



# The Impact of Online Learning During COVID-19 on Chinese Students

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**Abstract.** The pandemic forced students to switch from in-person to online learning suddenly. After almost three years of online learning, what are students' experiences about it? This study is designed to investigate how online learning affects Chinese students' mental/physical health and learning experience. It is revealed in this study that online learning in general negatively impacts all three aforementioned perspectives of Chinese students, and many students from different learning stages might be in urgent need to have psychological support to minimize such negative effects. Furthermore, this study provides details regarding the different underlying components contributing to the negative impressions, which might be used to provide guidance for school therapists to help students from different learning stages and health conditions more efficiently.

**Keywords:** COVID-19 · Online Learning · Attention Deficit Hyperactivity Disorder (ADHD) · Chinese students

## 1 Introduction

With the rapid growth of the internet, the way of teaching and learning has altered, and online learning emerged as a result. Several practices were exercised in or before 2019. [1, 2] Undoubtedly, the coronavirus (COVID-19), a global incident that caused a public health crisis, has naturally fastened the process of online learning due to the lockdown.

Admittedly, there are some advantages to online education. First, online learning offers an interactive condition, [3] enriching students' learning experiences. Additionally, online learning may empower students in confidence and self-reliance [4]. Furthermore, students can access various online resources such as Coursera, which may improve their self-learning and proactive learning ability. Moreover, students can explore and try more learning strategies to find the most suitable one since there is less supervision and instructions from schoolteachers and more freedom.

However, the sudden significant change gives students and teachers limited time to adapt, which causes some problems, such as a less engaging education experience, [5] and interrupted interaction caused by the instability of the network [6]. Some students complained that they were not used to the shift. In addition, students with ADHD may face a more severe crisis for some reasons, including that they are more likely to experience increasing mental health symptoms during the pandemic [7].

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Attention deficit hyperactivity disorder (ADHD) is one of the most common neurodevelopmental disorders in children and adults [8]. The disorder's symptoms are as follows: inattention, forgetfulness, restlessness, and impulsivity [9]. In offline learning, due to the factors above, students with ADHD have a higher likelihood of experiencing difficulties in academic performance compared with students without ADHD [10]. Since they already suffer from an intellectual impairment, online education's disadvantages may worsen.

Previous studies have shown that online learning exacerbates academic challenges, particularly for students with ADHD [11]. For instance, math and reading scores declined in the United States of America [12]. To figure out the specific impact in China, especially for those with ADHD, this research was conducted. This study aims to explore the implications of online learning on the academic performance and mental health of Chinese adolescents with and without ADHD by conducting a survey. It is hoped to provide scientific support and an immense scale of description to teachers and counselors in China to benefit the students. Since those with ADHD need more attention than students without ADHD, but there has not been enough awareness of them in China, it is hoped that this research can help them in particular.

## 2 Method

### 2.1 Demographic of Participants

The main purpose of this study was to evaluate the impact of online learning during covid outbreaks by gathering data from Chinese students with and without ADHD, ranging from middle school to post-graduate. The data were collected between 11th October 2022 and 24th October 2022. It happened approximately half a year to one year after long-term online learning. A total of 1455 students finished the survey. Individuals in elementary school were excluded due to legal reasons and frequent invalid answers. The survey data of 502 participants who provided informed consent were analyzed, resulting in a participation rate of 34.5%, with 27.89% male, 67.13% female, and 4.98% others. 8.57% (n = 43) participants were diagnosed with ADHD by professional institutions or individuals, and 25.3% (n = 127) were self-diagnosed with ADHD. Adults were self-diagnosed by WHO Adult ADHD Self-Report Screening Scale (ASRS-V1.1). While analyzing, participants with ADHD professional diagnosis and self-diagnosis were combined into ADHD one column. Among them, 75.88% (n = 129) are female, 12.94% (n = 22) are others, and 11.18% (n = 19) are male (Table 1).

**Table 1.** Demographic characteristics of participants. Participants were depicted by their gender, primary learning stage during the COVID-19 outbreak, and ADHD symptoms.

Students' demographic details (n = 502)			
Gender	Male: 27.89%(n = 140)	Female:67.13% (n = 337)	Others:4.98% (n = 25)
Learning stage	Middle school: 24.7%(n = 124)	High school: 25.1%(n = 126)	College and beyond 50.2%(n = 252)
ADHD	ADHD with professional diagnosis: 8.57%(n = 43)	ADHD with self-diagnosis: 25.3%(n = 127)	non-ADHD: 66.13%(n = 332)

## 2.2 Survey Items

We created a survey with 23 multiple-choice questions to measure the impact of COVID-19 on Chinese students' with and without ADHD. The average time to complete is 5 min and 2 s. The questionnaire was shown in Microsoft Forms and distributed via WeChat, Weibo, etc., the main social media in Mainland China. The questions were categorized into three sections: psychological wellness, physical wellness, and academic performance. To examine the mental and physical well-being, we took the Coronavirus Health Impact Survey (CRISIS) Youth Self-Report, [13] which was indicated to evaluate the influence of COVID-19 on teenagers' mental and physical health, as a reference. To measure academic performance, we took the Learning and Study Strategies Inventory (the LASSI), [14] which considers one's attitude, concentration, etc., as a reference.

It aims to get a deeper and more detailed understanding of students' performance during online learning, especially for those with ADHD, thereby providing scientific and solid support to school counselors and teachers. Since online learning may happen again in the future, it is hoped that students can minimize the negative impacts and maximize the advantages of online learning next time (Table 2.)

## 2.3 Statistics

The statistical analysis mainly used the pipeline developed by Schweinberger.<sup>15</sup> In addition, student t-tests were performed to access whether or not the differences were significant different from each other.

## 3 Results

Most Chinese young population investigated in the paper thought online learning had negative impacts on their learning experience (241 out of 502, 48%), mental (235 out of 502, 47%), and physical health (330 of 502, 66%, Fig. 1). Specifically, most middle school students and college and beyond students thought their health level had decreased during online learning, but high school students thought oppositely (Fig. 2). Sleep qualities and physical activity levels were two of the most important factors affecting health. Most students across different age groups reported having better sleep quality with longer sleep hours (246 out of 502, 49%), but most students indicated a lower physical activity level (377 out of 502, 75%, Fig. 1). The online learning-induced sedative lifestyle may contribute to the overall negativity towards it. Moreover, the age groups and the amount of negative feeling towards online learning shows a negative correlation. As the age increases, less percentage of people in that population dislike online learning. One possible explanation can be that people with more years of learning are more resilient to the change in teaching methods since they have found and formed their own learning routines.<sup>16</sup> Online learning decreased most students' communication frequency with their peers (305 out of 502, 61%, Fig. 1). However, with having a longer time with family members, most students indicated that they experienced less loneliness (295 out of 502, 59%) and paid more attention to their mental health (305 out of 502, 61%, Fig. 1). Compared with the other two groups (middle school: 83 out of 124, 67%; college and

**Table 2.** Impacts of online learning on participants. The effects were evaluated by psychological wellness, academic performance, and physical wellness. Each section includes 3 or 10 multiple-choice questions.

Psychological wellness	Academic performance	Physical wellness
Q1: Do you have positive experience with online learning?	Q10: Does COVID related new daily routines bother you?	Q9: Do you have longer sleep hours?
Q2: Does online learning increase your communication frequency?	Q15: How does it affect the communication frequency between you and your teachers? How does that affect your learning?	Q12: Are you healthier?
Q3: Do you have increased loneliness?	Q16: Does online learning improve your time management abilities?	Q13: Do you have more physical activities?
Q4: Do you have a higher anxiety level	Q17: Have you adapted to online learning?	
Q5: Do you have a higher angry level	Q18: Does multi – technology improve your learning experience?	
Q6: Do you pay more attention to your mental health?	Q19: Do you often get distractions from cameras?	
Q7: Do you have more mood swings?	Q20: Do you have longer study hours?	
Q8: Does online learning improved your mental acuteness?	Q21: Do you have a better ability to concentrate?	
Q11: Do you have more time to relax?	Q22: Do you have better learning performances?	
Q14: How does it affect your time with your parents? And how does that affect your emotion?	Q23: Do you like your current way of handling online learning? Will you change it?	

beyond: 163 out 252, 65%), fewer high school students reported paying more attention to their mental health (67 out 126, 53%, Fig. 2). Online learning affects different age groups of students similarly, namely 45% of middle school students, 49% of high school students, and 49% of college and beyond students reported to be negatively affected (Fig. 2). Most students indicated that they had a hard time concentrating (331 out of 502, 66%). Among those students, 174 out of 331 students belong to the college and beyond group. More college and beyond students reported being more distracted by COVID-related things (189 out of 252, 75%), for example, regular PCR tests and more time to worry about future careers during the pandemic.

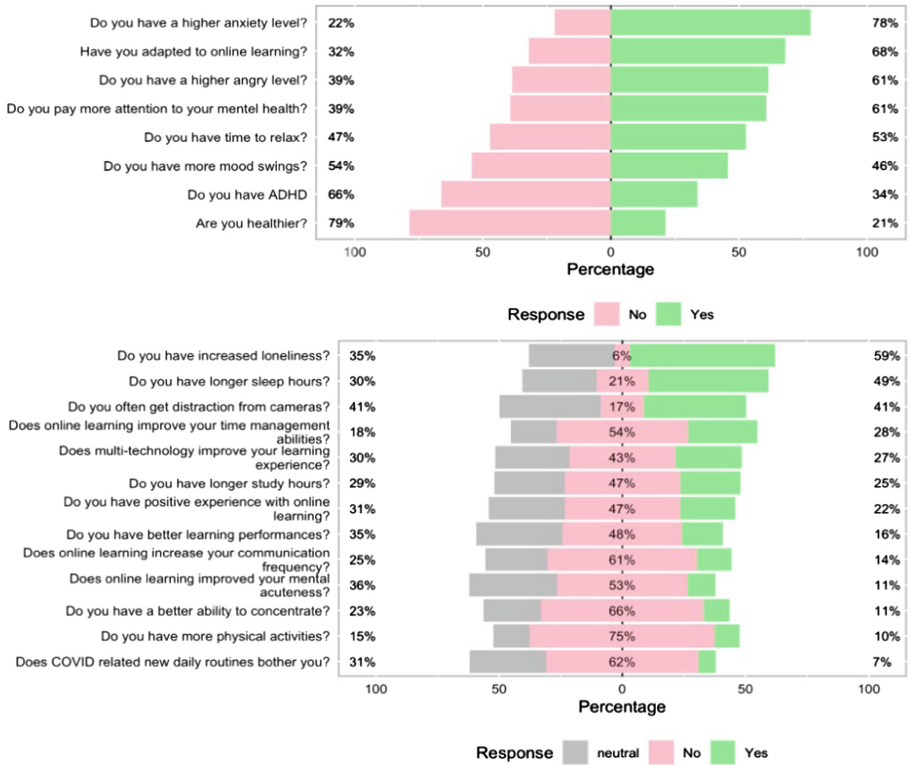
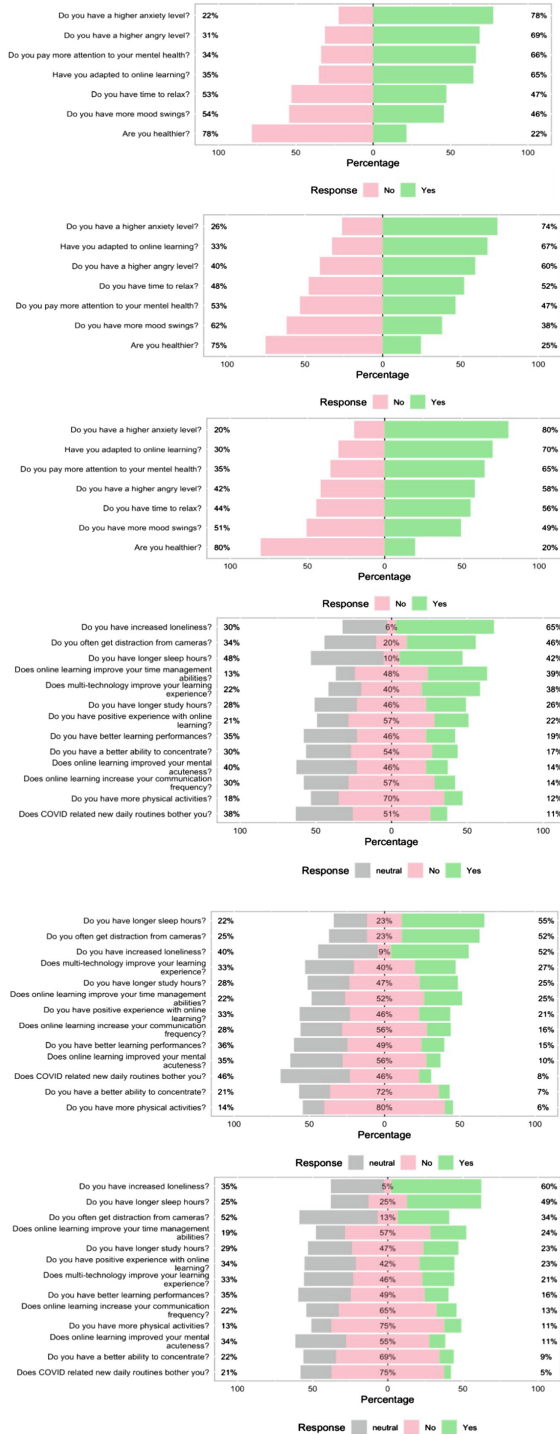


Fig. 1. Survey results for all the participants.

When the data is grouped based on whether the student has ADHD conditions, there is no significant difference between ADHD and non-ADHD students (t-tests,  $p > 0.05$ ). Especially in the physical health category, more students in both groups were reported to be less healthy (78% in ADHD and 79% in non-ADHD), less physical activity (76% and 75%, respectively), and longer sleep hours (55% and 46% respectively). However, differences do exist between the two groups. More ADHD students reported having higher anxiety (84%) and anger (65%) levels and experience more mood swings (60%) compared with that without ADHD conditions (anxiety level: 75%; anger level: 59%, and mood swings (38%), Fig. 3). More non-ADHD students reported feeling increased loneliness (62%), compared with the ADHD group (53%). The majority of people in both groups indicated that they had negative learning experiences with online learning (46% in ADHD and 47% in non-ADHD), and their learning performance decreased (54% in ADHD and 46% in non-ADHD). The underlying reasons for the negative results are different between the two groups. More students with ADHD reported having a harder time concentrating (76% vs. 61%), and they got distracted by the multi-technology teaching learning platforms (54% vs 37%) and the COVID-related daily routines (72% vs. 56%). More students in the non-ADHD group are distracted by the turned-on cameras (44% vs. 36%).



**Fig. 2.** Survey results for middle school, high school, and college and beyond students (top to bottom).

Students with different learning stages and health conditions may have different underlying reasons regarding why they had negative feelings toward online learning. The sudden change to this learning mode has caused negative impacts on students' health, both mental and physical, and their learning experiences.

## 4 Discussion

This study has shown that Chinese students are negatively impacted by pandemic-induced online learning. The fact that there is no significant difference between the non-ADHD and the ADHD group in the psychological wellness questions is an alarming sign. One example is anxiety level. There are 84% of students in the ADHD group and 75% in the non-ADHD one reported having a higher anxiety level, which is not close to being significantly different ( $p\text{-value} = 0.1$ ). According to one previous study, students with ADHD would have over two times more likely than non-ADHD students to have anxiety disorders and anxiety-associated symptoms.<sup>17</sup> There are details regarding how similar the responses are between these two groups in the result section (Fig. 3). Chinese students are in urgent need to have psychological support, and this study provides details regarding the different underlying components contributing to the negative impressions.

For example, 69% of middle school students reported having a higher anger level. After knowing this information, school therapists can pay more attention to helping middle school student to alleviate or control their anger. Among the three learning stages, much fewer high school students pay attention to their mental health. So, how to guide them to think more about it would be a focus for therapists in high schools. Other perspectives would be providing information to teachers.

Interestingly, some teachers use multi-technologies, including authorizing students to write on screens or digital blackboards and taking screenshots of students' answers to engage students. However, according to this study, it is reported by nearly half of the students have negative impacts, such as wasting time and distraction. Similarly, to ensure students are paying attention to the content, some teachers ask students to turn on their cameras so that they can supervise their activities. However, it is said by nearly half of the students are a distraction because they might look at what other students are doing behind the camera. Therefore, comprehensive interventions and technical support are needed for students to ensure learning outcomes. For instance, teachers might change the frequency and means of using tools to teach. Technicians and programmers might block students' right to access other students' images on the screen.

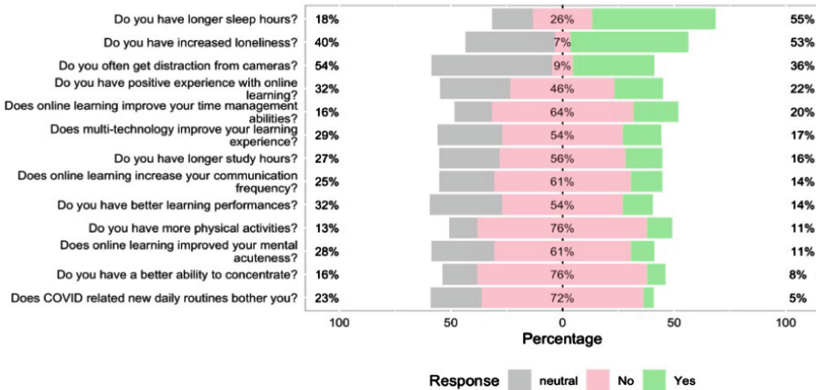
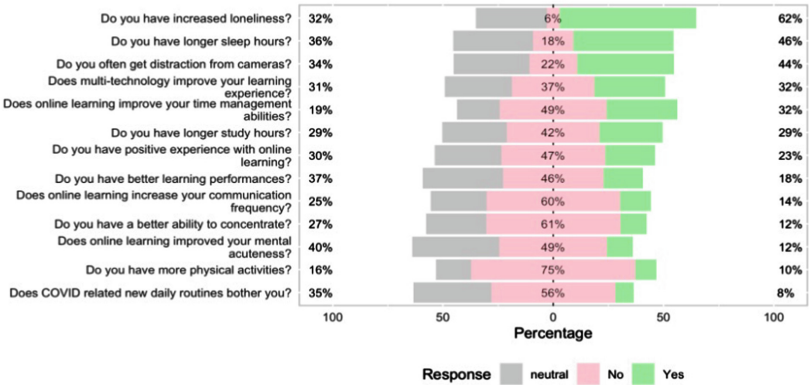
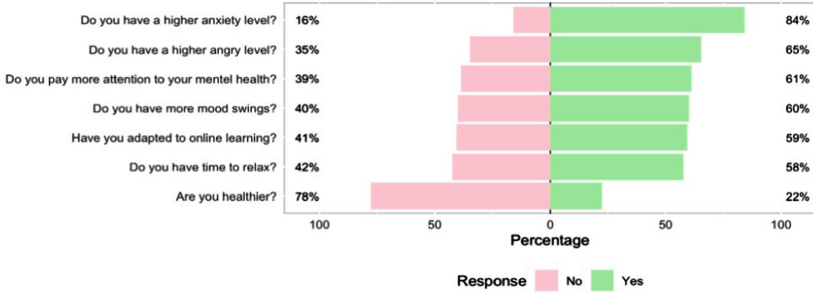
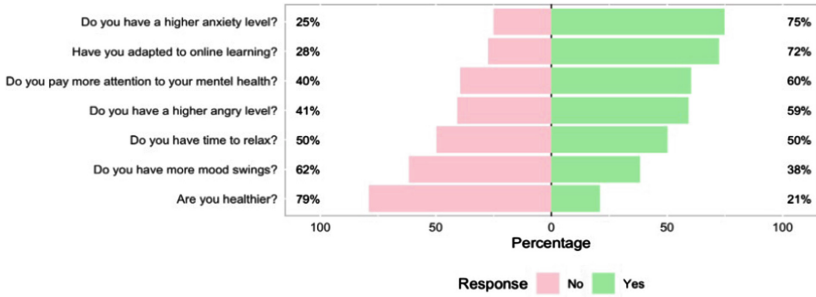


Fig. 3. Survey results for non-ADHD (top) and ADHD (bottom) group.



## 5 Conclusion

The outbreak of the pandemic forced students to switch to online learning suddenly three years ago. With certain limitations, such as limited demographic coverage, this study extensively investigated how such sudden change affects Chinese students. The non-discriminative difference between ADHD and non-ADHD students regarding mental wellness is an alarming sign and indicates the urgent need for providing psychological support to Chinese students. In addition, this study has shown that most participating students think online learning also negatively affects their physical health and learning performance. Since this study investigated what might be the underpinning reasons for the negativity school therapists and teachers can use this information to better help students overcome their struggles.

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