

# A Survey of Forgetting in the Classroom during the Long Covid Era

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**Abstract:** In the Long Covid era, the normalization of COVID infections have led researcher to identify cognitive decline in COVID patients. Reduced class hours and increased cognitive - decline risk challenge education quality. Our survey has interesting findings. Firstly, 62% of teachers and 65.4% of students report more severe forgetfulness this year. Secondly, COVID-19 induced classroom forgetting is more prevalent among in-attentive students and new/experienced teachers (working years < 2 or > 9). Thirdly, knowledge - presenting courses are more forgettable than hands - on ones. Fourthly, 56.8% of teachers skip forgotten content and 27% pause for recollection during teaching. Fifthly, only 44% of teachers are aware that COVID-19 affects memory, but many have given up protection. Schools, given the lack of understanding of Long Covid harm, should address the dual impact of cognitive decline on teachers and students. They should assist low - performing students and new/old teachers to mitigate forgetting's impact on teaching quality. Teachers should adjust course structures, enrich interactive and practical segments, and reduce knowledge - preaching time. Students should use diverse memory methods. In China, traditional teaching methods are long - established, but without improvement in the post COVID era, educational inequality may worsen.

**Keywords:** Forgetting in Classroom; COVID; Long COVID; Memory Loss; COVID-19 Affects Memory

## 1. Introduction

According to the definition of the World Health Organization (WHO), Long Covid refers to the continuation or emergence of new symptoms, including fatigue, shortness of breath and

cognitive dysfunction, 3 months after the initial infection of COVID-19 (SARS CoV-2), and these symptoms last for at least 2 months. On June 5, 2024, the National Academy of Sciences, Engineering, and Medicine in the United States also released the definition of Long Covid, officially using "Long Covid" as a term[1]. Long Covid patients may have more than 200 symptoms, including dyspnea, cerebral fog, thrombosis, dizziness, extreme fatigue after exercise, loss of taste or smell, rapid heart rate, diarrhea, constipation, diabetes and autoimmune diseases, such as lupus[1]. These symptoms can appear alone or in multiple combinations, and can be persistent or gradually worsening, or the patient may intermittently improve and then worsen again[2]. According to data from the Centers for Disease Control and Prevention in the United States (March 15, 2024), 17.6% of people in the country have reported contracting Long Covid, and 1.5% have lost their workforce as a result. Multiple investigations have shown that repeated infection with COVID-19 will increase the risk of suffering from Long Covid[3]. The risk of COVID-19 infection twice is 1.7 times that of COVID-19 infection once, and 2.6 times that of COVID-19 infection three times[4]. Schools with large populations have always been an important place for the spread of COVID-19. According to the statistics of British COVID-19's sequelae from April 2020 to July 2022 from the British National Bureau of Statistics, among about 2 million people who voluntarily reported having Long Covid, fatigue symptoms involved 62%, and attention deficit involved 33%. Of particular note is that among the approximately 2 million Long Covid population, the two industries with the highest proportions are social care (5.58%) and teaching and education (4.35%), with a Long Covid risk almost twice that of agriculture (2.8%). The "Tracking COVID-19 for Safer

Schools" project of BC Children's Hospital in Canada found that from January to May 2023, 74% of 1153 teaching staff had been infected with COVID-19, of which 35% reported new onset persistent symptoms, including fatigue, brain fog, sleep disorders, etc[5,6].

The incidence of student absenteeism has become the most direct indicator of the impact on classroom education. The national average proportion of continuous student absenteeism in the United States has skyrocketed from 15% in 2019 to 26% in 2023. A sampling survey conducted by the Sutton Education Foundation in the UK revealed that during the 2021-2022 academic year, among 13th-grade students preparing for college entrance exams, 21% were absent for more than four weeks due to COVID-19 infection, while only 16% were present for all classes. In the 2022-2023 academic year, 150,000 students in UK public schools were severely absent, a 150% increase from the 60,000 students in the 2018-2019 academic year. In May-June 2022, some classes at Glen Waverley Secondary College in Victoria, Australia, saw one-third of the students absent due to illness. The absenteeism rate for students in grades 7 to 9 at Auburn High School, a public middle school, has exceeded 33%; Miner's Rest Primary School, a public elementary school, has to deal with nearly 30% to 40% of the teaching staff being absent daily[7].

In the era of Long Covid, with the normalization of COVID-19 infections and teacher-student absenteeism in schools, an increasing number of scholars have found a decline in cognitive function among patients with COVID-19. A study on COVID-19 at Huoshenshan Hospital in Wuhan found that about one-third of the cases exhibited neurological involvement in the early stages of infection. Long-term observational follow-up studies of COVID-19 patients have found that COVID-19 infection may lead to long-term progressive cognitive decline in patients, with a significantly increased risk of dementia. Large cohort studies from the UK and Norway have confirmed the correlation between COVID-19 infection and a decline in cognitive ability, with mild cases experiencing a decrease of about 3 IQ points, and Long Covid and severe cases

experiencing a decrease of 6-9 IQ points[4]. Fewer class hours and a higher risk of cognitive decline will undoubtedly bring new challenges to the quality of education. Taking one of the most important symptoms of Long Covid—memory loss—as an example, memory loss not only affects students in class but also teachers. Under the new circumstances of Long Covid, how teachers and students cope with memory loss during the learning and teaching process, and whether they are aware of changes in their cognitive levels due to the impact of COVID-19, are the questions this study will attempt to answer.

## 2. Methods

This study was conducted using an online questionnaire survey. The subjects of the survey were undergraduate students from the 2021 and 2022 cohorts at the School of Software Engineering, Chengdu University of Information Technology, and all professional teaching faculty members of the school. The students' majors covered Software Engineering, Big Data Science, and Spatial Information and Digital Technology; the teaching faculty mainly consisted of instructors for computer-related courses. A total of 136 valid student questionnaires and 50 teacher questionnaires were collected. The teacher version of the questionnaire focused on self-assessed frequency of memory loss, COVID-19 positivity status, teaching experience, and teaching habits; the student version focused on self-assessed frequency of memory loss during class, the relationship between memory loss and learning outcomes, and the level of concentration. A brief introduction and validity analysis of the objective questions in the questionnaire are presented in Table 1 and Table 2.

### 2.1 Analysis of Forgetfulness

Through Tables 1 and 2, it can be observed that the results of both the teacher and student questionnaires can be explained by three main factors, which account for 62.8% and 55.7% of the total variance, respectively. Moreover, both survey questionnaires are suitable for factor analysis.

**Table 1. Validity Analysis of Objective Questions in the Teacher's Questionnaire**

Questionnaire items/indicators	factor 1	factor 2	factor 3	communality
1. How many years have you been teaching?	0.06	0.73	-0.22	0.590

2. What is the duration of a continuous class session that you are more accustomed to without a break?	0.03	0.82	0.16	0.699
3. Have you ever experienced the situation where a word is on the tip of your tongue but you forget what to say during class? If so, approximately how many times does it occur in one class?	0.25	0.03	-0.69	0.532
4. Compared to last year, is the frequency of forgetting things and items more or less recently?	-0.79	0.15	0.23	0.694
6. How much do you think "forgetting" during teaching affects teaching quality?	0.05	-0.04	0.85	0.729
8. Including tested and estimated results, how many times have you tested positive for COVID-19 since 2022?	0.77	0.07	0.08	0.607
9. Have you heard that "COVID-19 can lead to memory decline"?	0.62	0.37	-0.16	0.544
Eigenvalue (before rotation)	1.99	1.28	1.12	-
Variance interpretation rate % (before rotation)	28.49%	18.36%	15.95%	-
Cumulative variance interpretation rate % (before rotation)	28.49%	46.85%	62.80%	-
Eigenvalue (after rotation)	1.66	1.38	1.36	-
Variance interpretation rate % (after rotation)	23.76%	19.66%	19.38%	-
Cumulative variance interpretation rate % (after rotation)	23.76%	43.42%	62.80%	-
KMO value	0.596			-
Bartlett's sphericity value	33.696			-
df	21.000			-
p-value	0.039			-

**Table 2. Validity Analysis of Objective Questions in the Student's Questionnaire**

Questionnaire items/indicators	factor 1	factor 2	factor 3	communality
1. How long is the continuous study time without a break that you are more accustomed to?	-0.08	0.81	-	0.663
2. Do you realize during class that you have already forgotten what the teacher just taught?	-	-	1.00	1.000
3. On average, how many times will forgetting occur in one class?	-0.65	-0.12	-	0.432
4. Do you think there is a relationship between forgetting and listening attentively in class?	0.09	0.56	-	0.320
5. If the score for listening attentively ranges from 0 to 10, how many points do you think you can get?	0.70	0.19	-	0.520
6. Compared to last year, is the frequency of forgetting things and items more or less recently?	0.78	-0.04	-	0.607
7. How much do you think "forgetting" affects learning?	-0.25	-0.54	-	0.353
Eigenvalue (before rotation)	1.77	1.12	1.00	-
Variance interpretation rate % (before rotation)	25.34%	16.02%	14.29%	-
Cumulative variance interpretation rate % (before rotation)	25.34%	41.37%	55.65%	-
Eigenvalue (after rotation)	1.58	1.31	1.00	-
Variance interpretation rate % (after rotation)	22.60%	18.76%	14.29%	-
Cumulative variance interpretation rate % (after rotation)	22.60%	41.37%	55.65%	-
KMO value	0.685			-
Bartlett's sphericity value	42.313			-
df	21.000			-
p-value	0.004			-

In this study, several items in the survey questionnaires were subjected to correlation analysis. In the teacher version of the

questionnaire, the correlation between "How many times have you tested positive for COVID-19 since 2022?" and "Compared to last

year, has the occurrence of 'forgetfulness' in your recent life increased or decreased?" is  $-0.36$  ( $p<0.01$ ), indicating a significant correlation between the positivity for COVID-19 and an increase in forgetfulness in daily life. In the student survey questionnaire, 81.6% of the students realized that they forgot the knowledge points just taught during class, with 41.4% forgetting more than three times per class. 64.0% of the students believe that forgetfulness is related to not paying attention in class, but at the same time, 65.4% of the students reported that their forgetfulness of things and items has become more severe this year compared to last year. Cross-analysis reveals that students who self-assess their forgetfulness as more severe than last year are more likely to fall into the category of students who self-assess their attentiveness in class as less serious (0-6 points, 72.7%)(Table 3),

Non-knowledge-based Science and Engineering Courses

Programming Language Courses

Ideological and Political Courses

Mathematics Courses

Knowledge-based Science and Engineering Courses

Foreign Language Courses

suggesting that students who are not attentive in class tend to experience increased forgetfulness in their daily lives. Conversely, students who self-assess their attentiveness in class as serious (7-10 points) mostly do not agree that attentiveness in class affects forgetfulness, indirectly supporting the above speculation. Only 8.8% of the students self-assess that forgetfulness has no impact on their learning, 50% believe it has an impact but they can overcome it, 23.5% think it has a significant impact, and 17.7% believe it has a severe impact. When analyzed by course, among 102 valid responses, the courses with higher frequency rankings are Foreign Language (English, 24.5%), Knowledge-based Science and Engineering (24.5%), Mathematics (17.6%), Politics (10.8%), and Programming Language courses (9.8%)(Figure 1).



**Figure 1. Bar Chart of the Statistics on the Types of Courses and the Learning Burden**

**Table 3. Cross-Analysis Table of Self-Assessed Listening Scores and Increased/Decreased Forgetfulness in Daily Life**

Self-Assessed Listening Scores	Increased/Decreased Forget-fulness in Daily Life	Increased	Decreased	Subtotal
0-2	6(85.71%)	1(14.29%)	7	
3-4	10(71.43%)	4(28.57%)	14	
5-6	48(80%)	12(20%)	60	
7-8	24(51.06%)	23(48.94%)	47	
9-10	1(12.5%)	7(87.5%)	8	
Subtotal	89(65.44%)	47(34.56%)	136	

In the teacher version of the survey questionnaire, 62% of the faculty members indicated that their forgetfulness of things and items has become more severe this year compared to last year. Cross-analysis revealed that faculty members who self-assess their forgetfulness as more severe than last year are more concentrated among those who experience more frequent word-forgetfulness during class (more than 2 times) (Table 4). The cross-analysis results of working years and word-forgetfulness during class showed a U-shaped trend: new teachers with 2 years of experience have an average of 1.29 times of word-forgetfulness per class, which gradually

decreases to 1.2 (2-4 years), 0.67 (5-8 years) as the working years increase. However, after working for more than 9 years, the average number of word-forgetfulness per class rebounds to at least 1.44 times (the minimum value of 5 is taken for more than 5 times, thus this data is the most conservative estimate). This seems to suggest that the impact of forgetfulness during the teaching process is greater for newly hired teachers and older teachers, while the impact is the least for teachers aged 5-8 years, who benefit from both proficiency in their work and better physical fitness(Table 5).

**Table 4. Cross-Analysis Table of teachers Word-Forgetfulness during Class and Increased/Decreased Forgetfulness in Daily Life**

Increased/Decreased Forget-fulness in Daily Life Word	Increased	No feeling	Decreased	Subtotal
Forgetfulness During Class				
Never occurred.	6(46.15%)	<b>7(53.85%)</b>	0(0.00%)	13
0 - 2 times.	<b>18(62.07%)</b>	11(37.93%)	0(0.00%)	29
3 - 5 times.	<b>4(80%)</b>	1(20%)	0(0.00%)	5
More than 5 times.	<b>3(100%)</b>	0(0.00%)	0(0.00%)	3
Subtotal	31(62%)	19(38%)	0(0.00%)	50

**Table 5. Cross-analysis Table of Teachers Forgetting Words during Class and Years of Service**

Years of services Word	Less than 2 years.	2 - 4 years.	5 - 8 years.	More than 9 years.	Subtotal
Forgetfulness During Class					
Never	1(7.69%)	<b>4(30.77%)</b>	<b>2(15.38%)</b>	6(46.15%)	13
0 - 2 times.	<b>5(17.24%)</b>	4(13.79%)	<b>4(13.79%)</b>	<b>16(55.17%)</b>	29
3 - 5 times.	<b>1(20%)</b>	<b>2(40%)</b>	0(0.00%)	2(40%)	5
>5 times.	0(0.00%)	0(0.00%)	0(0.00%)	<b>3(100%)</b>	3
per capita	1.29	1.2	0.67	<b>1.44</b>	
Subtotal	7(14%)	10(20%)	6(12%)	27(54%)	50

## 2.2 Analysis of Improvement Actions for Classroom Forgetfulness among Teachers and Students

A significant majority, 78%, of teachers believe that brief moments of forgetfulness during teaching do affect the quality of their instruction, but they feel they can overcome the impact. 72% of teachers consider that courses they have recently taken over and newly launched courses (72%), as well as courses with a heavy emphasis on theoretical principles (56%), are more significantly affected by forgetfulness. Among the teachers who experience forgetfulness during teaching (n=37), 27% choose to pause their lecture for a few seconds to recall the content they intended to teach; 56.8% of teachers opt to skip the forgotten content to ensure the continuity of the lecture material. 84.6% of teachers believe that thorough preparation and familiarity with the teaching material can reduce the occurrence of forgetfulness during lectures, and 46.2% of teachers find the note function of slides to be helpful as a prompt when they forget.

Students' methods for improving forgetfulness are relatively singular, including repeated recitation of knowledge points (32.4%), note-taking and transcription (68.38%), and regular review of knowledge points (51.47%). Less than one-third of students (32.4%) utilize multimedia and other new technologies as aids.

## 2.3 Understanding of COVID-19

Among the teachers surveyed, 44% had not heard of the view that COVID-19 affects memory, while 8% had not heard of it and considered it impossible. Another 56% of teachers had heard of this viewpoint and believed it might be true. Notably, no one chose "heard of it but thinks it's impossible." In the survey on protective measures taken against COVID-19 infection, the highest proportion was the use of disposable surgical masks, reaching 72%. This was followed by vaccination at 56%, hand sanitizer with alcohol at 46%, and N95 masks at 38%. Other protective measures were relatively lower, with fresh air systems and air disinfectors at 8%, topical antibody nasal sprays and liquid masks at 4%, and ozone disinfection machines at 4%. Additionally, 36% of individuals have declared that they have completely given up on protection.

Including self-tests and estimates, since 2022, the proportions of teachers who have tested positive once, twice, and three times are 30%, 38%, and 20%, respectively. Four individuals (8%) claim to have never tested positive, while two individuals (4%) report having tested positive more than four times. Cross-analysis indicates a significant weak correlation between "How many times have you tested positive for COVID-19 since 2022?" and "Have you heard of the view that 'COVID-19 can lead to memory decline?'" ( $\rho=0.28$ ,  $p<0.05$ ). This seems to suggest that increased understanding of COVID-19 may help reduce the number of

COVID-19 positive cases.

### 3. Results

The results of the survey questionnaire in this study seem to reflect some interesting conclusions, including:

62% of teachers and 65.4% of students believe that the incidence of forgetting things and items is more severe this year compared to last year.

The classroom forgetting phenomenon caused by COVID-19 is more common among students who are less attentive in class and among both new and older teachers (with working years of less than 2 years or more than 9 years).

Courses that present knowledge points are most affected by forgetting, while courses with more hands-on activities are less affected.

The actions taken by teachers and students to improve classroom forgetting are relatively singular. 56.8% of teachers will skip the forgotten content during teaching, and 27% of teachers will pause to recall the teaching content. Note-taking and transcription remain the most commonly used methods by students to combat forgetting (68.38%).

Teachers have limited knowledge of the view that "COVID-19 affects memory" (44%), and a significant number of people have declared that they have completely given up on any protection.

### 4. Discussion

Lindsley found in 2021 that placing two HEPA air purifiers near patients could reduce the aerosol exposure of those around them by 65%, and if those around them also wore masks, the aerosol exposure could be reduced by about 90%[8]. Many private schools have established systems to prevent COVID-19 infections. For example, Abrome School, a private elementary school in Austin, Texas, USA, has achieved zero infections on campus since the outbreak of the epidemic through indoor mask-wearing for all, outdoor dining, increasing classroom ventilation, and daily nucleic acid mixed testing. An independent school in Brisbane, Australia, has achieved zero transmission of COVID-19 on campus by placing HEPA air purifiers in areas with poor air circulation within the school. King's College School, a private school in Wimbledon, UK, has also equipped itself with air purification devices that can reduce the spread of the coronavirus[9]. However, most public schools are not very enthusiastic about

reducing the spread of COVID-19 on campus. Some scholars believe that this is related to the lack of understanding of COVID-19 among school policymakers. In July 2022, UNISON, ASCL, NAHT, NEU, GMB, and other seven major UK school staff unions wrote an open letter to the UK Education Minister James Cleverly, urging the Ministry of Education to provide additional funds to schools to improve ventilation and purchase HEPA air filtration equipment for all schools[10].

We suggest that universities should add HEPA air filtration equipment to classrooms. Even if they are limited by funding issues and cannot provide it, they should also provide teachers and students with COVID-19 related popular science and general courses, because the results of this study show that even increasing the understanding of COVID-19 can help reduce the number of positive cases of COVID-19.

In view of the current insufficient understanding of the harm of Long Covid, schools should pay attention to the dual impact of the cognitive decline caused by COVID-19 on teachers and students in the post-epidemic era. Schools should provide help to students with poor grades and new or old teachers to reduce the potential impact of forgetting on teaching quality. For example, they could provide more course tutoring and teaching care for students who are lagging behind.

Teachers should take the initiative to adjust the structure of courses, enrich interactive and practical teaching segments, and reduce the "dry" course time of knowledge preaching. Students should actively use a variety of memory methods to minimize the adverse effects of single memory methods on learning. In China, the simple classroom teaching and learning methods have a long history, but in the post-COVID-19 era, if we do not find ways to improve these teaching and learning methods, it may lead to more severe educational inequality.

### Acknowledgments

This paper is supported by the Fundamental Research Funds for the Central Universities (KYTZ202278, SETRF202514).

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