to get insight into the effectiveness of the chatbot as an intervention technique.

2.3. Data Collection

Before conducting the study, approval, and consent were taken from the ethical committee of SPM College (Number SPM/RC/2201). For the study, the Google form comprising of the self-designed questionnaire, COVID-19 Student Stress Questionnaire (CSSQ), and Pittsburgh Sleep Quality Index were included and sent out to the target population, i.e., undergraduate college students. The Google form also consisted of a consent form for participation in the study. Participation in the study was voluntary, and basic details about the purpose of the study were given without exposing any details that might lead to biased answers. It contained of all the instructions and the eligibility criteria for participation in the study. The relevant demographic details were also collected, and the right to confidentiality was addressed and assured. The data was collected on these measures twice one's before the introduction of chatGPT intervention and one's after the intervention. The intervention was provided for 4 weeks. After the data was collected, out of which 10 individuals who had consented to participate in the semi-structured interview and were using Digital Technology to address various psychosocial issues and personal issues were interviewed, a few questions were devised, and each interview session lasted 40-45 minutes which was later subjected to thematic analysis.

3. RESULT

3.1. Data Analysis

The present study investigated the COVID-19 stress, psychological, cognitive, behavioral aspects and sleep pattern index of undergraduate students. Furthermore, it also

studies the impact of Chatbots as an intervention on COVID-19 stress, Psychological, cognitive, behavioral aspects, and the sleep pattern index of undergraduate students during the pandemic. In this study, responses of 214 undergraduate subjects in the age range of 18-23 years were collected. Purposive sampling was the sampling technique used in this study. The responses attained were uploaded on SPSS software and descriptive statistics Table 2 (Mean, SD, frequency and percentage) were calculated along with inferential statistics in the form of paired t test were analysed, apart from that, the data was also collected through semi-structured interviews and open-ended questions, which were analysed qualitatively in the form of frequency, Percentages, Global and sub-themes, which are discussed below in Tables 3-7 (Frequency and Percentage), which highlights the role of digital technology in addressing various psychosocial issues of the undergraduate students.

Table 2. Mean and SD of COVID-19 stress and sleep pattern index before intervention.

Variable	Mean	SD
Covid-19 Stress	16.50	2.15
Sleep Quality Index	11.34	2.73

Table 3. Shows percentages on various psychological, cognitive behavioural and social aspects.

Areas of Concern	%age
• 1 to 3 friends and they occasionally meet them.	65.40%
• Fear of being judged, want someone to listen to them without being biased.	50.50%
• Having Mood swings, not satisfied with life	60%
• Classes, assignments, and test are stressful and are overburdened	50%
• Learning capabilities have been hampered due to stress and anxiety	71.40%
• Learning capabilities have been hampered due to financial strains	44.80%
• Having issues in maintaining a relationship	63.08%
• Increased screen time is affecting concentration and learning capabilities	72.40%
• Disturbed daily routine due to the pandemic	77.17%
• Listened to a Motivational Speaker	60%
• poor time management skills	60.20%
• Unable to take decisions decisively need constant approval.	58.60%
• Lack of the ability to control their thoughts, emotions, and actions	48.50%
• they need some type of counselling to handle their stress	57.50%
• wanted someone to talk to and express and burst their stress levels	64.40%

The above results depict that undergraduates are experiencing high levels of perceived COVID-19-related Global stress and also have poor sleep patterns.

Table 4. Mean and SD of COVID-19 stress and sleep pattern index before and after intervention.

-	Before Giving Intervention (Chatbot) 0		After Giving Intervention (Chatbot)		paired t-value
	Mean	SD	Mean	SD	
Covid-19 Stress	16.50	2.15	15.80	1.89	4.90
Sleep Pattern Index	11.34	2.73	10.78	2.69	7.50

Note: The paired t-value is significant at .01 level.

These are the areas that were identified and the undergraduate students faced issues mostly during the pandemic before any support was provided to them and more than half of the students reported that they were looking for some kind of intervention.

The results indicate that on covid-19 stress and Sleep Pattern Index overall after the introduction of the chatbot significant difference was observed on both the domains and a reduction in covid-19 stress was observed and the sleep pattern index overall of undergraduate students improved.

4. DISCUSSION

The present study investigated the COVID-19 stress, psychological, cognitive, behavioral aspects and sleep pattern index of undergraduate students. It also studies the impact of Chatbots as an intervention on COVID-19 stress, Psychological, cognitive, behavioral aspects, and the sleep pattern index of undergraduate students during the pandemic. The first and second objectives of the study were to examine the COVID-19 stress, Psychological, cognitive, behavioral aspects, and sleep patterns of undergraduate students during the pandemic. The results of Tables 2 and 3 indicate that undergraduates are experiencing high levels of perceived COVID-19-related stress and are also having poor sleep pattern. To cope with these challenges effectively, the present study used chatbot as an intervention technique.

The third objective was to investigate the effectiveness of Chatbot as an intervention technique to mitigate COVID-19-related stress, psychological, and cognitive behavioral aspects, and sleep patterns of undergraduate students during the pandemic. The general population's stress levels have been growing recently, and the global epidemic has now made it even worse. It further impacts sleep and daily functioning. Sleep is necessary for preserving homeostasis, and in postmodern society, chronic sleep deprivation is becoming a growing issue. The results of Table 4 show mean, SD, and t-values on COVID-19 stress and sleep quality index before and after the use of artificial intelligence chatbots. The results indicate significant differences in COVID-19-related stress and sleep patterns of undergraduate students. After the introduction of Chatbot, the undergraduate students' global score of COVID-19-related stress reached to average and sleep patterns also became

better as compared to previous scores. It has been observed that a common application of Artificial Intelligence in understanding and providing intervention is artificial Intelligent Chatbots, also known as conversational agents and relational agents. These are computer programs embedded into digital mental health hubs that can have a conversation with a human user. It was Joseph Weizenbaum in 1966 who created ELIZA, the first chatbot. ELIZA was designed on the principles of the Rogerian psychotherapy technique, which involves looking up keywords in user input and then using a rule based on those keywords to give a response. Interest in chatbots has grown significantly since ELIZA, particularly in digital mental health intervention, and after 2016, analysis revealed that 39% of chatbots related to health addressed mental health concerns, while another study revealed that 41 chatbots related to mental health were created in 2019. Presently, the majority of chatbots for mental health are intended to treat positive psychological constructs like psychological well-being, self-compassion, mindfulness, and quality of life, as well as conditions including depression, anxiety, PTSD, stress, dementia, and acrophobia. Additionally, chatbots have been created for a range of demographics, such as kids, teens, adults, senior citizens, and particular healthcare populations.

Chatbots might also provide early input, and thus, further courses of action can be taken at group and individual level. Table 6 shows students' responses after using the proposed chatbot. From the table, it is clear that post-COVID-19, students made limited friends and met them less frequently than before. After using the chatbot the percentage of students having the fear of being judged, has drastically come down to 40%. Around 72% of the students are having frequent mood swings, but 47% are feeling overburdened due to their classes, which is an improvement over the initial figure. 71% of the students who reported that their learning capabilities were hampered due to stress and anxiety were again interviewed and it was found that this number had fallen to 48%. Compared to 63.08%, now 60% of the students are finding it difficult to handle their relationships. From 58.6%, the percentage of students who were unable to make decisions has come down to 45%. Moreover, instead of 57.5%, now 40% students need some counselling to handle their stress and the biggest improvement recorded was that instead of 64.4%, now 35% of the students wanted someone to talk to and express their stress.

The fourth objective was to examine in depth the impact of AI chatbots as an intervention. To analyze the Role of AI (chatbot) and its utility, we interviewed 10 students asking them about it. The qualitative analysis is presented in Table 7 which shows that eight themes were identified, out of which six themes were positive and two were negative in reporting the utility of chatGPT as a tool to support the psychosocial well-being of undergraduate students.

The first theme thus formed was that of availability and accessibility; this theme highlights how AI chatbot provide accessible and anonymous support, reducing barriers to seeking help. The sub-themes further also indicated that undergraduate students could use the

chatbot at any time as per their need. This all-time availability, especially during off-hours, also helped students to overcome their loneliness issues. Chatbots provide instant responses. This feature is quite beneficial specially to address urgent needs or provide instant assistance in managing stress.

The second theme formed was Responsiveness which indicates the chat-based interface simulates a conversation, making it feel more approachable and engaging. It provides rapid responses to queries, and instant feedback enables students to quickly address concerns.

The third theme was confidentiality it relates to the AI chatbot offering a sense of anonymity, which can encourage students to ask questions they might hesitate to ask in person, promoting a safer and more comfortable learning environment. The students found that the chatbot provided them with a non-judgmental and confidential space to express their thoughts and feelings. They could now openly interact with the tool without any fear of judgment or stigma.

The fourth theme was emotional and social comfort, which emphasizes that chatGPT understands the students' emotions and offers understanding and support. It offers motivational messages and encouragement to help students stay positive. This indicates the relevance of chatGPT in providing mental health support, where emotional support plays an important role in the treatment (Asch. D.A (2023) [2].

The fifth theme was information and knowledge, which indicates that chatGPT serves as a valuable educational tool, supplementing students' learning and making them aware of issues. This helped the students to find valuable educational content immediately when required.

The sixth theme was coping strategy, this theme offered techniques related to stress management, various coping strategies like exercises, deep breathing, and other relaxation techniques, and finally, the resources for seeking professional help. The pandemic came with added stressors in many domains of university students' lives. It led to a lot of uncertainty for the future and the anxiety associated with it; it disrupted their daily routine and led individuals to isolate themselves, which decreased social interaction. Although the pandemic had a negative impact on the students, it also showed how technology can work together with students' lives to increase connections and open many new domains for them (Chin H. (2023)). It was programmed to check in with users regularly, asking about their well-being and offering additional support. With this regular interaction, students felt nostalgic about being cared for and got the encouragement to stand strong in the adversities they were facing [22].

The seventh theme was ethical consideration; this theme raises concern about the use of chatbots in counselling, such as ensuring informed consent and avoiding harm. Digital technology can be vulnerable to cyber-attacks and data breaches, compromising sensitive information.

The eighth theme was limited capability, which reflects Chatbots may not have the same level of expertise or knowledge as a human counsellor, which can limit their

ability to provide effective support. Over-reliance on digital technology can lead to decreased face-to-face communication skills and deepened feelings of isolation. Chatbots may struggle to understand the nuances of human communication, as they cannot pick up on nonverbal cues like body

language or tone of voice, which can lead to misperception. While chatbots can provide support and guidance, they lack the emotional depth and personal connection that comes with human interaction.

Table 5. Comparison of learning capabilities of students during pandemic and post-pandemic.

Question	During Pandemic	Post Pandemic
Has your learning capabilities been affected?	96.3% students accepted that their learning capabilities were affected during pandemic	45% students feel that their learning capabilities have improved post pandemic, 15% felt that their learning capabilities have deteriorated, and rest are not sure.
Are you comfortable with teaching-learning process?	Only 29.9% were comfortable	65% students are more comfortable with the current teaching leaning process than that practised during pandemic.
Did your learning capabilities improve with digital technology?	53.7% informed that their learning capabilities had improved with digital technology.	60% reported that their learning capabilities had improved with digital technology.
Why are your studies affected?	46.77% Lack of personal space 25.7% Power Cut 54.7% Noise from surroundings 62.14% Technical Issues 77.17% Disturbed routine	20.5% Lack of personal space 25% Power Cut 40% Noise from surroundings 60% Distraction because of gadgets
When was your level of motivation and attention higher?	7.5% students felt motivated to attend the class attentively.	65% students reported an increase in motivation level and attention. 25% said that their levels were always same, and rest were not sure.
Do you feel that your memorizing capabilities have been adversely affected due to COVID-19?	52.8% reported Yes	62% reported Yes
What factors affected your classes?	61.68% students said that recording of lecturers were not available 71% students said that sessions were not interactive 51.8% students could not attend due to poor net connection 42.98% students did not have enough devices to attend classes 35.98% students did not had access to the study material 80.8% students could not concentrate in online classes	40% students are not attending their classes regularly 20% students suffer due to lack of financial support 30% students have disturbed routine and unhealthy eating habits
Do you face Technological literacy and competency challenges?	27.10% Lack competence and proficiency in using various interfaces or systems 21.49% resist learning technology. 30.37% are distracted by an overly complex technology. 29.43% perceive technology as a barrier to getting help from others during online classes.	35% students feel that they are not very confident in using technology

Table 6. Shows percentages on various psychological, cognitive behavioural and social aspects after the introduction of chatbot.

Areas of Concern	%age
• 1 to 3 friends and they occasionally meet them.	74%
• Fear of being Judged, and want someone to listen to them without being biased.	40%
• Having Mood swings, not satisfied with life	32%
• Classes, assignments, and test are stressful and are overburdened	47%
• Learning capabilities got hampered due to stress and anxiety	48%
• Having issues in maintaining a relationship	60%
• Listened to Motivational Speaker	63%
• Poor time management skills	60.2%
• Unable to take decisions decisively need constant approval.	45%
• Lack of the ability to control their thoughts, emotions, and actions	43%
• They need some type of counselling to handle their stress	40%
• Wanted someone to talk to and express and burst their stress levels	35%

Table 7. Global, sub-themes and verbatims of 10 participants on the use of digital technology (chatbot) as an intervention to psychosocial issues.

Themes	Sub-themes	Verbatims
Availability and Accessibility	• Easily available • More readily accessible than "real life" therapy	"After the COVID when classes were shifted to digital mode. Mostly Wi-Fi is easily available, and it becomes easier to share your thoughts and feelings online with someone than face-to-face, and the meeting was restricted due to restriction imposed." (P4) "Whenever I am feeling low and isolated and want, I can connect. It is a click away" (P6)
Responsiveness	• Immediate • Convenient	"Whenever I wanted to I could talk to and instantly got response" (P5) "I know it is there whenever needed" (P9)
Confidentiality	• Anonymous Outlet • No one needs to know	"It seems many individuals—younger people are hesitant to seek professional help as stigma is attached with seeking guidance related mental health. This way digital technology works." (P2) "You can preserve your privacy while sharing your problems. There is no need to tell anyone. Therefore, there is no judgment involved while using the chatbot." (P8)
Emotional and Social Support	• Comfort through a virtual medium • Way to fill mental space • Support system • A mode of Self-Expression • Stress reliever • Self-reflection and Personal growth • Mood enhancement	"It felt more like you were speaking with a real person who is like you, like if I have some issues, can discuss it". (P3) "If have to seek professional help from a counselor a bit intimidated" talking to a counselor, whereas talking to Chatbot was easier because it was virtual". (P10) "If I am feeling lonely, stressed, and anxious I restore to technology either connect through a chatbot, watch random reels, and videos". (P7)
Information and Knowledge	• Source of awareness • Gained information • Information about Resource • New skills • Psychoeducation	"Was able to obtain a variety of information in one place was practical because "if you're like, 'what should I do?'" It's all consolidated." (P1) "I got to learn a lot of new things. Earlier, my thoughts knew no bounds, but now it has become easier for me to assimilate them.."(P5) "It has quite good resources. It also suggests which books and videos to refer to, which are very useful." (P8) "It is a huge resource bank of knowledge it goes beyond traditional skills and was able to gain information about various coping styles" (P6) "It provided a lot of information by simply highlighting what one is going through, which I was hesitant to share with this I learned a lot"(P7)
Ethical Consideration	• Data Protection • Validation • Security concerns • Accuracy	"I was worried if my personal details /health-related queries which I share can leak out" (P4) "The information we are getting—how authentic it is and where to validate it—is a challenge. The question is, whom should we approach?" (P5) "It is after AI how accurate the information is, still have reservation about it" (P9)
Limited Capability	• Repetitive • Lacks Empathy • Personal Touch • Face-to-Face communication	"When I typed something AI could not grasp it and then I felt as if conversing with a machine".(P7) "Felt as if information was repetitive and suggestions were general". (P3) "At some point, it felt like a personal touch was required to build a connection." (P6) "When you are conversing with a professional, they can know a lot when they see your face, your reaction that was lacking" (P5)
Coping Strategies	• Managing stress • Practical Solutions • Self-Control • Motivation and Goal Setting • Spirituality	"It gave practical solutions to alleviate stress like relaxation tips, journaling, cultivating hobbies, doing yoga"(P2) "It helped to stay focused when was overwhelmed" (P4) "When I got aware of using it to improve my mood taking online counseling has really helped me take good care of myself and also improve my relationships with my family" (P10) "Have started pursuing my interest it gives fulfillment" (P9)

A large number of participants said chatGPT offers useful information, but they still had doubts about the material's dependability and correctness. In a study by Yang K *et al.* it was reported that Generative AI Models like chatGPT might not be able to effectively diagnose patients' mental health issues. In addition, its capacity to comprehend intricate emotions, decipher nonverbal clues, and precisely gauge the intensity of mental health symptoms may be limited, thereby compromising the standard of care rendered [9].

Undergraduate students' proclivity to open while dealing with chatbots suggests that these systems might evolve into alternate methods for treating the pandemic's sadness and stress, particularly for replacing limited contacts due to lockdowns. Finally, our study demonstrates how digital technology may be utilized to investigate public opinions and feelings during a health crisis. People utilize the chatbot to

express good and negative feelings, as well as to search for information, just like they would on any other digital platform. Rather than tracking individuals' emotions, the general emotional state of users visible in chats might be used to gauge the psychological impact of social upheaval.

CONCLUSION

The results of this study show that AI Chatbots are a useful tool for promoting student well-being in educational settings and providing access to general health information. However, a few drawbacks need to be addressed, so more advancements to the application might be necessary. To fully comprehend the impact of using digital technology for mental health support, more research is also necessary. This study's results have theoretical and practical implications. Firstly, this study fills in a couple of the existing gaps regarding AI chatbot's potential applications in education

and how it can be used with students and enhance performance and well-being. Secondly, the findings of the present study can be used by policymakers, organizational heads, and research institutions can use the study's findings to create strategies for using AI chatbots to supplement psychological support. Moreover, the study has few limitations. Data for the study were only gathered from a specific region and a small sample. Individuals may vary in their awareness of and proficiency with AI applications. As a result, caution must be used when extrapolating the study's findings.

STUDY LIMITATIONS

Thus, it can be concluded that this study though has limitations in terms of the proportion of the sample; nevertheless, the findings of the present study have future implications for how students, in general, during the crisis, can use AI to express their negative emotions especially go out their fears and doubts and help them reduce stress and cope effectively.

The study's reliance on digital interventions may exclude participants with limited access to technology, potentially affecting generalizability. Moreover, we considered only students of Delhi University in the age bracket of 18 to 21 years. Future research can explore diverse populations, incorporate objective physiological measures, and assess the long-term impact of digital tools on mental health outcomes.

AUTHORS' CONTRIBUTION

It is hereby acknowledged that all authors have accepted responsibility for the manuscript's content and consented to its submission. They have meticulously reviewed all results and unanimously approved the final version of the manuscript.

LIST OF ABBREVIATIONS

NLP	=	Natural language processing
CBT	=	Cognitive Behavioral Therapy
AI	=	Artificial intelligence
CSSQ	=	COVID-19 Student Stress Questionnaire

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval for human experimentation was given by the ethical committee of SPM College (Number SPM/RC/2201), India.

HUMAN AND ANIMAL RIGHTS

All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

The students voluntarily participated in the study. They were informed about the purpose of the study. Data from them was collected only after taking their informed consent. The researcher informed the students that the

students were free to withdraw their consent at any point in the study if they felt uncomfortable in any way.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of the article is available at https://docs.google.com/spreadsheets/d/1cd_xUGe_maEXaS_EfCMDSPoXEjCqCeq/edit?usp=sharing&oid=102331762256157628937&rtopof=true&sd=true.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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