The Impact of Online Teaching on High School Students' Academic Stress

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Abstract. When the Covid-19 hit China in 2019, Chinese schools adopted online teaching to minimize the spread of the epidemic. After the outbreak passed, online teaching remained, and many students experienced academic stress while online teaching, causing anxiety for both students and parents. It is necessary to investigate the factors that contribute to academic stress when online teaching. The research used a questionnaire to survey more than three hundred high school students in several districts to find out the factors that cause academic stress during online teaching. The results show that three factors can influence academic stress during online teaching. Firstly, there is a significant positive correlation between duration of the online course and the academic stress. Secondly, the correlation between the number of one-to-one online courses and the amount of academic stress is students have more one-to-one online courses, the academic stress fewer. Third, correlation between the number of subjects in an online course and academic stress is also significant. What's more, there are many other factors can influence students 'academic stress during the online learning. First, a good family environment is conducive to reduce online teaching stress: the family environment better, the academic stress during online teaching fewer. Second, cultivating students' self-control is helpful for reducing online teaching stress: students are more self-control, academic stress during online teaching fewer. Third, teacher-student interaction facilitates is conductive to reduce online teaching stress: teacher interact with students more times, academic stress during online teaching.

Keywords: High school students; online teaching; academic stress; mental health.

1. Introduction

Due to the outbreak of the Covid-19 in early 2020, using the Internet to attend classes at home became the main way for primary and secondary school students to learn at that time. After the Covid-19, online teaching is still preserved. High school students who are faced with a heavy academic load and are in their adolescent years should be the group of students who are more affected by the process of online teaching [1]. The inability to study with peers, the inability to communicate face-to-face with teachers about academic problems, and the conflicts with parents at home can all have an impact on students' mental health, which also has a subtle effect on high school students' academic stress [2].

One of the major differences between online teaching and studying at school is that high school students are not able to have discussions with their peers and are in a relatively closed state at home; many high school students begin to become addicted to the Internet or become uncommunicative in the process of online teaching. Many students also can't find a sense of direction in learning, can't study efficiently, and are prone to blind anxiety. While online teaching brings convenience to high school students, there are also some hidden dangers [3].Only by finding these problems and causes and coming up with relevant countermeasures can we minimize the negative emotions that affect high school students' studies and reduce their academic pressure.

A number of scholars have already presented their views on academic stress. Zhang Yue suggests that stress is a special relationship between human beings and their environment. In this relationship, people feel that the demands of the environment are beyond their ability to cope with, or the demands

of the environment have threatened their own needs and motives. She believes that academic stress is the learner's reflection or feeling of the demands of the internal and external environments that are beyond his or her ability to cope with or that may threaten him or her[4].However, the academic stress situation involved in this study only involves artificially designed research scenarios, which are distant from the real academic stress situation of high school students. As the Covid-19 led to a long period of online teaching in Chinese high schools, some scholars have already made studies on the impact of online teaching on academic stress. Liu et al. surveyed high school students in Henan Province through the Public Health Emergency Psychological Questionnaire (PQEEPH) and the Secondary School Student Stress Questionnaire on Learning Stress (SSQMSS) [5], and found that students' mental health as well as psychological stress changed during the period of online teaching caused by the Covid-19, and came to the conclusion that academic stress during the period of online teaching caused by the Covid-19 was an effective predictor of mental health. The study was conducted to determine the effects of the Covid-19 on students' mental health and psychological stress. The study included only the academic stress and mental health of students in online classes due to the Covid-19, and did not include the effects of online teaching on students' stress during normal times. In this paper, the long period of online teaching due to the Covid-19 is not representative of online teaching in normal times, and the implications of this issue for the psychoeducation of high school students will be examined in the study of the effects of online education in normal times on students' academic stress.

Regarding online education, Takács, R. et al. in their study on the impact of CKP on students' performance suggests that the dropout rate increases significantly due to the inequality between home study and distance learning provided by universities during the period of CKP [6]. However, this study is very limited and is only representative of student dropout rates during the time of CKP.

Further research is needed in the psycho-pedagogical community on the effects of online teaching on academic stress during non-specialized periods. Therefore, the research takes high school students as the target and conducts empirical research on the impact of online teaching on high school students' academic stress by means of a questionnaire survey.

2. Methods

2.1. Design

Based on the need to collect data conveniently in the research, high school students are selected as the research subjects and the questionnaire was utilized in the research. The questionnaire is divided into three main sections. First, a survey of the respondents' basic information, including gender, grade level, time spent in online education, and type of online class. Second, questions adapt from the DASS-21 questionnaire to investigate the level of academic stress among high school students. Third, questions about other factors affecting the academic stress during the online teaching period, and suggestions for current online teaching questions about the impact of online education on high school students.

2.2. Research Object

The questionnaire of this study is released on July 3, 2023 on the platform of Questionnaire.com, and a total of 331 questionnaires are collected by July 17, 2023, excluding 40 questionnaires due to irregularities in completion, leaving a total of 291 questionnaires. The high school students who completed the questionnaire are mainly from Guangdong Province, Jiangsu Province and Hubei Province in China. Among them, 51.06% are female and 48.94% are male. Among them, 44.71% were seniors, 38.67% are sophomores, and the remaining 16.62% are freshmen. Among them, 41.39% are from general high schools, 32.93% are from international high schools, and the remaining 25.68% are from key high schools. Since the questionnaire is completed voluntarily, the response rate is not calculated. All participants volunteered to answer the questionnaire anonymously and provided informed consent online prior to the survey

2.3. Research Process

The questionnaire is designed in advance and the measurement scale is selected DASS-21[7].The scale has been tested to have good reliability and validity and is highly practical and suitable for investigating high school students[8]. Questionnaires are sent to high school students from different regions, different genders and different learning abilities. Thus, the error of the experiment is reduced and the results are more accurate. Students are required to complete the questionnaire independently and within a certain period of time. After collecting the questionnaire, the data are sorted out, analyzed and tested, and the research results were obtained.

2.4. Analysis Method

Microsoft Excel sheet is used to collect the data information on the student questionnaire and SPSS 25.0 statistical software is used to analyze the collected data. The count information is expressed as percentage and the calculated information is expressed as mean and standard deviation. In addition to this, chi-square test is also required to be used for the analysis of variance and regression analysis. The comparison and analysis of the data shows that the students are taught online due to the change in teaching methods: the corresponding changes in psychology.

3. Results

In response to the theme of "the impact of online teaching on high school students' academic stress ", the research conducted a questionnaire survey on 331 high school students from different regions, 48.94% of male students and 51.06% of female students, of which 16.62% were freshmen, 38.67% were sophomores and 44.71% were juniors, of which 25.68% were from key high schools, 41.39% were from regular high schools and 32.93% were from international high schools. 44.71% senior high school students, who were 25.68% from key high schools, 41.39% from general high schools and 32.93% from international high schools respectively.

After a fine analysis of the survey, it can be seen that 86.71% of the students think that online teaching are more stressful compared to offline courses. The student has come up with the following three research conclusions, and the following analyses are made specifically according to the research results.

3.1. Longer Online Teaching Time Will Bring More Academic Stress

According to the results of the Chi-Squared Test in Table 1, the significance coefficient is less than 0.01, which indicates that the duration of online courses is significantly related to academic stress, and there is a significant difference based on the classification of the duration of online teaching.

According to the results of cross-tabulation analysis in Table 2, online teaching duration of about one semester causes a high proportion of academic stress, indicating that in online course causes high academic stress , and in online courses, online teaching duration of about one week causes a small proportion of academic stress, indicating that in online teaching, short online teaching duration causes low academic stress. The results of the survey show that 6.04% of high school students' online courses lasted for about a week, 21.15% lasted for about a month, 38.07% lasted for about a semester and 34.74% lasted for one academic year and more.

When taking online courses, 78.55% of the students felt that the person had difficulty in breathing, which indicates that the students' physical stress capacity has been reduced, which will affect whose studies in the long run.

Table 1.Chi-Squared Test

	value	Degree of freedom	Progressive significance (bilateral)
Pearson's chi-squared test	40.934[a]	9	.000
likelihood ratio	40.381	9	.000
Linear correlation	10.320	1	.001
Number of valid cases	331		

a. One cell (6.3%) has an expected count of less than 5. The minimum expected count is 2.05.

Survey results show that a total of 91.23% of students found it difficult to be quiet while participating in online teaching; 89.73% of students did not feel any pleasure or smoothness emotionally because of the stress caused by long hours of online teaching. From a psychological point of view, every student has a different level of acceptance of knowledge, and certain groups of students with poorer comprehension skills will face heavy learning tasks, which will lead to greater psychological pressure on themselves, and serious students may even suffer from low self-esteem and depression, according to the results of the survey, 84.89 per cent of the students thought that because of the pressure given by on-line learning, it made it impossible for them to be enthusiastic about anything and 81.27% of the students broke down because of the learning pressure generated by participating in online learning, which will be very unfavourable to students' growth and learning. In online teaching, the shorter the duration of the online course the less the learning pressure; the longer the online course, the more the academic stress.

Table 2. Cross-tabulation analysis

	Q6_ The duration of your online teaching	Q8_When taking part in online teaching, I didn't seem to feel any pleasure at all because of the great pressure				
		Sometimes agree with	Sometimes agree with	always agree with	disagree	Total
Percentage of Q6_ duration of your online teaching	A week or so	20.0%	35.%	25.%	20.%	100.0%
	A month or so	45.7%	27.1%	15.7%	11.4%	100.0%
	A semester or son	28.6%	34.9%	27.8%	8.7%	100.0%
	academic year or more	13.9%	25.2%	51.3%	9.6%	100.0%

3.2. More Online One-on-one Courses Bring More Academic Pressure

According to the results of the Chi-squared test in Table 3, the significance coefficient is less than 0.01, which indicates that the type of online teaching is significantly related to academic stress, which is significantly different based on the classification of the type of online teaching.

According to the results of cross-tabulation analysis in Table 4, a high percentage of academic stress is caused by attending live class sessions in online courses, indicating that live class sessions cause more academic stress in online learning, and a low percentage of academic stress is caused by attending audio courses, indicating that audio courses cause less academic stress in online learning.

During the survey, the person found that the types of online courses routinely offered by colleges and universities are roughly divided into four categories, which are "one-on-one live class", "class live class", "audio class" and "recorded class". "Recorded Classes". Among them, the proportion of "class live class" is the highest at 41.39%, and

The proportion of "one-to-one live class" is the lowest at 17.82%, which reflects that there are certain deficiencies in universities in customizing the types of courses for students.

One-on-one courses refer to face-to-face lectures between teachers and students, in which teachers are able to better care for each student's learning process and understanding of knowledge, thus better solving the individualized learning needs.

The results of the survey show that 84.59% of the students said that more often than not the pressure the person feel is more beat up than anyone else, bearing in mind that academic pressure is a personal experience that varies from person to person when dealing with the educational environment The person are in. Some students feel more relaxed and confident with one-to-one tutoring, while others feel more anxious.

Table 3. Chi-Squared Test

	value	Degree of freedom	Progressive significance (bilateral)
Pearson's chi-squared test	70.042[a]	9	.000
likelihood ratio	76.298	9	.000
Linear correlation	1.548	1	.0213
Number of valid cases	331		

a.The expected count of 0 cells (0.0%) is less than 5.

Table 4. Cross-tabulation analysis

Q4_The type of online courses you regularly attend		Q8_When taking part in online teaching, I didn't seem to feel any pleasure at all because of the great pressure				
		Sometimes agree with	Sometimes agree with	always agree with	disagree	Total
Percentage of Q4_ Types of online courses you regularly take	Live class lesson	39.4%	22.6%	24.1%	13.9%	100.0%
	Audio lesson	7.7%	43.1%	46.2%	3.1%	100.0%
	Record and broadcast lesson	12.9%	30.0%	55.7%	1.4%	100.0%
	One-on-one live lesson	33.9%	32.2%	13.6%	20.3%	100.0%

3.3. More Online Teaching Bring More Academic Stress

According to the results of the Chi-Squared Test in Table 5, the significance coefficient is less than 0.01, which indicates that the number of online teaching is significantly related to academic stress, and there is a significant difference based on the classification of the number of online teaching duration.

According to the results of cross-tabulation analysis in Table 6, in online teaching, the number of online course subjects is about 5 to 10 courses causing a high proportion of academic stress, indicating that the number of online course subjects in online learning causes a high proportion of academic stress, and the number of online teaching subjects in online teaching is 1 course causing a small proportion of academic stress, indicating that the number of online course subjects in online teaching causes a low proportion of academic stress.

During online instruction, the more subjects in an online teaching the more academic stress you have. Subjects vary in difficulty. Some courses are relatively easy for students, but others are difficult, thus causing academic stress. The results of the survey show that fewer high school students have "1" online course (5.44%), 35.95% have "3-5" online courses, and 36.25% have "5-10" online courses. There are 35.95% of high school students have "3-5" online teaching, 36.25% of high school students have "5-10" online courses, and 22.36% of high school students have "10 or more" online courses.

The fewer subjects you take online, the less pressure you have to study. In the face of many online courses, 86.40% of the students think that the person consume more energy than attending offline courses, which leads to less study time allocated to various subjects, on the contrary, the fewer subjects one takes, the more time students have to cope with various subjects, and a reasonable arrangement will reduce the degree of academic tension, thus reducing the pressure of academic studies.

Table 5. Chi-Squared Test

	value	Degree of freedom	Progressive significance (bilateral)
Pearson's chi-squared test	49.520[a]	9	.000
likelihood ratio	56.919	9	.000
Linear correlation	8.049	1	.005
Number of valid cases	331		

a. 2 cells (12.5%) have an expected count of less than 5. The minimum expected count is 1.85.

Table 6. Cross-tabulation analysis(Table 6)

Q5_ The number of online courses you have taken during your online education is		Q8_When taking part in online teaching, I didn't seem to feel any pleasure at all because of the great pressure				
		Sometimes agree with	Sometimes agree with	always agree with	disagree	Total
Q5_ The number of online courses you have taken during your online education is	one course	33.3%	27.8%	22.2%	16.7%	100.0%
	three courses~five courses	37.0%	28.6%	19.3%	15.1%	100.0%
	five courses~ten courses	29.2%	28.3%	33.3%	9.2%	100.0%
	Above ten courses	4.1%	35.1%	58.1%	2.7%	100.0%

4. Discussion

From the analysis of the questionnaire, it is clear that there are other factors that add to the academic pressure of the student population during the period of online teaching.

4.1. A Good Family Environment is Conducive to Reduce Academic Stress.

In addition to relying on the training of teachers and the talent and diligence of individuals, the learning quality of students also depends on the disadvantages of the family environment [8]. In online teaching, most students are home-schooled. Therefore, it's inevitable that they will communicate and even argue with their family members. And the results of the collected questionnaires also show that most high school students believe that tensions with their parents will cause them to be unable to concentrate on their studies. If school teachers do not intervene in a timely manner to co-operate with parents, high school students can easily become resistant to their parents and refuse to communicate with them, thus exacerbating the consequences. Schools can even offer parents courses on how to get it right with their kids, and relationships can only improve if both parties are able to think about and make changes for each other. The online teaching should pay attention to emotional interaction, so the design should follow the principles of inspirational content, convenient mode, two-way process and interactivity and openness [9]. Therefore, in addition to focusing on class efficiency in online teaching, it is important to pay more attention to the mental health of students. Teach students things other than textbooks, such as how to get along with family

members. When high school students have better relationships with their family members, they are able to communicate better. High school students are also able to talk to their parents about academic matters, which plays a positive role in their mental health. At the same time, their parents will also give them some advice, which will reduce their academic stress to some extent.

4.2. Cultivating Students' Self-control is Helpful for Reducing Academic Stress.

High school students are still immature, and without the strict management of the school during online classes, they are easily attracted to other non-academic things, thus reducing their autonomy in learning. In online teaching, students are required to use electronic devices for longer periods of time each day. However, due to their lack of self-control, they are likely to use their electronic devices for things that are not related to their studies. This can waste a lot of study time, making them less efficient and more anxious. A high school student, once a high achiever, became addicted to the internet during online teaching and regressed academically, triggering an aversion to learning that manifested itself in drowsiness in class and failure to hand in assignments [10]. Even for students who do well academically at school, the enthusiasm and autonomy for learning is greatly reduced when they take online classes at home. But it is useless to rely solely on the control of parents and schools, because high school students are in their adolescence and they are more resistant to ideas that are different from their own. They may even do extreme things to show their resistance. Schools and parents of high school students should emphasise the development of autonomy and self-control in their children. For example, incentives can be provided. Or students can be taught to think about priorities. Rather than completely eliminating the use of electronics for entertainment, use electronics only after ensuring that quality learning tasks are completed. Teachers can also make learning tasks more difficult and reduce the amount of homework. Students will be motivated to spend more time on thinking about difficult problems. All of these unique teaching styles will increase students' autonomy, which will enhance their learning efficiency. This will give high school students some relief from their academic stress.

4.3. Teacher-student Interaction Facilitates is Conductive to Reduce Academic Stress.

Some students also suggested in the questionnaire that teachers should have more opportunities for interaction when conducting online teaching. Increasing the number of interactive opportunities during online teaching can effectively improve the efficiency of teaching. And there are many ways to interact. For example, group work, individual questions and answers after classes, random questions in the classroom and so on. Random questions, for example, the teacher will randomly ask students to answer questions during class, so students need to pay attention to the lecture to make sure they can answer the teacher's questions when they are asked. One-on-one questions and answers sessions can be held during class because students usually have questions when they do their homework after classes. Unlike at school, they can't get to the teachers' office quickly enough to solve the problem in person. But the accumulation of problems over time can increase their academic stress. That's why answering questions after classes isso important. And group work is a very common class format today. Even though they are online classes, some software applications allow the teachers to organise group discussions. Zoom(an application) has a similar function that allows the classes to be divided into different discussion groups. Teachers should take the initiative to learn some new technologies and make good use of the convenience that the Internet brings to the their teaching. Changing the classroom format will allow students to reap the benefits of learning even during online teaching and will make them take their studies more seriously. So enhancing the richness of the classroom is also a form of relieving their learning pressure.

Teachers are the most important roles of the educational field. In addition to excellent personal achievements and high academic levels, a truly good teacher should understand and care for his or her students. Teachers should be good at identifying difficulties in learning of students and finding solutions to them. During special periods such as online teaching, a lot of teaching work can't be carried out properly, and this will surely have an impact on the students' learning. It is vital for

teachers to minimise these negative effects. High school is a very important stage of learning, and teachers should provide their students with the utmost help and support.

Summing up, Online teaching is a prevalent teaching method in the new era, online courses provide convenience for both teachers and students, we should pay attention to online teaching and develop a more perfect online teaching programme for the general student population. Reasonable arrangement of online teaching can promote the students' learning efficiency, in a relaxed state and then more quickly achieve the learning goals.

5. Conclusion

In the research, it can be seen that when conducting online teaching, the longer high school students conduct online teaching, the greater the academic stress. When conducting online teaching, one to one courses bring more academic stress than live class lesson; when conducting online teaching, the more courses high school students take, the more academic stress they experience, and the fewer courses they take, the less academic stress. The research concludes the causes of high school students' academic stress in online teaching, and after knowing the causes, high school students and their parents can make adjustments, such as appropriately reducing the time of online teaching to reduce the academic stress of high school students and to ensure the mental health of high school students. What's more, there are many other factors can influence students 'academic stress during the online learning, like a good family environment is conductive to reduce online learning pressure, cultivating students' self-control is helpful for reducing online learning pressure and teacher-student interaction is conductive to reduce online learning pressure.

In the future, research can be continued to study how to effectively reduce the academic stress of high school students during online teaching. Since this study only used a questionnaire survey as a research method and did not conduct interviews, the results obtained have limitations and cannot represent all high school students.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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