Effect of Virtual Lifestyle during COVID-19 Pandemic on Student Mental Health

Ishan Dey[1]

[1]*The International School Bangalore (TISB)*

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Abstract - The pandemic of CIVOD-19 has had a profound impact how humans go about their daily lives. With people being confined to homes, with less physical and outdoor activities, with increased communications and collaboration across digital platforms, human race has entered an unprecedented era of sedentary and physically secluded lifestyle. One community that is impacted in more ways than understood is the student community. Student health and development (physical and mental) depends on a lot of factors like sports, exposure to different environments, participation and collaboration in group activities, home environment, parents, siblings and teacher interactions, academics and many more. Students in the COVID-19 world are deprived of many of the developmental aspects mentioned above and are over exposed to home environments, possibly more parent/sibling interactions, digital interactions with teachers and getting drawn towards more social media and gaming platforms to stay connected with friends. The recency and relevance of this global phenomenon prompted this research to understand the impact of virtual lifestyle on student's mental health. Research is conducted through online survey, one-on-one interviews and applying an AI Model to analyze student's mood during online sessions within a controlled group of students from 9th to 11th standards across different schools in India.

This research shows that one third of the survey population shows ELEVATED levels of Anxiety or Depression amongst students during this COVID-19 pandemic. with the female population being more vulnerable than the male population. A third of the surveyed students have seen deterioration in their academic performance with over 40% gained body weight during these sedentary times where they are spending on an average 9 hours per day in front of computers. About a quarter of the survey population experienced ELEVATED levels for both Anxiety and Depression which signifies a systemic student mental health issue during this pandemic. Students with ELEVATED levels of anxiety and depression when compared to students with LOWER levels of anxiety and depression show significant differences in their academic performance, body weight, sedentary hours per day and time spent on social media/video games. One-on-one Interviews with the survey participants have revealed that Parents and Teachers play significant roles in contributing to Student Mental Health in either aggravating or remediating students' anxiety and depression levels. Self-confidence, time management and physical activities are identified as key tools that students can leverage to improve their mental health.

*Key Words***:** Student Mental Health, COVID-19, Virtual Classroom, Virtual Lifestyle, Anxiety, Depression

1.INTRODUCTION

Understanding student's mental health requires both Quantitative and Qualitative approaches. Quantitative approach is critical to understanding the overall impact on student mental health. The groups of relevant data that can be collected from the surveyed population is broadly classified into three buckets 1) Student Mental Health Data 2) Visual Clues Data and 3) Neural Activity Measurements Data. Manfred E Beutel et. al. published research in 2017 on the impact of Aircraft Noise on Depression and Anxiety in General Population [5]. This paper took the approach of recording Depression Score and Anxiety Score of the target population through standardized medical questionnaires and correlated those with exposure to high noise levels from various sources. This approach of systematically measuring depression and anxiety levels is applied to the current research to understand Student Mental Health. Visual Clues are an important aspect in understanding student mental health, focus and engagement. In the current setting of virtual classrooms, the main visual clues are facial expression, hand gestures and voice modulations. For the purpose of this research, only facial expressions are taken into consideration to understand students focus and engagement as they can serve as good proxies for mental health [6]. The third element of quantitative data are to capture Neural Activity measurements to assess the impact of mental health on human brain functioning. Ishan Dey et. al. while attending Summer Research Program (SRA) at University of California – Santa Barbara (UCSB), proposed a research approach of measuring Neural Activity as one interacts in a Virtual setting [7]. Classic sensory neuroscience approach of Hyperscanning [11] of students' brain responses can be measured during and post virtual classroom sessions. Hyperscanning has undergone a number of technical developments; it has been performed successfully with functional magnetic resonance imaging (fMRI), electroencephalography (EEG), functional near-infrared spectroscopy (fNIRS) and magnetoencephalography (MEG). Whole-brain functional magnetic resonance imaging (fMRI) can help focus on the network centered in the medial and ventrolateral prefrontal cortex that is exclusively engaged in social interaction analysis [12]. This technique of medical measurements is out of scope for the current research and can be adopted for further studies.

Qualitative research helps explore the hows and whys instead of simply focusing on how many or how much from the Quantitative research [2]. In this research, direct interaction through live interviews helps the researcher to immerse oneself with target population and deeply understand the actions, behaviors and catalog accounts of events from the participant's perspective. There are two main approaches to conducting Qualitative Analysis. *Phenomenology* and *Grounded Theory*. Phenomenology is defined as "study of the meaning of phenomena or the study of the particular" [3] whereas Grounded Theory is defined as "generation of a

theoretical model through the experience of observing a study population and developing a comparative analysis of their speech and behavior." [4]. Grounded Theory aims to develop a theory for social phenomena through an examination of various data sources whereas Phenomenology focuses on describing and explaining an event or phenomena from the perspective of those who have experienced it. Since the aim of this research is to develop a hypothesis of the general impact of virtual lifestyle on student mental health (and not necessarily focused on a specific event or phenomena), the theory and methodology of Grounded Theory is adopted for this research.

2. METHODOLOGY

In order to conduct both quantitative and qualitative research, a methodology was devised to first collect and analyze the quantitative data and then through immersive interview sessions with target population, seek to extract the themes and patterns that are expressed in the quantitative data analysis.

2.1. QUANTITATIVE ANALYSIS

Mental Health Measurement: A detailed online survey is prepared to capture the subjects (in this case students) demographics, environment, interaction patterns with various parties like fellow students, family and teachers, digital/social engagement patterns and mental health through a standardized medical health questionnaire. The survey seeks to collect the broad range of factors that can affect students due to virtual lifestyle (while in class as well as beyond virtual class hours). These broader set of data points will help in performing correlation analysis between potential factors that ultimately impact the student's mental health. Data are collected through a 15min online survey that captures the following elements. Participants who take the survey consent to providing this data voluntarily. Such Data can only be used for Academic Research purposes and any individualized data will not be shared with any third party.

Demographics & Environment: This part of the survey tries to capture information pertaining to the subjects demographics like age group, gender, social orientation (introvert/extrovert) and home environment like number of siblings and number of people residing in the same household. These data help establish the home context of the student.

Physical Interaction Patterns: Understanding the participants physical interaction patterns with siblings, parents and select friends, while broadly maintaining social isolation during COVID-19, provided insights into the limited physical interactions for the subjects

Digital Interaction Patterns: Under the context of current physical isolation, it is critical to understand the patterns and times and nature of digital social interactions the students are having and also seek to capture the digital avenues students are taking to keep themselves occupied and engaged during school and off-school hours.

Virtual School Setting: This section of the surveys seeks to capture data that pertain to school hours, break times, teachers' adeptness of conducting virtual classes and progression of academic results during the year 2020. These could provide vital insights into the students' ability to cope with the virtual school setting.

Health Questionnaire: This is the most sensitive and critical section of online survey that captures the students' mental health condition. More specifically, the survey tries to quantitatively capture the Depression Score and Anxiety Score through structured and standardized Medical Health Questionnaire. Manfred E Beutel et. al [5] took the approach of leveraging well established testing framework of GAD (Generalized Anxiety Disorder) and PHQ (Patient Health Questionnaire) to capture Mental Health of target population. In this research, GAD-7 [8] and PHQ-9 [8] Standardized Questionnaires are used to capture Anxiety and Depression scores respectively. GAD-7 Anxiety Scores scale from 0-21 whereas PHQ-9 Depression Score scale from 0-27

AI Model for Visual Clues (Facial Expressions) Measurement: Availability of visual clue is limited to facial expressions, hand gestures and voice modulations in virtual classroom settings. Research performed by Gabrielle Simcock et al. [6] suggests a high degree of correlation between facial expressions and mental health in early adolescent subjects. In this research, the primary focus is to extract mood of the subjects based on facial expressions during virtual classroom sessions. Student pictures are captured during virtual classes, which provides a rich library of visual clues to extract student moods. Mood Extraction from pictures require visual image processing, facial feature identification and mood extraction algorithms. Google Vision AI is a deep learning model that provides out-of-the-box pre-trained AI Models to detect emotions like joy, sorrow, anger and surprised [10]. This technology delivered in the Cloud is leveraged to extract student mood from pictures and live video feeds.

2.2. QUALITATIVE ANALYSIS

The theory and methodology of Grounded Theory [4] is adopted to conduct Qualitative Analysis. After analyzing the quantitative data (from the Quantitative Analysis), two groups are identified for further studies. Group 1 consisting of students with LOWER levels of Anxiety and Depression and Group 2 consisting of student with ELEVATED levels of Anxiety and Depression. With the willing survey participants from each group, online interviews are conducted to capture their perspectives on their mental health and the contributing factors and possible remediations. The feedback is captured, analyzed and summarized in the Qualitative Analysis Findings section.

3. PROCEDURE

The research is conducted in two different stages.
Stage 1: Conduct an online survey to assess Student Mental Health through Quantitative Analysis
Stage 2: Conduct in-depth interview with a subset of the Stage 1 participants who fall in the interest groups of LOWER and ELEVATED levels of anxiety and depression to describe and explain the observations of this social phenomena
For each of the stages, different techniques are used to capture and analyze the observations. The following section details the experimental setup for each Stage.

Stage 1: For this stage, on online questionnaire is constructed after extensive research of various research papers on similar topics. The survey tries to capture feedback on a broader set of potential variables that may impact student mental health through standardized medical questionnaires [8][9]. Students from various age groups, various school and various cities in India are offered to participate in this survey. Since the survey contains personal data, care is taken to provide transparency on the intended use of this data and the confidentiality of such. Fig 1 & 2 below show the demographics of the 97 survey participants.

The goal of this stage is to identify relevant variables that impact student mental health in virtual classroom sessions and help identify the Stage 2 focus group for further analysis.
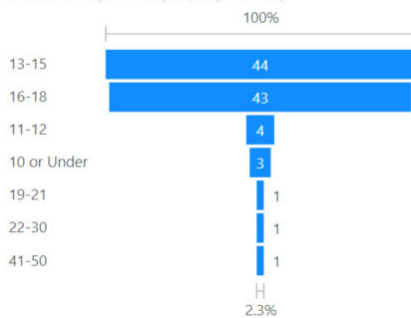
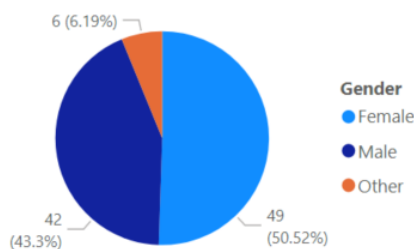Fig 1. Survey Participants Age Group

Fig 2: Survey Participants Gender Diversity

Stage 2: Based on the survey results, focus group is created to dive deeper on the cohort of students that showed LOWER & ELEVATED levels of Anxiety and Depression. The key objective of this stage is to conduct in-depth interview with the focus group and unearth the potential causes and remedies for anxiety and depression. During the in-depth session, overall findings of the Stage 1 are presented, and open-ended discussions are conducted to confirm the findings and explore other potential causes that may have been left out in the Stage 1 Survey questionnaire. These discussions also covered collecting input from participants on potential remediations to anxiety and depression. Following section illustrates the methodology used to create the focus group.

Of the total 97 survey participants in Stage 1, 33 participants showed Severe and Moderate Anxiety levels as illustrated in Fig 3.

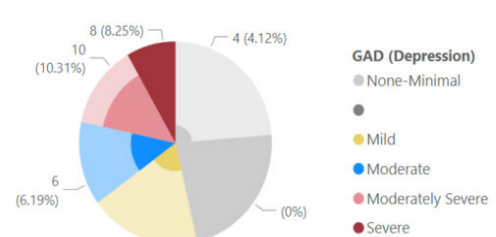Fig 3: Distribution of Anxiety Levels

Fig 4: Distribution who show both Anxiety & Depression

Of the 33 participants who showed Severe and Moderate levels of Anxiety, 24 participants also showed elevated levels of Depression (Severe, Moderately Severe and Moderate). Fig 4 shows the distribution of 24 participants who show ELEVATED levels for both Anxiety and Depression. This cohort of 24 candidates, there is only 1 participant in the 11-12 years age groups and the rest 23 belonged to the age groups 13-15 years and 16-18 years as shown in Fig 5. Since the number of participants in the 11-12 years age group is too low and, hence they are eliminated for further studies.
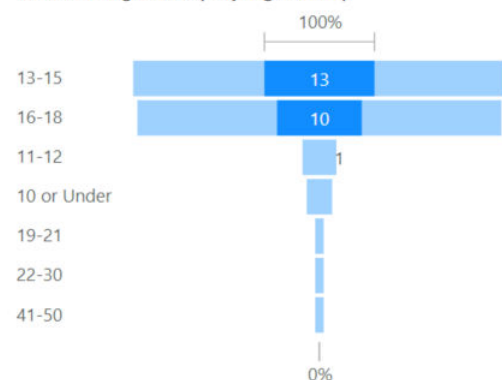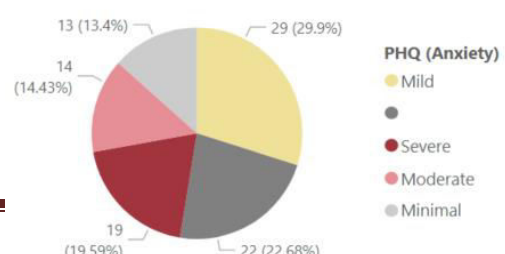

Fig 5: Age Groups who show ELEVATED levels for both Depression and Anxiety

GROUP 1 Cohort consists of 23 participants who meet the following criteria: Anxiety Levels of Severe and Moderate, and

Depression Levels of Severe Moderately Severe and Moderate, and Age groups 13-15 years and 16-18 years

In order to compare and contrast the findings and using similar approach of defining Group 1 Cohort, another cohort is formed (GROUP 2 Cohort) consisting of 31 participants who meet the following criteria: Anxiety Levels of Mild and Minimal
Depression Levels of Mild and None-Minimal and Age groups 13-15 years and 16-18 years

In-depth one-on-one interviews are conducted with willing participants from both the Cohorts to understand and explain and augment the findings from Stage 1.

4. FINDINGS

This section details the Qualitative and Quantitative Analysis findings.

4.1. QUANTITATIVE ANALYSIS FINDINGS

Captured survey data are uploaded into Power BI Dashboard to perform Analysis. Fig 6,7,8 shows screenshots of the analysis dashboard that shows the survey population and demographics.

First, analysis is done based on Gender and observations are noted.
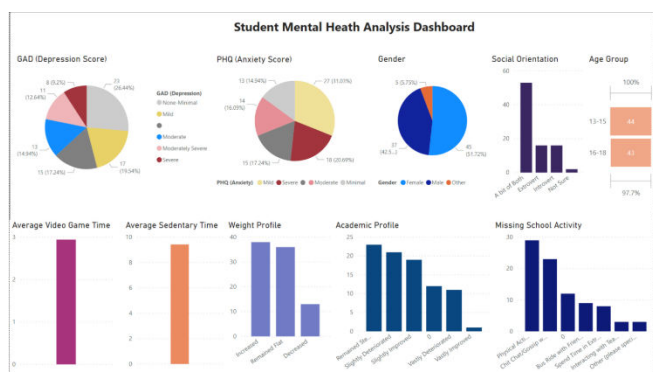

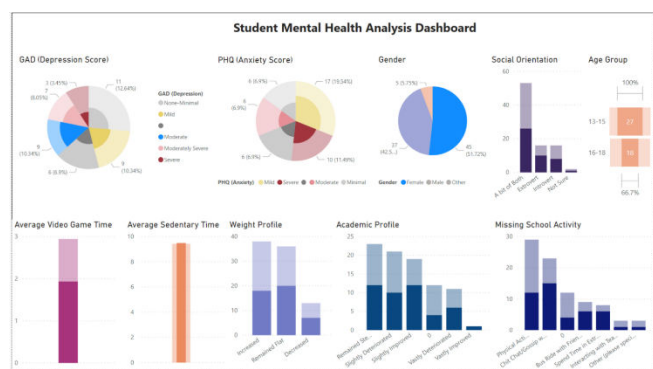Fig 6: Survey Results of 87 Participants
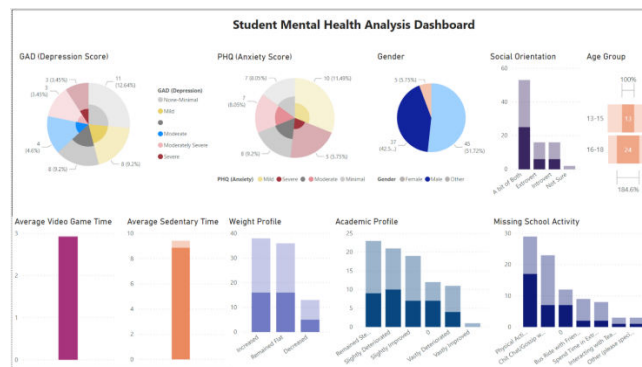

Fig 7: Survey Results of Female Population

Fig 8: Survey Results of Male Population

Observations from Fig 6, 7 & 8 are in Table 1

Table 1: Survey Results by Gender

Observation	Universe	Male	Female
A. Survey Population	87	43%	52%
B. Exhibiting Depression (Moderate, Moderately Severe & Severe)	33%	11%	22%
C. Exhibiting Heightened levels of Anxiety (Moderate & Severe)	32%	14%	18%
D. Exhibiting both Depression & Anxiety (B & C together)	23%	8%	15%
Average Sedentary Time per Day (hours)	9	9	9
Weight Profile in the past 12 months (Increased body weight)	43%	43%	40%
Academic Profile in the past 12 months (Deterioration)	37%	38%	36%
Average Game Time per Day (hours)	3	3	2
Most Missed School Activity	Physical Activity	Physical Activity	Chitchat Gossip
Adeptness of Teacher in handling Virtual Classroom sessions	86%	84%	91%

Second, analysis and observations are made based on the two identified cohorts Group 1 and Group 2 based on their levels of Anxiety and Depression respectively.

Group 1: Consists of survey participants who show "ELEVATED" levels of Anxiety & Depression. Conditions that meet this Group criteria are
Anxiety Levels of Moderate and Severe
Depression Levels of Moderate, Moderately Severe and Severe

Group 2: Consists of survey participants who show "LOWER" levels of Anxiety & Depression. Conditions that meet this Group criteria are
Anxiety Levels of Mild and Minimal
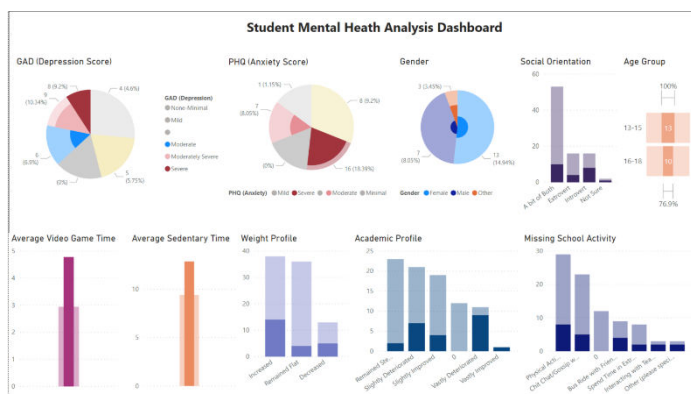Depression Levels of Mild and None-Minimal

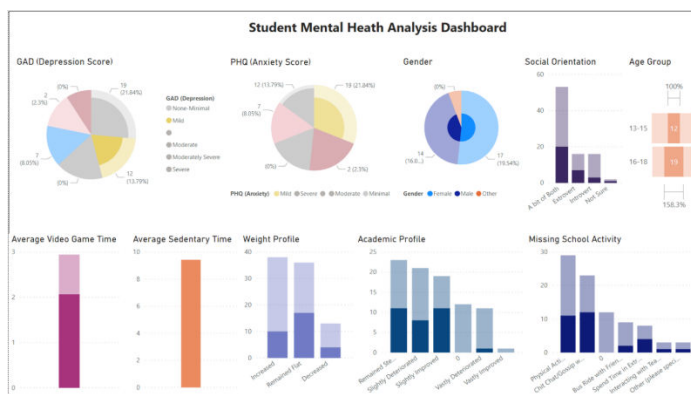Fig 9: Group 1 Cohort -Survey Results of 23 Participants showing ELEVATED levels of Anxiety & Depression

Fig 10: Group 2 Cohort - Survey Results of Participants showing LOWER levels of Anxiety & Depression

The following observations are made from Fig 9 & 10.

Table 2: Survey Results by Cohorts (Group 1 & 2)

Observation	Universe	Group 1	Group2
Survey Population	87	23	31
Average Sedentary Time per Day (hours)	9	13	9
Weight Profile in the past 12 months (Increased body weight)	44%	61%	32%
Academic Profile in the past 12 months (Deterioration)	37%	70%	29%
Average Game Time per Day (hours)	3	5	2
Most Missed School Activity	Physical Activity	Physical Activity	Chitchat Gossip
Adeptness of Teacher in handling Virtual Classroom sessions	86%	70%	97%

Finally, observations of the Quantitative analysis are summarized as follows.

Summary Observations from Tables 1 & 2:

TOTAL SURVEY POPULATION (Universe):
- A significant percentage of Students surveyed show elevated levels of Anxiety & Depression (23%)
- 43% of the surveyed Students show increase in Body Weight

- More than 1/3 of the Student Survey (37%) experienced decline in Academic Performance
- Most important activities Students missed in Virtual settings is Physical Activity followed by Chitchat/Gossip with friends

GROUP 1:
- 61% of the population gained weight
- Significant deterioration of Academic profile (70%)
- Roughly 50% more sedentary time as compared to the Total Population
- Roughly 67% more time spent on Video Games
- Most important activity Students missed in Virtual settings is Physical Activity
- Does not feel that Teachers are well equipped to handle Virtual Classroom sessions

GROUP 2:
- Sedentary time is in-line with that of the Total Population
- Weight Gain and Academic Profile shows better results that the Total Population
- 33% less time spent on Video Games that the Total Population
- 97% feel that Teachers are well equipped to handle Virtual Classroom sessions
- Most important activity Students missed in Virtual settings is Chitchat/Gossip with friends

4.2. QUALITATIVE ANALYSIS FINDINGS

Online one-on-one interviews are conducted with willing survey participants from Group 1 and Group 2. Below are the observations made from the interviews.

Group 1: ELEVATED Levels of Anxiety and Depression
Adapting to the virtual lifestyle has been the most challenging for this group. The long tiring hours in front of computers, less physical interactions with friends coupled with high expectations from parents about academics and achievement are the main sources of anxiety and depression in students. On top of that, teachers need to pay special attention and care to individual students who are struggling to cope with this new reality rather than applying a common approach for the entire class. Also, the relentless academic pressure from school and the overemphasis on academic results rather than the complete mental and physical development of the students has added to the anxiety and stress levels of the students.

Group 2: LOWER levels of Anxiety and Depression
This group has adjusted well to the virtual lifestyle during the pandemic. One of the main reasons is Parents support and confidence. Providing students with the space to be on their own, keeping the tone of communication to be more encouraging, helping build confidence in spite of failures, not overstressing on academic performance and worrying more about the present than the future are identified as key factors that helped this group manage their mental health. Students who are able to engage themselves with hobbies or home chores and are able to do better time management are less likely to feel anxiety and stress.

5.CONCLUSION

Research has shown that one third of the survey population shows ELEVATED levels of Anxiety or Depression amongst students during this COVID-19 pandemic. with the female population being more vulnerable than the male population (from Table 1). A third of the surveyed students have seen deterioration in their academic performance with over 40% gained body weight during these sedentary times where they are spending on an average 9 hours per day in front of computers. About a quarter of the survey population experienced ELEVATED levels for both Anxiety and Depression which signifies a systemic student mental health issue during this pandemic. Students with ELEVATED levels of anxiety and depression when compared to students with LOWER levels of anxiety and depression show significant differences in their academic performance, body weight, sedentary hours per day and time spent on social media/video games (from Table 2). Observations from the Qualitative analysis reveal that Parents and Teachers have significant roles in contributing to Student Mental Health in either aggravating or remediating students' anxiety and depression levels. Self-confidence, time management and physical activities are identified as key tools that students can leverage to improve their mental health.

6.APPLICATIONS OF THE STUDY

One of the applications of this study is to establish an early warning system such that Students can self-diagnose their mental health and take preventing actions from further deterioration of their condition. A mobile application is developed to continuously measure student mental health by extracting their moods from video feeds and conducting mental health surveys. The mood extraction feature can be turned on during the classroom sessions and the Android App will automatically capture, extract and catalog student mental health over time. The confidential mental health surveys can be taken by students at any time to understand their condition and take remedial actions as outlined in this research. The developed Android application is called "Moodify" and can be downloaded from Google Play Store [14].

7.LIMITATIONS AND FURTHER SCOPE

Quantitative Analysis is performed based on 97 survey respondents from various schools in India between ages 11 through 15 years. The analysis could be further enriched with a large number of respondents. Such broad data sets can lead to a more detailed analysis of student mental health across different age groups.

Qualitative Analysis is based on few survey respondents who were willing to participate in the online one-on-one interview sessions. If counselors can be solicited to conduct these interviews, then students will be more open to answering personal questions rather than to the researcher alone.

Biological measurement of brain activity using techniques like magnetic resonance imaging (fMRI), electroencephalography (EEG), functional near-infrared spectroscopy (fNIRS) and magnetoencephalography (MEG) while student are in virtual classroom sessions or engaged in other online activities can augment the current research findings and improve our overall understanding of Student Mental Health during this pandemic.

A future study of Student Mental Health post the pandemic can reveal valuable insights into the lasting impact of this pandemic on the student population.

ACKNOWLEDGEMENT

REFERENCES

1. "Boundless Sociology." *Lumen*, courses.lumenlearning.com/boundless-sociology/chapter/understanding-social-interaction.
2. Tenny S; Brannan GD; Brannan JM;Sharts-Hopko. "Qualitative Study." *National Center for Biotechnology Information*, U.S. National Library of Medicine, pubmed.ncbi.nlm.nih.gov/29262162/.
3. "Phenomenology." *Phenomenology - an Overview | ScienceDirect Topics*, www.sciencedirect.com/topics/social-sciences/phenomenology.
4. "Grounded Theory Online." *Grounded Theory Online*, www.groundedtheoryonline.com/what-is-grounded-theory/.
5. Beutel, Manfred E, et al. "Noise Annoyance Is Associated with Depression and Anxiety in the General Population-the Contribution of Aircraft Noise." *PloS One*, Public Library of Science, 19 May 2016, www.ncbi.nlm.nih.gov/pmc/articles/PMC4873188/.
6. Gabrielle Simcock et al. "Associations between Facial Emotion Recognition and Mental Health in Early Adolescence." Published Jan 2020, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6981578/
7. Anaaya Dalal, Ishan Dey, Mariah Mathias "INTERACT INTELLIGENTLY: How Neural Activity Differs As One Interacts In a Virtual Setting As Opposed To a Physical Setting", Dated July 2020 https://www.ishandey.org/research . Summer Research Program (SRA) at University of California-Santa Barbara
8. "Generalized Anxiety Disorder 7-Item (Gad-7)." *National HIV Curriculum*, www.hiv.uw.edu/page/mental-health-screening/gad-7.
9. "Patient Health Questionnaire-9 (Phq-9)." *National HIV Curriculum*, www.hiv.uw.edu/page/mental-health-screening/phq-9.
10. "Vision AI | Derive Image Insights via Ml | Cloud Vision API." *Google*, Google, cloud.google.com/vision.
11. Czeszumski, Artur, et al. "Hyperscanning: A Valid Method to Study Neural Inter-Brain Underpinnings of Social Interaction." *Frontiers in Human Neuroscience*, Frontiers Media S.A., 28 Feb. 2020, www.ncbi.nlm.nih.gov/pmc/articles/PMC7059252/.
12. Marsh, Rachel, et al. "Neuroimaging Studies of Normal Brain Development and Their Relevance for Understanding Childhood Neuropsychiatric Disorders."

Journal of the American Academy of Child and Adolescent Psychiatry, U.S. National Library of Medicine, Nov. 2008, www.ncbi.nlm.nih.gov/pmc/articles/PMC2759682/.

13. Dey, Ishan P. "Studying the Effects of Virtual Classrooms on Students." *Survey*, www.surveymonkey.com/r/K8Y2T7L.

14. Dey, Ishan P. "Moodify... - Apps on Google Play." *Google*, Google, play.google.com/store/apps/details?id=io.ionic.moodify

BIOGRAPHIES

Author is a 12th standard STEM student at The International School Bangalore (TISB), India, with a deep interest in Computational Neurobiology. Ishan conducts independent research work to pursue his quest for knowledge outside of his school curriculum