Physiology

EVALUATION OF COVID 19 IMPACT ON THE LEARNING STRATEGIES OF HEALTH SCIENCE STUDENTS: A SURVEY

Padmanabhan Rajesh	II year MBBS Student, Amrita School of Medicine, Amrita Institute of Medical Sciences, Kochi, Kerala, India.
Amalendu Vijay	II year MBBS Student, Amrita School of Medicine, Amrita Institute of Medical Sciences, Kochi, Kerala, India.
Shankar Sethuraman	II year MBBS Student, Amrita School of Medicine, Amrita Institute of Medical Sciences, Kochi, Kerala, India.
PV Sai Karthik	II year MBBS Student, Amrita School of Medicine, Amrita Institute of Medical Sciences, Kochi, Kerala, India.
Prakhar Rustagi	II year MBBS Student, Amrita School of Medicine, Amrita Institute of Medical Sciences, Kochi, Kerala, India.
Dr. Girish BN*	PhD, Associate Professor, Department of Physiology, Amrita School of Medicine, Amrita Institute of Medical Sciences, Kochi, Kerala, India. *Corresponding Author
Dr. (Col) Vishal Marwaha	MD, DNB, MNAMS, Principal, Amrita School of Medicine, Amrita Institute of Medical Sciences, Kochi, Kerala, India.
Dr. Saraswathy L	MD, Professor & Head, Department of Physiology, Amrita School of Medicine, Amrita Institute of Medical Sciences, Kochi, Kerala, India.
Dr. Saritha Sekhar S	MD, DNB, Associate Professor, Department of Cardiology, Amrita School of Medicine, Amrita Institute of Medical Sciences, Kochi, Kerala, India.
Dr. O.S.Deepa	Associate Professor, Department of Mathematics, School of Engineering, Coimbatore, Tamil Nadu, India.

ABSTRACT **Background:** The lockdown period following the COVID 19 pandemic has affected students in many ways. The present study aims to investigate any changes in learning practice during this pandemic. We conducted this study to investigate any variations in the learning approach by health science students during the Covid 19 pandemic and also to assess possible confounding factors on learning.
Methods: A survey was conducted on 630 health science students from South Indian states through 2 pre-validated questionnaires - Approaches and Study Skills Inventory for Students (ASSIST) and Generalised Anxiety Disorder Assessment (GAD 7), to assess learning approach and anxiety levels respectively. Another set of questionnaire consisting 10 questions were prepared that may affect learning approach. These questionnaires were shared via Google forms across various health science institutions of South India.
Results: A significant decrease in strategic and deep learning scores and increase in surface learning scores were observed after Covid 19 pandemic. Anxiety scores were increased after pandemic. A significant negative correlation was observed between change in deep learning scores vs change in anxiety scores and change in strategic scores vs change anxiety scores. A positive correlation was observed between change in surface learning scores vs anxiety scores. Decrease in strategic and deep learning scores were significantly correlated with students perceptions on worsening study environment, decreased effectiveness of academic assessments, decreased time devoted for studies, decreased ability to figure out high yielding questions and a decreased ability to frame quality answers. Increase in surface learning negatively correlated with worsening study environment and decreased study time. A negative correlation was observed between suitable study environment and change in anxiety scores.
Conclusion: Increased anxiety level was associated with decrease in deep and strategic learning and increase in surface learning approach after Covid 19 pandemic. Appropriate measures are essential to improve students' academic performance

BACKGROUND
The novel coronavirus which triggered the COVID 19 pandemic originated in Wuhan, China and was reported to the WHO on 31st December 2019.[1] Since then it has spread across the globe, fashioning an aftermath which has brought the world into a standstill. The rising numbers of cases and deaths, and highly contagious nature of the virus, lead to indefinite periods of lockdown and quarantine across various nations worldwide to contain the spread of the disease.[2] This led to various levels of stress over healthcare community both physically and mentally.

Consequently, the grounds for distress among health science students have further increased manifold. Augmentation of the interpersonal communication gap along with negative emotion and hostility due to fear amid COVID 19 has affected the psychological state of students and has built up a sense of anxiety amongst them.

In some, the anxiety may be a force, driving them for scholastic excellence, while in others it might stir thoughts of fear, uselessness or even rage.[3] For success, even in these times of distress necessitates excellence in academics for which learning styles and approach have to be the key. This has got us engrossed about knowing the correlation of one's learning techniques to earn high degree of perfectionism [4] with psychological parameters like stress and anxiety during this pandemic. Nevertheless, this crisis has altered the source of learning from classroom to the online mode which itself impacted the approach towards learning.

Methodology adopted by students for learning can be classified largely into 3 categories: Deep, surface and strategic learning.[5] Deep learning is based upon the interest in the concepts and monitoring understanding to seek meaning. Surface learning is regarding the rote memorising in order to cope nominally to qualify an exam. While

strategic learning is a balance between the two mentioned above and is based on time management and organized study to yield maximum scores.

Deep learning would facilitate the holistic way of learning by own interpretation and integrating existing knowledge. Strategic learning would facilitate the organized way of learning in meeting required objectives. On the other hand, surface learning takes a narrow approach to the course requirement by focusing on unconnected facts that do not help in understanding the concept as a whole.

Designing teaching and assessment methods and students involvement both plays an important role in the development of deep and strategic learning. Implementation of online teaching and learning at the earliest became a challenging task for teachers and students during the Covid 19 pandemic. This study aims to investigate the factors affecting learning strategies by health science students on their learning conduct alongside anxiety during the COVID 19 pandemic.

This study aims to investigate the challenges faced by health science students on their learning conduct alongside anxiety during the COVID 19 pandemic.

METHODOLOGY
This study was conducted among health science students of South India. Participation was voluntary and informed consent was obtained through Google form which was followed by the questionnaires for the study. The study was approved by the ethical committee of our institution (IEC No: IRB-AIMS-2020-354).

This survey was conducted from the month of October to December 2020 during the Covid 19 virus outbreak. We created a link to our questionnaire through Google forms and circulated it among health science students of various institutions of South India. Google form attached at Annexure 1.

Annexure 1. Questionnaire to evaluate possible confounding factors that may affect learning approach by students.

Please grade following factors:
1. Your socioeconomic status

Significantly worsened	Worsened	No change	Improved	Significantly improved

2. Personal attention by teachers:

Significantly worsened	Worsened	No change	Improved	Significantly improved

3. Time for relaxation:

Significantly decreased	Decreased	No change	Increased	Significantly increased

4. Discussion with friends:

Significantly worsened	Worsened	No change	Improved	Significantly improved

5. Suitable study environment

Significantly worsened	Worsened	No change	Improved	Significantly improved

6. Effectiveness of academic assessment:

Significantly worsened	Worsened	No change	Improved	Significantly improved

7. Time devoted for studies:

Significantly decreased	decreased	No change	Improved	Significantly increased

8. Learning from online resources(soft copies of textbooks, presentations etc)

Significantly worsened	Worsened	No change	Improved	Significantly improved

9. Your ability to figure out high yielding questions from an exam point of view

Significantly worsened	Worsened	No change	Improved	Significantly improved

10. Your ability to frame quality answers

Significantly worsened	Worsened	No change	Improved	Significantly improved

Return item questionnaire was prepared to assess the demographic details of the participants. A first set of questionnaire consisting of 10 questions was prepared after face and content validated by experienced teaching faculty members that may possibly affects students learning approach [Annexure 1]. This was followed by pre-validated short version of the Approaches and Study Skills Inventory for Students (ASSIST) questionnaire [6] which identifies the participant's learning approach as deep, strategic or surface. Students respond to items on a 1-5 scale (5 being high). Students were instructed to answer these questions in two separate sections – before and after Covid 19 pandemic. Subscale scores are formed by adding together the responses of each of the items in that subscale. The next questionnaire that followed was pre-validated seven items GAD 7 which was used to assess the anxiety levels in the participants.[7] Each of the seven items scored from 0 to 3 (hence the score range 0-21). Cut points of 5, 10, 15 (GAD scores) represented the mild moderate and severe anxiety levels respectively. Students were instructed to answer these questions in two separate sections – before and after Covid 19 pandemic. The change in deep, strategic and surface learning scores was calculated by subtracting the learning scores before Covid 19 pandemic from learning scores after Covid 19 pandemic. Likewise change in anxiety scores was calculated by subtracting anxiety scores before Covid 19 pandemic from anxiety scores after Covid 19 pandemic.

Statistical Analysis
Statistical analysis was conducted by using SPSS (version 17). Data was reported as mean ± SE and frequencies. Internal consistency of the questionnaire was assessed using Cronbach's alpha. Paired student t test was used to compare mean scores of deep, strategic and surface learning before and after Covid 19 pandemic. Student t test and ANOVA were used to compare the change in mean values of deep, strategic and surface learning scores. Chi-square test was used to compare categorical variables such as the mild, moderate and severe anxiety levels before and after Covid 19 pandemic. Comparison of anxiety scores between males and females was carried out by student t test. Pearson correlation was used to correlate normally distributed variables and correlation coefficient was computed. P value less than 0.05 considered to be statistically significant.

RESULTS:
A great majority of students were from health sciences students studying in various courses such as MBBS, BSc, BDS and Pharmacy from South Indian states [Table 1]. Eighty-seven percent of students (630/725, 87%) agreed to participate in our study.

Table 1. Demographics Of Study Population

Age	20.18 ± 0.057
Male: Female	171 (27.14%):459(72.85%)
States	
Kerala	360 (57.14%)
Tamil Nadu	98 (15.55%)
Karnataka	69 (10.95%)
Andhra Pradesh	43 (0.07%)
Telangana	43 (0.07%)
Maharashtra	17 (0.026%)
Course	
Bachelor of Medicine and Bachelor of Surgery (MBBS)	311 (49.36%)
Bachelor of Science (Health science)	143 (22.69%)
Bachelor of Dental Surgery (BDS)	5 (0.008%)
Bachelor of Pharmacy (B.Pharm)	79 (12.54%)
Doctor of Pharmacy (Pharm D)	74 (11.74%)
Master of Pharmacy (M.Pharm)	13 (0.02%)
Bachelor of Veternary Science (BVSc)	5 (0.008%)

The Cronbach's alpha coefficient was 0.867, 0.866, and 0.909 for the initial questionnaire prepared by us, ASSIST and GAD7

questionnaires respectively, suggesting that the items have relatively high internal consistency.

As per the instructions of the ASSIST questionnaire, 18 questions were subdivided into 3 categories, and scores of these questions were added that represent deep, strategic, and surface learning. After the Covid 19 pandemic, there was a significant increase in deep learning and strategic learning scores whereas surface learning scores were significantly decreased when compared to deep, strategic, and surface learning scores during pre-Covid 19 pandemic [Figure 1].
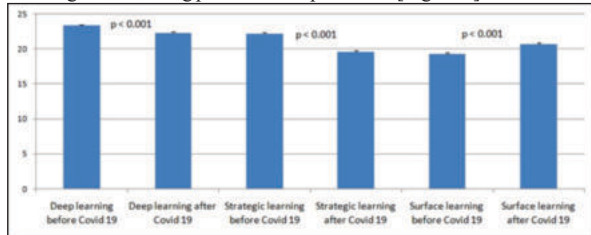
Figure 1. Comparison Of Mean Deep, Strategic And Surface Learning Scores Before And After Covid 19 Pandemic

There was significant increase in anxiety scores after Covid 19 pandemic as compared to pre-Covid 19 (1.88 ± 0.03 vs 1.54 ± 0.03, $p < 0.001$). When actual values of anxiety scores were considered, there was significant increase in severe anxiety scores and decrease in mild anxiety scores after Covid 19 pandemic as compare to pre-Covid 19 pandemic [Fig 2].
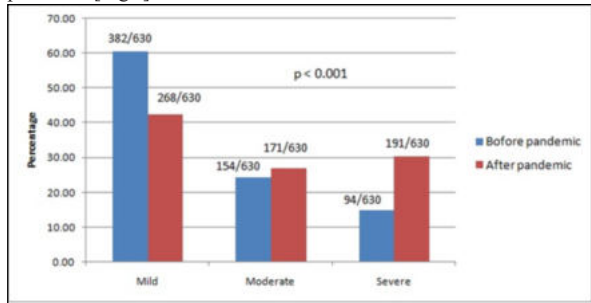

Figure 2. Anxiety Scores Before And After Covid 19 Pandemic

Significant negative correlation was obtained between change in deep learning scores vs change in anxiety scores [Fig 3] and change in strategic learning scores vs change in anxiety scores [Fig 4]. There was significant positive correlation between change in surface learning scores vs change in anxiety scores [Fig 5].
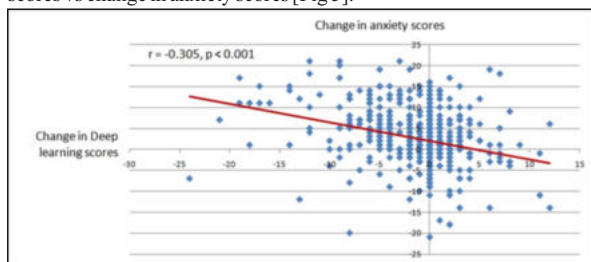

Figure 3. Correlation Between Change In Deep Learning Scores Vs Change In Anxiety Scores
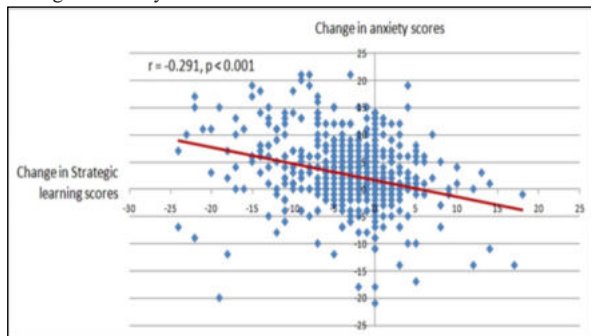

Figure 4. Correlation between change in strategic learning scores vs change in anxiety scores
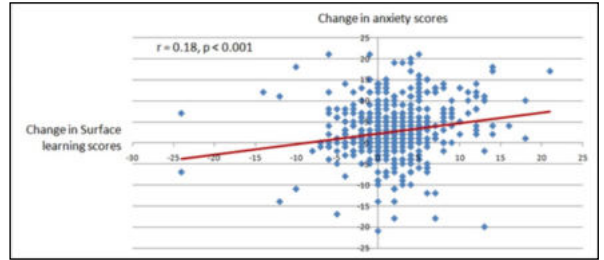

Figure 5. Correlation Between Change In Surface Learning Scores Vs Change In Anxiety Scores

There was no significant difference in change of anxiety scores between boys and girls (2.47 ± 0.43 vs 2.6 ± 0.27, $p = 0.61$). Sixty students reported to have Covid 19 patients in their family. There was no significant increase in anxiety scores due to the presence of Covid 19 patients in the family of our study subjects (3.33 ± 0.63 vs 2.41 ± 0.25, $p = 0.25$). No significant correlation was reported between age and change in anxiety scores ($r = 0.008$, $p = 0.835$).

Significant positive correlation was observed between change in deep learning scores and questions like suitable study environment, effectiveness of academic assessment, time devoted for studies, learning from online resources, ability to figure out high yielding questions from an exam point of view and ability to frame quality answers (Table 2) indicating that worsening of these items decrease deep learning scores. Rest of the questions showed very weak significance [Table 2].

Table 2 Correlations Between First 10 Questions Of Questionnaire And Change In Deep, Strategic And Surface Learning Scores

		Change in deep learning scores	P value	Change in strategic learning scores	P value	Change in surface learning scores	P value	Change anxiety scores	P value
1	Change in socioeconomic status	r = 0.147	p < 0.001	r = 0.099	P = 0.013	r = -0.047	p = 0.237	r= -0.147	p < 0.001
2	Personal attention by teachers	r = 0.18	p < 0.001	r = 0.128	p = 0.001	r = -0.061	p = 0.128	r = -0.128	p = 0.001
3	Time for relaxation	r = 0.076	p = 0.058	r = 0.001	p = 0.98	r = -0.052	p = 0.195	r = -0.132	p = 0.001
4	Discussion with friends	r = 0.157	p < 0.001	r = 0.154	p < 0.001	r = -0.167	p < 0.001	r = -0.141	p < 0.001
5	Suitable study environment	r = 0.293	p < 0.001	r = 0.349	p < 0.001	r = -0.249	p < 0.001	r = -0.225	p < 0.001
6	Effectiveness of academic assessment	r = 0.268	p < 0.001	r = 0.313	p < 0.001	r = -0.182	p < 0.001	r = -0.189	p < 0.001
7	Time devoted for studies	r = 0.337	p < 0.001	r = 0.448	p < 0.001	r = -0.212	p < 0.001	r = -0.14	p < 0.001
8	Learning from online resources	r = 0.23	p < 0.001	r = 0.189	p < 0.001	r = -0.016	p = 0.691	r = -0.072	p = 0.071
9	Ability to figure out high yielding questions from an exam point of view	r = 0.306	p < 0.001	r = 0.361	p < 0.001	r = -0.161	p < 0.001	r = -0.131	p = 0.002
10	Ability to frame quality answers	r = 0.326	p < 0.001	r = 0.366	p < 0.001	r = -0.154	p < 0.001	r = -0.15	p < 0.001

There was significant positive correlation between change in strategic learning scores and questions like suitable study environment,

effectiveness of academic assessment, time devoted for studies, ability to figure out high yielding questions from an exam point of view and ability to frame quality answers [Table 2] indicating that worsening of these items decrease strategic learning scores. Rest of the questions showed very weak significance.

There was significant negative correlation was observed between change in surface learning scores and questions like suitable study environment and time devoted for studies [Table 2] indicating that worsening of these items increase surface learning scores. Rest of the questions showed very weak significance [Table 2].

Change in anxiety score negatively correlated with suitable study environment [Table 2]. Rest of the questions showed very weak significance.

DISCUSSION

Our study showed a significant decrease in deep and strategic learning and an increase in surface learning as compared to the pre-Covid 19 pandemic. We observed a significant increase in anxiety scores of the population surveyed. When actual scores were considered, there was a significant increase in severe anxiety scores and a decrease in mild anxiety scores during the Covid 19 pandemic as compared to the pre-Covid 19 pandemic. Nationwide lockdown, isolation, and quarantine rules might have affected the mental and emotional well-being of students. Report from Sultan AyoubMeo et al [8] identified that quarantine caused psychological stress among medical students. Interestingly, Chang Jinghui et al [9] found that non-medical students are more prone to develop moderate anxiety compared to students from a health science background as health science students have a better understanding of the disease dynamics.

We did not notice a significant change in anxiety scores between males and females. This finding agrees with previous studies [10, 11] that showed no significant difference in the prevalence of depression and anxiety between the different genders of students during the Covid 19 outbreak. However, it contrasts with other studies [12, 13] that state that females are relatively more prone to develop anxiety than males. We did not find a significant correlation between the presence of a Covid 19 patient at home or having Covid 19 symptoms and anxiety levels which contradicts the results of studies done in the past.[14] Our study also did not find a significant correlation between age and change in anxiety scores. These discrepancies may be due to sample size and differences in ethnicity.

Our study showed that an increase in anxiety scores correlated with a decrease in deep and strategic learning scores whereas an increase in anxiety scores correlated with an increase in surface learning scores. Anxiety by increasing the mental stress may decrease the competence of a student. Christine Cipra and Brigitte Müller-Hilke [10] showed in their study that the surface learning approach by medical students correlated significantly with anxiety. Besides, students with surface learning scores obtained the poorest results in their academics. Therefore it is postulated that students who are worried about their failure are not able to focus and tend to adopt a surface learning approach.

Furthermore, we tried to investigate the possible reason for the change in learning approach and increase anxiety levels. We observed mild to moderate association between decrease in deep, strategic learning and increase in surface learning approach with a decrease in socioeconomic status, decrease in personal attention by teachers, decreased time for relaxation, decreased discussion with their friends, decrease suitable study environment, decrease effectiveness of academic assessment by teachers, decrease time devoted for studies, decrease in learning from online resources, decrease ability to figure out high yielding questions from an exam point of view and decrease in ability to frame quality answers. None of these items showed strong correlation. Therefore we assume that multiple factors may be responsible for the development of such a change in the learning approach.

The positive aspect of this study is that this is the first study to estimate deep, strategic, and surface learning approaches among health science students during the Covid 19 pandemic. We were able to recruit students from other institutions for this study.

In conclusion, the Covid 19 pandemic adversely affected students learning approach by increasing their anxiety and multiple other factors. Clinical orientation is of paramount importance for health science students that necessitate student-teacher interaction in classrooms and clinics. Therefore urgent steps are essential to facilitate the same.

Limitations
The limitation of this study is our acceptance of students' recall of their perception before the Covid 19 pandemic. We were unable to collect large data from other Indian states. Further studies have to be done with larger representations to arrive at concrete conclusions regarding their significance.

REFERENCES
1. Reynolds, Matt (4 March 2020). "What is coronavirus and how close is it to becoming a pandemic?". Wired UK. ISSN 1357-0978. Archived from the original on 5 March 2020. Retrieved 5 March 2020. Retrieved 25 April 2020.
2. Yang H, Bin P, He AJ. Opinions from the epicenter: An online survey of university students in Wuhan amidst the COVID-19 outbreak1. *Journal of Chinese Governance*. 2020 Apr 2;5(2):234-48.
3. Dyrbye LN, Thomas MR, Shanafelt TD. Medical student distress: causes, consequences, and proposed solutions. *Mayo Clinic Proceedings*. 2005 Dec;80(12):1613-22.
4. Henning K, Ey S, Shaw D. Perfectionism, the imposter phenomenon and psychological adjustment in medical, dental, nursing and pharmacy students. *Medical education*. 1998 Sep;32(5):456-64.
5. Entwistle N. Promoting deep learning through teaching and assessment. InAssessment to Promote Deep Learning: Insights from AAHF's 2000 and 1999 Assessment Conferences 2000 Jun 14 (pp. 9-20).
6. Entwistle NJ, McCune V, Tait H. The approaches and study skills inventory for students (ASSIST). Edinburgh: Centre for Research on Learning and Instruction, University of Edinburgh. 1997.
7. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of internal medicine*. 2006 May 22;166(10):1092-7.
8. Meo SA, Abukhalaf AA, Alomar AA, Sattar K, Klonoff DC. COVID-19 Pandemic: Impact of Quarantine on Medical Students' Mental Wellbeing and Learning Behaviors. *Pakistan journal of medical sciences*. 2020 May;36(COVID19-S4):S43-S48.
9. Chang J, Yuan Y, Wang D. [Mental health status and its influencing factors among college students during the epidemic of COVID-19 *Nan fang yi ke da xue xue bao= Journal of Southern Medical University*. 2020 Feb 29;40(2):171-176.
10. Cipra C, Müller-Hilke B. Testing anxiety in undergraduate medical students and its correlation with different learning approaches. *PloS one*. 2019 Mar 13;14(3):e0210130.
11. Liu J, Zhu Q, Fan W, Makamure J, Zheng C, Wang J. Online mental health survey in a medical college in China during the COVID-19 outbreak. *Frontiers in psychiatry*. 2020 May 13;11:459.
12. Saddik B, Hussein A, Sharif-Askari FS, Kheder W, Temsah MH, Koutaich RA, Haddad ES, Al-Roub NM, Marhoon FA, Hamid Q, Halwani R. Increased Levels of Anxiety Among Medical and Non-Medical University Students During the COVID-19 Pandemic in the United Arab Emirates. *Risk Management and Healthcare Policy*. 2020 Nov 3;13:2395-2406.
13. Nakhostin-Ansari A, Sherafati A, Aghajani F, Khonji MS, Aghajani R, Shahmansouri N. Depression and Anxiety among Iranian Medical Students during COVID-19 Pandemic. *Iranian journal of psychiatry*. 2020 Jul;15(3):228-235.
14. Cao W, Fang Z, Hou G, Han M, Xu X, Dong J, Zheng J. The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry research*. 2020 May;287:112934.