

Covid-19 and Behavioural Changes in Students' Learning Patterns and Efficiency

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ABSTRACT. *The COVID-19 epidemic, which was first identified in Wuhan, spread rapidly throughout China and caused many changes in students' learning behaviors to an online-based method. This has caused students to have different behaviors while learning, which might help or harm their studying efficiency. Thus, this research is aimed to investigate this change in Chinese high school students' studying behavior and their learning efficiency. Previous researches have revealed that the COVID-19 outbreak already brought mental and emotional stress to college students and young teenagers, which might cause their learning behaviors to change. However, as there were no researches that are based on a population of high school students, we aimed to fill this gap in previous research and examine the changes in high school students' studying efficiencies. We used the method of survey and case study in our research. Our conclusion is that more than half of the students can hardly adapt to online learning, and their studying efficiency is harmed due to the lack of peer pressure and other factors. In certain cases, there are still students being benefited by online learning because of their extra time. Our findings might be used for school administrators to change their administrative strategies.*

KEYWORDS: *Covid-19, Learning patterns, Behavioural changes, Efficiency*

1. Introduction

The breakout of COVID-19 this year caused some serious social problems, and it influenced people's life dramatically. There were already several studies about students' learning efficiency and their changes in behaviors under online teaching. In order to have our own understanding of this topic, we designed a study to research it.

The survey in which we conducted has a high social value. As far as we have concerned, the outbreak of COVID-19 had a substantial impact on numerous students' learning patterns, while the most obvious and important change being that students now are forced to listen to the class online, which might result in a wealth of problems such as Internet-access, stay up late, lack of restriction, etc. In our study, we aimed to discover the root cause of these problems, analyze the reason, and, if possible, came up with our own suggestions based on scientific evidence to better help with students adapting the new study pattern.

During the study, our group members expected to deepen our understanding of the influences that COVID-19 poses on various students, by analyzing the root cause by using diverse measures like doing a survey and doing data collection. Our group members hope that what we conducted can help of students who are currently suffering from online learning (E-learning) to increase their efficiency and help them to achieve what they want.

Previous studies have shown that the COVID-19 epidemic has already brought negative effects on college students' mental situations (Wenjun et al., 2020). In addition, they suggest that there might be gender differences in college students' emotional panics (Xiaoyan et al., 2020), which informed us to set up a sample base that has an almost equal gender ratio in the case study. However, these previous studies are based on population from college samples, and the studying patterns of high school students have not been studied. As home confinement might harm children and adolescents' physical and mental health (Guanhai et al., 2020), the result from this research can help high school administrators to achieve better results when coping with the changes from the COVID-19 outbreak.

2. Methods

We performed the research through several scientific measures. First, we conducted a survey in both Chinese and English, measuring the participants' time spent on studying in-school courses, extra-curricular courses, and writing assignments. After the results are received, we counted up the responses in the different questions, and we used statistical methods to show a tendency of how the students' studying patterns are changed during the COVID-19 outbreak. We also generated a theory, based on their responses in certain questions in the survey, to show how this situation has positively or negatively affected their learning efficiency. The population of our

study is Chinese students studying in Chinese public high schools, international high schools, and high schools in the US. The independent variable of our study is the COVID-19 outbreak and the schools' measures that students are now forced to learn at home, while the dependent variables are their learning patterns and learning efficiencies that has changed as a result of the independent variables. We limited the confounding variables by avoiding the potential wording effect; that is, we made the wording of our question clear and tried to make sure that no emotional descriptions are involved in them. In addition, we had a very broad population in the study, which helped us to remove some bias created by certain geographical locations or certain age groups among the high school students. Our questions for the survey that we conducted is in both Chinese and English, the questions reached to the public through social media such as WeChat Moments, and our population conducted the survey through an ethical and voluntary basis.

Table 1 the Survey Questions in Both Languages

问题(中文)	Questions (In English)
您目前来自哪种类型的学校	Are you a student in
您之前上学的时候在工作日一般每天会学习多长时间?	On average, how many hours did you study each day when you were in school on workdays?
您现在在工作日一般几点起床?	On average, when do you get up each work day for now?
您现在在工作日一般每天会学习多长时间?	On average, how many hours do you study each work day now?
您之前在学校一般每天会用多长时间完成校内作业?	On average, how many hours did you work on school assignment when you were in school each work day?
您现在在工作日一般每天会用多长时间完成校内作业?	On average, how many hours do you work on school assignments each work day now?
您在疫情期间用于学习校外课程的时间是否有所增加?(例:课外班,TOEFL,SAT,Coursera,其他自学的课程等)	Are you having more time for studying besides the school curriculum during the outbreak? (Examples: SAT, Coursera, Khan Academy, etc.)
您在远程学习的时候有没有遇到一些问题?	Are you facing some problems when learning at home?
自我评估:您现在觉得您的学习状况与以前相比更_____	Self-assessment: You currently feel that your learning situation is _____ than before:

In addition, we performed an additional case study to determine whether students resolved the problem after they returned to school in June 2020. Our aim for this study is to find out the potential reason that students are having different studying efficiencies during the COVID-19 outbreak and find ways to adjust the studying efficiencies if it is low. The population was found based on a voluntary basis by asking some students that give links on the group team members' posts in WeChat Moments, and those participants are from Public and International High Schools in Beijing. In addition, we found three random students in China based on the same voluntary basis who are in High School using the software Tencent QQ's random find people function (QQ 扩列). We found five female and six male students to complete the case study. The core questions can be found in the following chart:

Table 2 the Core Questions for the Case Study

No.	Question
1	Suppose your studying efficiency for studying in school is 5, Please rate your studying efficiency during the online studying from 1 to 10.
2	What's the reason for your rating for your studying efficiency during online learning?
3	Did you resolve the problems happened during the online learning if your learning efficiency is lower than before OR did you continue the behavior that helped your learning efficiency to be higher than before after returning to school?
4	Are you having new problems that harmed your learning efficiency OR new behaviors that helped your learning efficiency after you're back to school?

Although we first decided to ask question No. 4 every other day for three times, the second-wave outbreak of COVID-19 caused all students to return their online learnings, which made the results of some cases to be incomplete.

3. Results

Based on a broad and diversified population, the results showed that although students averagely were having more free time, their studying efficiency might be negatively influenced, and over than half of the participants said their learning situation is worse than before. Our participants are composed of those from Chinese normal high schools and International schools, and the percentages are shown in the graph below.

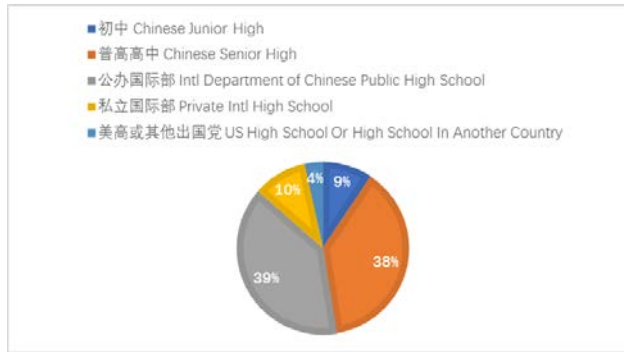


Fig.1 Are You a Student in?

The results showed several similarities before and after online learnings, including the time of getting up and the studying hours.

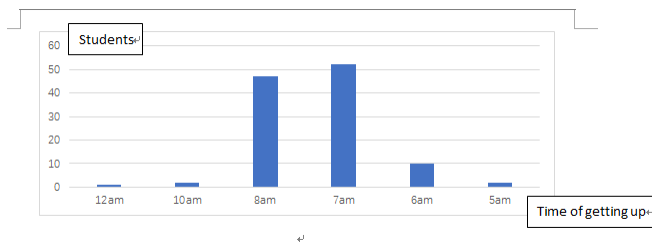


Fig.2 When Do You Get Up Each Day for Now?

Students usually get up around 8am and 7am in the past, and this result showed a strong positive correlation on their time of get up before and after. The correlation is very strong (+0.936) for the hours spent for students before and after online studying. The same tendency is shown when asking the participants their time usage working on school assignments, although some spend slightly more time during online teachings. Half of our population are having significantly more free time studying for other materials besides the school, shown in the graph below.



Fig.3 Are You Having More Time for Studying Besides the School Curriculum?

However, the students are facing several problems studying online. In this optional question, more than half of our population chose at least one problem.

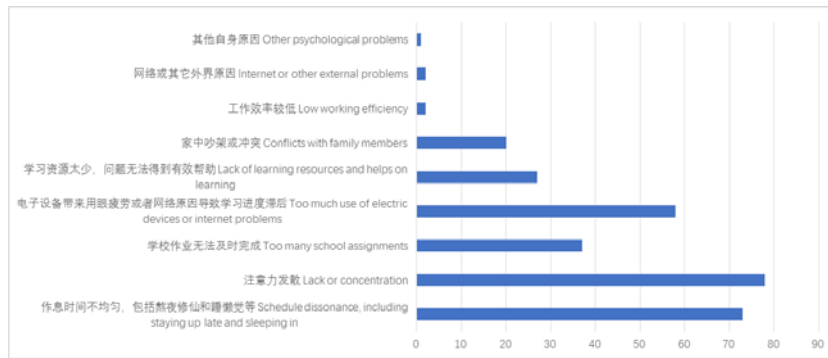


Fig.4 Are You Facing Some Problems When Learning At Home?

In the last self-assessment question, more than half of the population think that they were studying less efficient than studying in school, which might be an ongoing problem learning remotely.

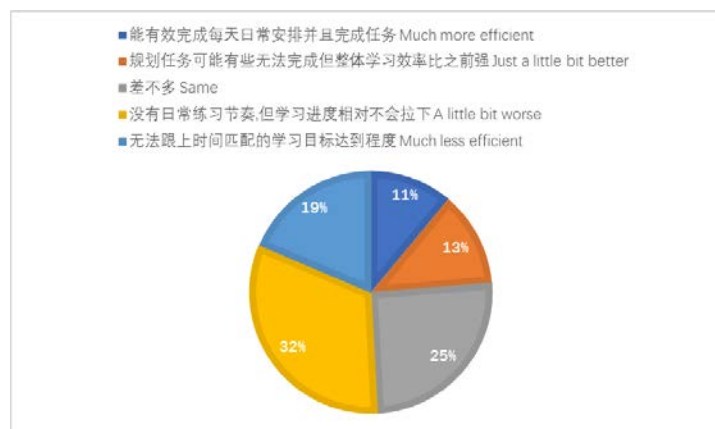


Fig.5 You Currently Feel That Your Learning Situation is ... Than Before?

After conducting case study for several days, our group collected the following information based on diverse group of samples. The background of the cases that we used are provided as below.

Table 3 Background Information For the Case Study

Sample	Background	Gender	Grade
A	Public HS, Beijing	Female	11
B	Public HS, Beijing	Female	11
C	Public HS, Beijing	Female	11
D	Public HS, Other Provinces	Male	10
E	Public HS, Other Provinces	Female	8
F	Private Intl, Beijing	Male	11
G	Public Intl, Beijing	Male	11
H	Private Intl, Beijing	Male	11
I	Public HS, Beijing	Male	11
J	Public Intl, Beijing	Female	11

By asking them the same questions with the same frequency, we received the following responses. The colors correspond with their rating on the first question: Suppose your studying efficiency for studying in school is 5, Please rate your studying efficiency during the online studying from 1 to 10. Those being marked with green have a decreased efficiency learning at home, blue refers to their learning efficiency have not changed, while orange means they think their learning efficiency is higher during online teaching.

Table 4 Questions and Responses on Before the Return and Changes after the Return

Sample	Suppose your studying efficiency for studying in school is 5. Please rate your studying efficiency during the online studying from 1 to 10.	What's the reason for your rating for your studying efficiency during online learning?	Did you resolve the problems happened during the online learning if your learning efficiency is lower than before OR did you continue the behavior that helped your learning efficiency to be higher than before after returning to school?
A	3	Not willing to study, felt like she was forced to study, there's no study atmosphere in the house	In the first week, she didn't adapt to the learning environment in the school. In the second week, it became much better
B	4	Not willing to study, want to do what she really wanted to do	It improves a little bit
C	5	Always want to use her phone since nobody monitors her.	It improves a lot since the school didn't allow students to use cellphone during the class time.
D	4	Want to play game, want to sleep, no study environment in house	It improves a lot, he deleted numerous games. The environment and peer pressure pushed him to study hardly.
E	2	Unable to get up, easily to be distracted by electronic devices, unable to focus on study	It improves a lot. She realizes it's important to focus on lecture and study. However, she is unable to persist.
F	2	Unable to study efficiently due to the lack of peer pressure	It needs considerable amount of time to adapt. Some psychological problems has been revealed from a survey by school
G	5	Sleep a lot, easily to be distracted by the electronic devices	It somehow improves.
H	5	No problem	The efficiency decreases since the school restrict a lot.
I	3	Play game at night, unable to focus on completing homework	There's no obvious improvement
J	9	Highly Motivated due to the upcoming AP Exam	Unable to focus since the AP exam has gone and she already get a satisfactory TOEFL Score

In our first question in the case study, *suppose your studying efficiency for studying in school is 5, please rate your studying efficiency during the online studying from 1 to 10*, there are three types of students shown from the results of our population. More than half (63%) students think learning at home harmed their studying efficiency, as they rated less than 5, which is lower than before (5). Those who rated higher than 5 composed of 20% of the final results, and there is one participant who thinks his studying efficiency had not changed.

We then discussed with our participants to find out why they gave their ratings. According to the majority who found learning at home unhelpful, there are 85% of them who rated that because they think they were lacking the motivation to learn, while 71% of them think their low learning efficiency is caused by the interference of electronic devices. 28% of them think the lack of peer pressures and stresses partially caused their low learning efficiency. On the other hand, one of the two who think online learning helped their learning efficiency thinks she achieved that by being motivated by the upcoming AP exams, and the other did not find out the reason for that. For the one who rated 5 in the first question, he told us that being easily to be tired and distracted by electronic devices became the reasons for him to think the learning efficiency has not changed.

5 of the 7 students who felt their learning efficiency is lower studying at home found their learning efficiencies improved as a result of returning to school. However, some still suggest that there are not obvious improvements, and it might need time to adapt to the new studying environment again. On the other hand, those who felt their learning efficiency is higher studying at home did not continue their high efficiency after they returned.

We further asked them to report new problems that they encountered after returning back to school.

Table 5 New Problems

Sample	New Problem(s)
A	Time is not enough. It is very late when she does the homework after dinner.
B	She still doesn't want to study, and she started to do other things not relevant to the course after finishing the assignment, and not very willing to review.
C	She can't sleep well at night, which results in a lack of concentration during the classes.
D	He thinks the courses become harder. He forgets many things he learned in the past. There are too many things to learn, which means he needs to find a new way to increase efficiency.
E	Unable to focus on the lecture in classes, lack of motivation to study on certain subjects due to the high level of difficulty and excessive amount of homework. Easy to be distracted by the electronic devices.
F	Need to adapt the trivial changes in the school, like can't order delivery foods
G	The courses and self-study periods during school time are still very inefficient.
H	The school has stopped offering lectures, students go back to the online learning.
I	Difficulties when adapting the school curriculum, and he always feels tired due to the lack of sleep.
J	Since she already finished the AP exams and she already got a good TOEFL score, she didn't pay too much attention studying and were mostly relaxing during school days.

Due to the second-wave outbreak in Beijing, sample H did not give us a valid response as he was back to online studying. According to the rest of the table, all of the samples except J, no matter how their learning efficiencies were at home, found new problems appearing when they were back to school.

4. Discussion

Generally speaking, the majority of students' study efficiency has increased after they returned to school (specific data has been presented in the results session). However, during the study, it is also evident that there are some samples who reported that their study efficiency has decreased since they go back to school due to various reasons, some of them stated that due to the restrictions in school, they can no longer efficiently use the electronic devices to study. Others claimed that they no longer kept their stress level in school due to certain arrangements. It can be inferred that this type of student thinks that it is more flexible to study at home, they do not have to follow a specific schedule but arrange their own time in a particular, suitable way instead, which may possibly improve their study efficiency.

It is also observed that there is one sample who reported no difference in the study efficiency between life and the online classes. Those students believe that they are both advantages and disadvantages of live lecture and online learning, and they have no personal preference between these two types of learning. It can be inferred that these types of students have a strong ability to restrict themselves, to keep themselves away from electronic devices during class and homework time, which helped them to maintain the level of efficiency compared to normal school schedules.

The presented two types of students could possibly be more successful when they enter a free environment such as the university, in which no teachers will remind them to not play video games or sleep in classes, where the ability of self-controlling is very important.

Also, our study showed that the majority of our students could not study efficiently at home due to the fact that they are easy to be distracted. Therefore, it is essential for the school to cultivate their independent thinking ability and help them to arrange their own time to pursue greater success in the future.

To sum up, those abnormal samples give us a kindly reminder that even though it is true that majority of students reported they were studying more efficiently at school, the minority of students can still utilize time efficiently in home due to various reasons such as their greater self-control ability, restraints at school, the flexible arrangement at home, etc. All of the schools, no matter public or private, should pay attention to those minoritized students by taking some practical actions, such as starting a survey to investigate which study pattern can help students to improve their efficiency of learning, or changing school policies to ensure that they can also adopt their favorited study pattern to fulfill their potential and achieve their ultimate goal.

However, there are some confounding variables that existed in our survey, like the wording effect. Also, in the case study, we asked several students to report their feelings by themselves; what they have report might be subjective instead of objective.

5. Conclusion

To sum up, our group members have utilized several methods to seek the impact in which COVID-19 has pose on students' thinking patterns by using not only surveys but also case studies. From the surveys, we can clearly draw the conclusion in which the majority of students reported that their study efficiency had been decreased when studying at home. After we conducted the survey, we further decided to do the case study in order to find the root cause of the phenomenon from the survey and discuss individual differences. In the case study, we picked up some students based on the random sampling principle and discovered individual differences in study efficiency between students; some students reported that they felt they could study more efficiently when studying at home due to various reasons, according to the discussion part. Some students also said that they found no differences in studying efficiency between school and home. However, there are some limitations to our study. One is that the population of our survey can be expanded so that the results can be more scientific. Another is that many of the participants in the case study did not report their Day-2 and Day-3 results due to the second wave COVID-19 outbreak in Beijing. These flaws should be considered when repeating this study again. To sum up, the study gives schools and educators a kindly reminder that the school needs to consider individual differences when consider making school policies to ensure that every student can maximize their potential under their favorite study pattern.

Admittedly, there were some flaws that took place in our academic essay, such as our sample might be not diverse enough (most of our samples were from Beijing, for example). Also, due to the reason that the school postponed again, most of our sample only reported for one day for the last question. It can be predicted that if we had more time and budget to seek samples from all over China, we could get a more diversified sample. Also, if the school did not postpone, we can report all of our samples for several days instead of just one day, which could generate more precise results.

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