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VISIONARY LEARNERS, VULNERABLE EYES: A CROSS-SECTIONAL STUDY OF COMPUTER VISION SYNDROME IN UNDERGRADUATE MEDICAL STUDENTS OF PUNJAB, PAKISTAN

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ABSTRACT

Background: In this age of digitalization, no field or person can deny the usage of digital devices. These devices are no doubt making the office work and socializing easy, but they are doing this somewhat at the cost of our visual health.

Aim: The aim of this study is to check the prevalence of computer vision syndrome in medical students and its associated factors.

Methodology: A cross-sectional questionnaire-based study was conducted at Sahiwal medical college during the month of June,2024. After taking ethical approval from institutional ethical review board and having informed consent of the study participants, a validated questionnaire was shared with them through WhatsApp as google forms. Data was collected and analysis was done using IMB SPSS software version 26.

Results: As per our calculated sample size, 371 students participated in our study, out of them 208(56.1%) were females and 163(43.9%) were males. Overall, 266(71.7%) students were suffering from computer vision syndrome. Females have a comparatively higher prevalence 161(43%) of CVS than males (p value=0.006). most of the students 197(53.1%) were using digital devices at the day time/mid-day. The occurrence of musculoskeletal pains due to digital device use was comparatively more in females than male students (p-value=0.041). There is a significant correlation between occurrence of CVS and adjustment of lighting at workspace while using digital devices (p-

value=0.014). Musculoskeletal pains were also associated with computer vision syndrome (p-value=0.001).
Conclusion: Majority of students are suffering from computer vision syndrome, with females having high number. Steps should be taken to minimize digital device usage by medical students in order to prevent their visual health.

Keywords: Computer vision syndrome, Digital eye strain, medical students, visual/eye health.

INTRODUCTION

In this digital age, the usage of virtual devices has emerged as a critical part of our daily lives, mainly for university and college students.[1] Digital devices are not only being used at work places, offices, academic institutions but their usage is also very common even at recreational places and homes.[2] Digital eye strain/computer vision syndrome consists of a number of eye and vision problems as a result of prolonged use of digital video display units like computer systems, smartphones, tablets, and smart watches.

According to the American Optometric Association, Computer vision syndrome, also known as Digital Eye Strain (DES), is defined as a complex of eye and vision problems related to activities, which stress the near vision and which are experienced in relation or during the use of computer.[3] Despite its prevalence, many people are nevertheless unaware of Digital Eye Strain and its capacity results.

Globally, nearly 60 million people are suffering from computer vision syndrome and approximately a million new cases are being reported every year. South Asian region including Pakistan has undergone rapid advancements in the field of technology but excessive use of technology has led to increased prevalence of Computer Vision Syndrome with resultant loss of productivity and reduced quality of life[4]. Unfortunately, we are living in the world of technology curse where the overuse of it has badly impacted our lifestyles including our sleep patterns, daily routine and eye health etc.[5]

The symptoms of Digital eye strain may be divided into four principal categories:

- Eye soreness (like sore eyes)
- Surface-associated issues (like dry eyes and infection)
- Visual issues (like double vision and blurred vision)
- Extra-ocular signs (like shoulder and neck ache).[6]

Several studies have shown a strong connection among extended use of digital devices and the arrival of these signs.

Undergraduate medical college students are specifically at greater threat for Digital Eye Strain due to the fact that they use digital devices substantially for studying and recreational purposes[7].The prevalence of harmful effects of prolonged digital device usage among medical students translates to computer vision syndrome/digital eye strain symptoms, especially when the visual demands of a given task exceed the visual abilities of a student to comfortably perform the task at hand.

Especially, during the "COVID-19 pandemic" when educational institutions introduced online classes the usage of digital devices for educational purposes increased tremendously.[8] Now, e-learning has become a necessary evil which has globally increased the screen time of students. Medical students use digital devices for book reading & watching video lectures and submission of their assignments. As every picture has two sides, similarly e-learning also has many advantages and disadvantages but there must exist a balance between the usage of digital devices so that the detrimental effects of digital devices can be reduced[9].

Studies indicate that between 65% to 90% of computer users worldwide experience symptoms of computer vision syndrome, highlighting its widespread impact on daily life. Factors contributing to Computer Vision Syndrome include poor lighting, improper viewing distances, and extended periods of uninterrupted screen time, which collectively strain the eyes and lead to discomfort. Efforts to

reduce Computer Vision Syndrome include ergonomic adjustments, regular breaks, and eye exercises, aiming to alleviate symptoms and promote eye health in a digital age.[10]

The objective of our study is to determine the prevalence of computer vision syndrome and its associated risk factors among undergraduate medical students. By figuring out the extent of Digital Eye Strain and its contributing elements, this research seeks to tell public health professionals and policymakers to design and implement an intervention strategy to reduce the symptoms associated with digital devices. These findings will help raise recognition about Digital Eye Strain and tell healthful practices among medical college students and teachers to improve overall well-being and overall academic performances.

Understanding the supremacy and danger elements of Digital eye strain is vital for growing effective preventive measures and growing more fit educational surroundings.

MATERIALS AND METHODS

A cross-sectional study was conducted during the month of June,2024 at Sahiwal medical college, Sahiwal after taking ethical approval from institutional ethical review board. Convenient sampling technique was used and informed consent was taken from the study participants. We collected data from 1st year to final year undergraduate medical students. The sample size was calculated as follows;

Sample size=$Z_{1-a/2}{}^2$ p(1-p) / d^2

sample size =371

value of $Z_{1-a/2}$= 1.96. Value of p= 0.59. Value of d =0.05

The questionnaire was created in Google forms. It had three sections. The first section consisted of demographics. The second section consisted of general questions regarding type and duration of digital device usage, screen time, symptoms experienced by prolonged exposure to digital devices. Third section consisted of a validated questionnaire used to check prevalence of computer vision syndrome in students. This third section mainly had questions regarding the frequency and intensity of each symptom experienced by the students. The questions were scored later on depending upon the frequency and intensity of individual symptoms experienced by the students. The sum was calculated and on the basics of final scores the students were categorized into computer vision syndrome positive and negative. All the above mentioned data was collected via google forms that were shared with the students through WhatsApp. All the responses were complete so, in short, we gathered 371 total responses, that was exactly according to our calculated sample size. The data was then analyzed using IBM SPSS version 26.

RESULTS:

Total 371 undergraduate medical students participated in our study, out of them 208(56.1%) were females and 163(43.9%) were males. Overall, 266(71.7%) students were suffering from computer vision syndrome and 105(28.5%) students were negative in terms of presence of CVS.

Table#1: Prevalence of computer vision syndrome and variables associated with it.

Sr. no.			Computer Vision Syndrome (n=371)		p value
			Absent (n=105)	Present (n=266)	
1.	Gender	Female	47(12.6%)	161(43%)	0.006**
		Male	58(15.6%)	105(28.3%)	
2.	Age	17-21 years	61(16.4%)	145(39%)	0.531*
		22-26 years	44(11.8%)	121(32.6%)	
3.	Residence	Day-scholar	19(5.1%)	54(14.5%)	0.630*
		Hostellite	86(23.1%)	212(57.1%)	
4.	Class	1st year	21(5.6%)	73(19.6%)	0.034**
		2nd year	34(9.1%)	49(13.2%)	

		3rd year	10(2.6%)	37(9.9%)	
		4th year	31(8.3%)	74(19.9%)	
		Final year	9(2.4%)	33(8.8%)	
5.	At what time do you use digital devise usually?	During the day/ mid-day	66(17.7%)	131(35.3%)	0.059*
		Early in the morning	4(1%)	16(4.3%)	
		Late night	35(9.4%)	119(32%)	
6.	Do you use digital devices continuously or take break of few seconds after some time?	Intermittent use (take breaks in between)	42(11.3%)	95(25.6%)	0.441*
		Use continuously	63(16.9%)	171(46%)	
7.	For how long you are using digital devices?	Less than 1 year	0 (0%)	3(0.8%)	0.483***
		Less than 2 years	6(1.6%)	13(3.5%)	
		Less than 3 years	13(3.5%)	31(8.3%)	
		Less than 4 years	15(4%)	34(9.1%)	
		More than 4 years	18(4.8%)	69(18.5%)	
		More than 5 years	53(14.2%)	116(31.2%)	
8.	Do you face any musculoskeletal pains?	Shoulder and neck pain	12(3.2%)	110(29.6%)	0.001****
		Difficulty in writing using pen	1(0.2%)	7(1.8%)	
		Pain in joints of fingers and wrist joint	1(0.2%)	22(5.9%)	
		No symptoms faced	91(26.6%)	127(33.4%)	
9.	On average, how many hours per day do you spend using computers (laptops, desktops, tablets)?	Less than 1 hour	11(2.9%)	12(3.2%)	0.088*
		1-2 hours	8(2.1%)	26(7%)	
		3-4 hours	30(8%)	57(15.3%)	
		5-6 hours	29(7.8%)	96(25.8%)	
		More than 6 hours	27(7.2%)	75(20.2%)	
10.	Do you adjust the lighting in your workspace when using a digital device?	Never	8(2.1%)	37(9.9%)	0.014**
		Rarely	15(4%)	29(7.8%)	
		Sometimes	17(4.5%)	77(20.7%)	
		Often	33(8.8%)	54(14.5%)	
		Always	32(8.6%)	69(18.5%)	
11.	How often do you take breaks from computer/digital device use during the workday?	Never	6(1.6%)	12(3.2%)	0.664***
		Rarely (less than once per hour)	26(7%)	71(19.1%)	
		Occasionally (once per hour)	40(10.7%)	113(30.4%)	
		Frequently (every 30 minutes)	29(7.8%)	56(15%)	
		Very frequently (every 15 minutes)	4(1%)	14(3.7%)	

*non-significant p-value calculated by Pearson Chi-Square test.
**significant p-value calculated by Pearson Chi-Square test.
***non-significant p-value calculated by Fischer-Freeman-Halton Exact test.
****significant p-value calculated by Fischer-Freeman-Halton Exact test.

Table#2: Duration of usage of digital devices and its association with gender.

		Gender		
		Female	Male	p value*
For how long you are using Digital Devices?	Less than 1 year	3	0	0.044
	Less than 2 years	13	6	
	Less than 3 years	32	12	
	Less than 4 years	25	24	
	More than 4 years	50	37	
	More than 5 years	85	84	
Total		208	163	

*p-value is calculated by Fischer-Freeman-Halton Exact test.

Table#3: Association between gender and musculoskeletal pains.

		Gender		p-value*
		Female	Male	
Do you face any musculoskeletal pains?	Shoulder and neck pain	78	44	0.041
	Difficulty in writing using pen	5	3	
	Pain in joints of fingers and wrist joint	16	7	
	No symptoms faced	109	109	
Total		208	163	

*p-value calculated by Fischer-Freeman-Halton Exact test.

		Gender		
		Female	Male	p value*
Do you use digital devices continuously or take a 20 second break after using digital device for 20 minutes?	Intermittent use (take breaks in between)	87	50	0.027
	use Continuously	121	113	
Total		208	163	

*p value is calculated by Pearson Chi-Square test.

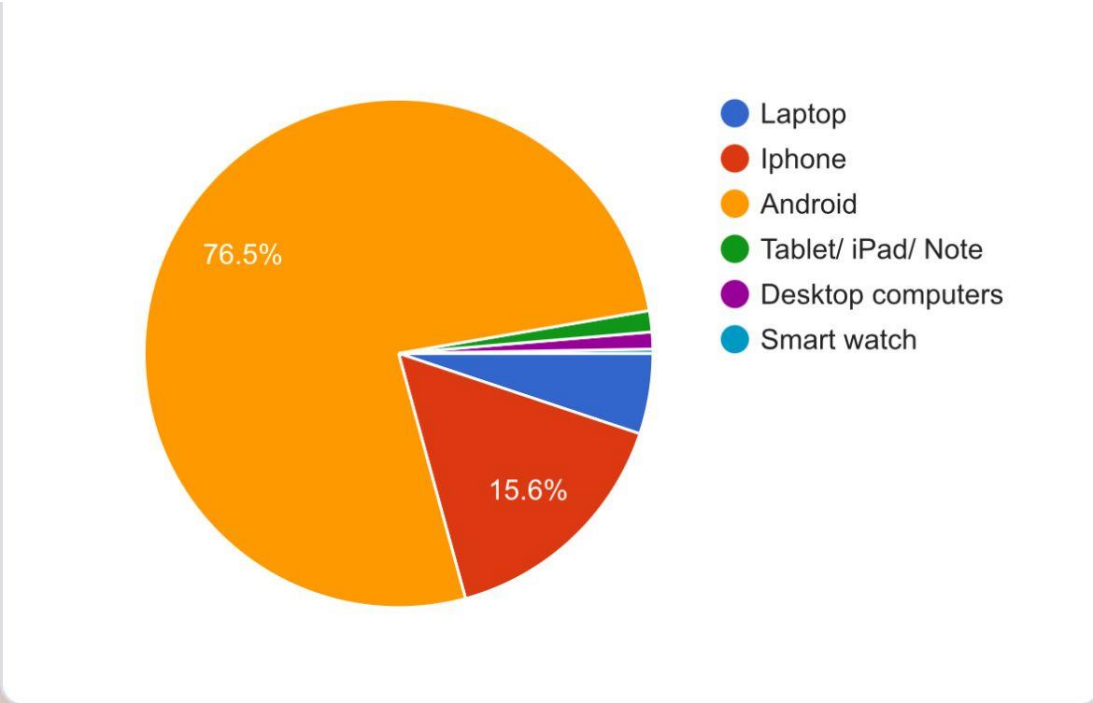
DISCUSSION

The present study is conducted among 371 undergraduate medical students and the prevalence of CVS is 266(71.7%). This prevalence is almost equal to the study conducted in Saudia Arabia i.e. 77.6%.[11] In contrast, the prevalence in Sri Lanka was about 67.4%.[12] And among Ethopian students was (70.4%).[13] The risk of CVS is very common among university students due to use of digital devices for educational purposes.[14]

In this study total participants were 371, out of them, 208(56.1%) are females and 163(43.9%) were males. The high percentage of females is because they are excelling in every field.[15] Most of the students 206(55.5%) were in between the age of 17-21 and 165(44.5%) were of 22-26. Just like the students of Abdulaziz University of Saudia which were mostly young.[16]

In our study, 298(80.3%) students were hostelites and 73(19.7%) were day-scholars. The massive percentage of hostelites is because mostly students are from far distant residence. In this study, highest percentage 105(28.3%) of responses were obtained from fourth year students, then first year students 94(25.3%), second year 83(22.4%), third year 47(12.7%) and final year 42(11.3%) respectively. The low ratio of participation of final year is due to high burden of their academic schedule.[17]

Types of digital devices used by university students:
Students of university use different types of digital devices for different purposes. In our study, the significant 287(76.5%) use was of android mobile phones, then followed by iPhone 58(15.6%), and Laptops 19(5.1%). Only 5(1.3%) students use Tablets/iPad/Note. However, ordinary Desktop computers (desktop screens) were only used by 4(1.1%) students. Almost similar findings were reported by some investigators in 2019.[18]



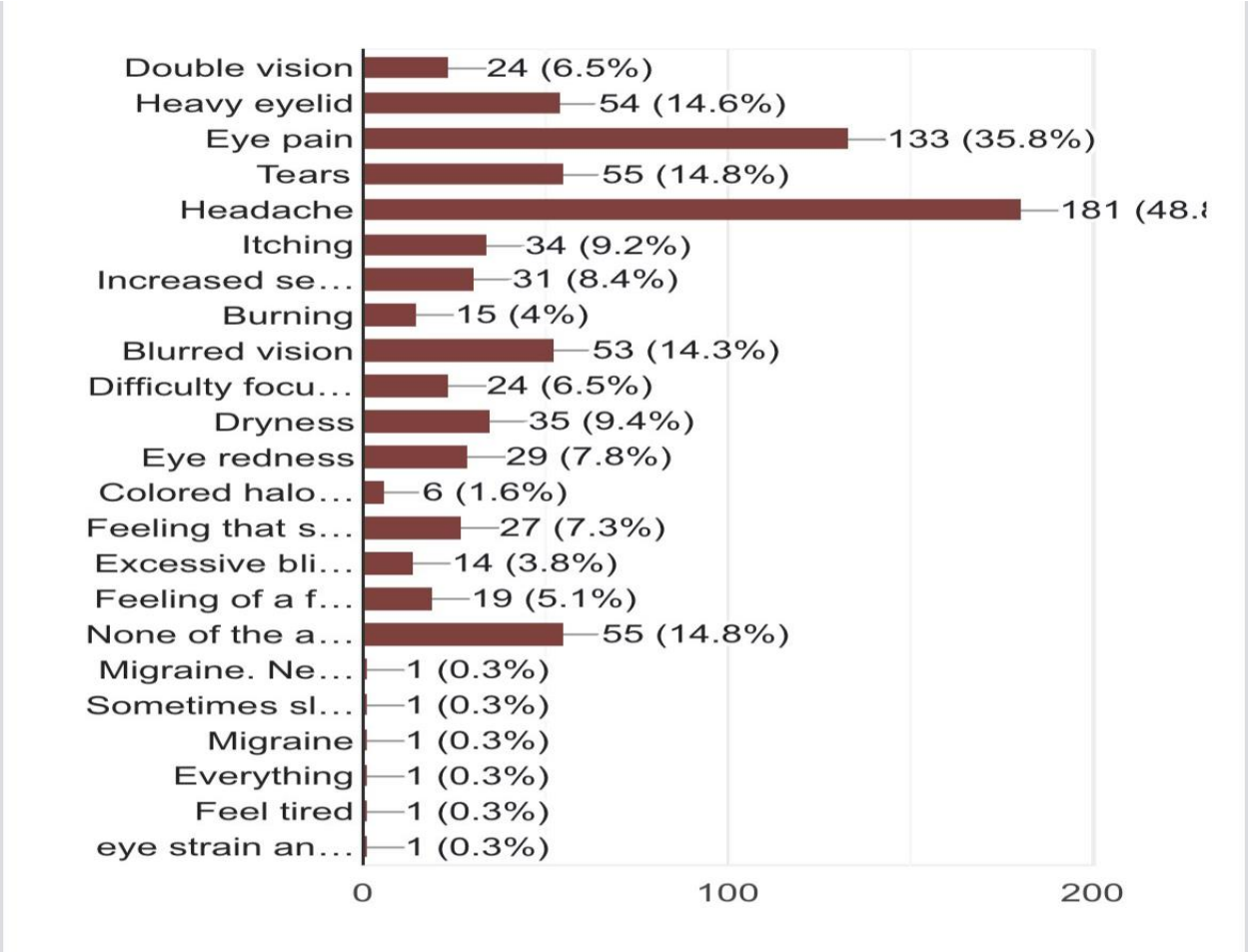
Duration of usage of digital devices by students:
The study showed that most of the students were using digital devices for many years. About 169(45.6%) students were using digital devices for more than 5 years. Similarly, 87(23.5%) students were using for more than 4 years, 49(13.2%) students were using digital devices for less than 4 years. However, some students were using it for less than 3 years i.e. 44(11.9%). There is a little percentage of students which are using them for less than 2 and 1 year i.e.19(5.1%) and 3 (0.8%) respectively. Most of the students were using digital devices for so long because of the COVID-19 pandemic, during which the online education system was common.[19]

Mode of usage of digital devices by students:
Continuous use of digital devices without breaks was associated with a higher prevalence of CVS. In our study, we asked students about their habit of using the devices. Only few students took breaks of 20 seconds after the 20 minutes usage of digital devices i.e. 137(36.9%). While majority 234(63.1%) of students were using the devices without minor breaks. Similar results occurred in another study because students prefer to have social attention and social interaction almost all the time.[20]

Time of usage of digital devices by students:
Mostly social activities are done during the day time. Similarly, students also perform their educational and social activities during day or mid-day time. The result of our study indicates that there is a high percentage 197(53.1%) of students, who use their devices during day/mid-day. Some students 154(41.5%) prefer to study at night time. However, few 20(5.4%) students also use their devices early in the morning about . We can also say that students get addicted to usage of mobile phones, that's why they spend most of their day by using digital devices as per a study conducted conducted at Taiwanese university.[21]

Upper musculoskeletal problems faced by students:
There are several complaints reported by students after prolonged usage of digital devices, which ultimately progress to CVS. In our findings, about half of students suffered with different muscular and skeletal strains such as shoulder and neck pain were significant among 122(32.9%) students. Neck pain is a common symptom observed among people as per cited by some researchers.[22] Some 23(6.2%) students also experienced joint pain in fingers and wrists. A few 8(2.2%) students faced difficulty in writing. More than half 218(58.8%) of the students faced no musculoskeletal complains.

Symptoms faced by students after prolonged usage of digital devices:
The prevalence of CVS in our study is more than 70%, which shows that most of the students suffer from several ocular and extra ocular symptoms. The major issue was headache about 181(48.8%). On the other hand, eye pain had also a significant margin of about 133(35.8%). About 55(14.8%) students faced the problem of tears in eyes, followed by heavy eye lid 54(14.6%). Several other symptoms were also reported like blurred vision 53(14.3%), itching 34(9.2%), dryness 35(9.4%), sensitivity to light 31(8.4%), eye redness 29(7.8%) , feeling that their sight is worsening 27(7.3%), difficulty focusing for near vision 24(6.5%), double vision 24(6.5%), feeling of a foreign body in eyes 19(5.1%), burning 15(4%), excessive blinking 14(3.8%) and colored halos around objects about 6(1.6%). However, the symptoms like sometimes sleepiness, eye strain and black spots around eyes, migraine, neck muscle stiffening, and feeling tired, each of these symptom was reported in the frequency of 1(0.3%). Nevertheless, about 55 (14.8%) students don't have any such kind of complications. The high prevalence of symptoms is because students use digital devices for prolonged periods for several different purposes either it is for educational or recreational purposes.[23]



Habit of usage of digital devices by students over the past month:

The study is conducted to have an idea about the usage of digital devices and their impacts on student's visual and mental health. It is related to the time they spend on digital devices regarding their education or personal issues. It was asked from the students that on average how many hours do use digital screens per day as per the previous studies on CVS.[24] Some answered that they spend for about 5-6 hours per day about 125(33.7%) students. About 102(27.5%) students spend about more than 6 hours per day. However, 87(23.5%) students spend 3-4 hours per day, followed by 34(9.2%) students use 1-2 hours per day. Nevertheless, only 23(6.2%) students use less than 1 hour per day. More than one-third of students spent more than 5 hours per day on screen because of their keen interest in global world.

When it was asked about taking breaks while using digital screens, it was revealed that about 153(41.2%) students take breaks occasionally (once per hour), 97(26.1%) students take a break rarely (less than once per hour) and 85(22.9%) students take break frequently (every 30 minutes). However, there is same percentage of the students who take breaks very frequently (every 15 minutes) and who take a break never i.e. about 18(4.9%). The prevalence of CVS is low among those who took breaks while their activity hours as indicated by studies.[25]

Furthermore, it is necessary to have a light source during the use of digital devices. The students who always have a light source during their digital activities are about 101(27.7%). However, about 94(25.3%) students have the light availability for sometimes, followed by the frequency of 87(23.5%) students who often use light. There is almost equal number of students who never use light and who rarely have light source i.e. about 45(12.1%) and 44(11.9%) respectively. There was a significant correlation between the occurrence of CVS and adjustment of lighting at workspace while using digital devices (p-value=0.014). also previous studies indicate that the students who use light have a little percentage of developing the CVS.[26]

In our study, we attempt to know a genuine relation of CVS with various components and other risk factors like demographic factors, age, academic years and other associated factors e.g. residence. Also we tried to figure out if he CVS is associated with the usage of different types of digital devices, their usage period and the time of usage. Furthermore, the association between the CVS and having minor breaks during the screen hours was also urged to study.

Nevertheless, the results are highly significant that the demographics and CVS are somehow related. The prevalence of CVS is significantly high among females as compared to males. This result positively correlates with a previous study done in Saudi Arabia[27] However, academic years have also a major impact on students about CVS as the p value for academic years was significant (p=0.034). Similar results were happened in a study conducted in previous years.[28]

Conclusion:

This study highlights the high prevalence of CVS among undergraduate medical students and identifies several risk factors for CVS, including gender, academic year, and prolonged device usage. The findings underscore the importance of addressing digital device usage patterns and incorporating preventive measures during usage. Recommendations include promoting regular breaks during screen time, optimizing lighting conditions, and raising awareness about CVS among students to lessen its impact on their visual health and overall well-being. By addressing these risk factors, educational institutions can help reduce the burden of CVS among students and can enhance their academic performance, health and quality of life.

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