Students' Satisfaction Towards Online Education During COVID-19 Pandemic
——Based on College Students in China

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ABSTRACT
The developing technology surely improved the way of learning and the education system. In 2021, Chinese government announced a report about the Big Data strategy and the online development of China. The report revealed that the national digital teaching system had been improving. The number of online education platforms totaled in 212, which so far had been visited for up to 3.6 billions of times. In 2020, the invasion of the corona virus had accelerated the online teaching system. During the quarantine, online platforms were used for teaching in the whole world, which will be an inevitable trend in the future. To promote the study efficiency and the platform, the research will look into the students' satisfaction towards the online teaching in four dimension: Students, Teachers, Courses and Platforms.

Keywords: *Online learning, Learning satisfaction, Covid-19, Online education.*

1. INTRODUCTION

The covid-19 pandemic has serious effects on the global education system. Millions of overseas students are sent back to their countries, studying online with ZOOM at home. Also, the whole world has to shut down all the traditional face-to-face classes and quarantined everyone in their houses to control the disease, which means that everyone needed to study and work online.

The pandemic forces students to learn through the online learning mode so that their feelings and satisfaction during the online study are key to the study efficiency.

Besides the aim of improving satisfaction and platform technology, it is essential to find out if students were capable to use the techniques and adapt to it. In this way, the research can also reflect students' competence and the regional difference.

In the end of the research, we will help promote the online platform by giving suggestions, and additionally conclude the project drawbacks.

1.1. Four dimensions

1.Students Dimension: Students attitude, interaction with teachers and classmates, study.

motivation,collaboration, and technology usage (the ease of use & perceived usefulness) on the intention of students to accept and keep studying online in the future.

2.Teachers Dimension: Teachers assistance during online study,teaching style.

3.Courses Dimension: Courses arrangement, subject difficulty, assignment and feedback, the final test.

4.Platform Dimension: Platform design, network and download speed.

1.2. Methods

The methods we use：

1.Literature Review

2.Questionnaire

3.Data Analysis

1.3. Domestic and literature reviews

Under the above conditions, many scholars investigated the issue domestically and abroad.

1.3.1 Domestic researches

The development of online education in China was a recent topic; however, it's significantly important to be discussed in the post-pandemic era. According to recent investigations, "The online education industry of China flourished in 2013 under the driving force of capitals; the scale production was achieved in 2017 supporting by livestreaming, maturing step by step." The pandemic allowed the quick expansion of online education among the education system in China [1]. Several scholars, in turn, investigated the satisfaction of students towards online education.

For domestic researches on student's satisfaction towards online education in post-pandemic eras, Researchers mainly used surveys to measure the satisfaction of students. Liu Yi and Zhang Hui Rong studied the online education outcome through teachers' and students' surveys from "5 dimensions including teachers' and students' adaptability, the usage of teaching platform and methods of teaching, the advantages and disadvantages of online education, online education effect and satisfaction, and the future of online education" [2]. Other Researchers investigated in the satisfaction and the influencing factors of students attending online courses during the pandemic through qualified surveys. "SPSS was used to evaluate the reliability and validity of the survey, and AMOS was used to analyze the structural education models" [3]. Dai Xin Lai et, al, using survey targeting "Chinese College MOOC Users", tested the satisfaction of college students using MOOCs as an online learning platform. [4]

The most recent and mainstream opinion in domestic researches about online learning shows dissatisfaction and flaws faced by the education system in China. Xue Cheng Long, in his report of "Steering and Coping Strategy of Online Teaching Reform in Colleges and Universities", reported that "the online education system implemented by now are emergent measures under the situation of the pandemic, teachers were not fully prepared with education strategies, teaching method, teaching habits, and technology in ideological and practical perspectives", therefore a strong reform and sophisticated change will have to be implemented in post-pandemic eras [5]. Overall, the attitude towards online education from domestic point of view remains negative and focus on the improvements in the future.

1.3.2 Foreign researches

The entire history of online education could be dated back years ago. back in 1960s, the University of Illinois created Intranet for students to receive online lectures and materials. This form of education cation continued to develop [6]. Later, the covid-19 pandemic in 2021 increased the speed of expansion of online education, leading to several researches to emerge centering this topic.

The main research methods in foreign studies fall into two categories: survey and Experimentation. Leah Flores Goerke, in his research, used a mixed method of experimentation and survey to investigate the students' satisfaction of online and hybrid courses in order to select the more suitable teaching method. He addressed: "The study may also add to the sparse body of comparative research literature addressing civilian and military continuing education, while, at the same time, offering senior military leaders, faculty, and support staff insights from comparisons made in a military education setting" [7]. Michele T. Cole, Daniel J. Shelley, and Louis B. Swartz "used a Web-based survey created in Vovici, an online survey software program. Following a pilot study in spring, 2010, surveys were sent to students in graduate and undergraduate business courses over a period of three years" [8]. More comparative studies and questionnaire formed investigations was used among foreign researchers.

The current conclusions of students' satisfaction towards online learning mainly focused on the pre-pandemic results and experiences of the students during the pandemic. Researchers held positive or neutral views towards online learning compared to conventional methods. Sakshi Agarwal and Jaya Shankar Kaushik found that majority of their participants found the course (97%) to be relevant to their learning, 95% found the course to be interesting [9]. On the contrary, some researches also suggests the deficiencies in online education. Michele T. Cole, Daniel J. Shelley, and Louis B. Swartz concluded that the lack of communication with classmates and instructors was experienced by students in an online environment. "[On ground] instruction affords the student the opportunity to have questions answered and for the instructor to elaborate on points to be made at the time the student is experiencing difficulty" [10].

Based on the information above, student's satisfaction of e-learning is not yet organized.Therefore, the issue will be discussed in the following context,and measurements will be implemented on 4 dimensions: teacher, student, platform technology, curriculum, with ACSI model (Fig.1). The current situation of online education will be revealed, and the method of improving the quality of online education could be.

2. CONSTRUCTION OF INFLUENCING FACTOR MODEL OF ONLINE EDUCATION SATISFACTION DURING EPIDEMIC

2.1. Determination and definition of influencing factors and variables

After tracing and sorting out the research literature, the corresponding questionnaire was prepared according to the collected influencing factor variables and the students participating in online classes were selected as the survey object. Finally, it was determined that the influencing factors of online education satisfaction during the epidemic period mainly included 6 first-class indicators: teacher, student, curriculum, students' satisfaction, online education system and platform technology, It includes 15 secondary indicator factors, such as course arrangement sequence, content detail, course duration, exercise explanation, course assessment, sense of use, interaction, learning style, ability to use, perceived ease of use, intention to use, learning motivation, correcting homework progress, timely feedback and tutor, as shown in tables below:

Table 1. Teacher

Teacher	Timely feedback	Efficiency of answering questions.
	Correct the operation progress	
	Tutor	

Table 2. Student

Student	Learning style	Individual differences, how to learn, suitable way to learn
	Ability to learn	
	Perceived ease of use	Easy to use or not
	Using intention	Want use it or not
	Learning motivation	Reasons for using it, e.g. using it when students see others use it, interest to it, and it is necessary to use it in order to cope with the final exam

Table 3. Platform Technology

Platform Technology	Sense of use	Platform layout, inconvenient search engine, how to feedback the advantages and drawbacks
	Interaction	Whether questions from student can be answered in time

Table 4. Curriculum

Curriculum	Course arrangement sequence	Whether it is consistent with students' own learning progress or school learning schedule
	Content detail	Online teaching knowledge is too basic or not
	Course duration	E.g. some courses only have a few minutes, which is not enough
	Explanation of exercises	Whether there are course exercises
	Course assessment	

2.2. The construction of hierarchical model

Referring to other relevant studies, we use the most representative ACSI model in customer satisfaction theory and adapt it into a model suitable for this study, which can clearly find the influence relationship between various variables. This study includes six variables: students' satisfaction, curriculum, student, teacher, online education system and platform technology, as shown in the figure below:

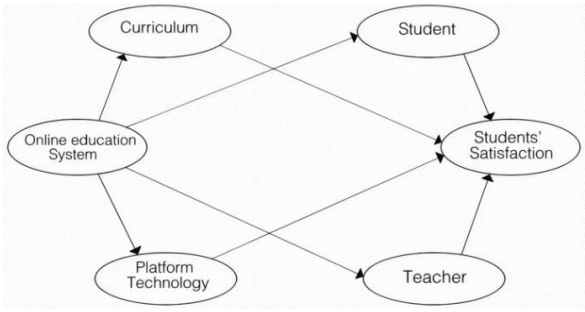

Figure 1 ACSI model.

According to relevant theories and models, this paper puts forward eight hypotheses:

1. Online education system has a positive impact on platform technology.

2. Online education system has a positive impact curriculum.

3. Online education system has a positive impact on students.

4. Online education system has a positive impact on Teacher.

5. Curriculum has a positive impact on students' satisfaction.

6. Student has a positive impact on students' satisfaction.

7. Platform technology has a positive impact on students' satisfaction.

8.Teacher has a positive impact on students' satisfaction.

2.3. Questionnaire design

The first part of the questionnaire collects the basic information of the respondents, including their age, gender, online learning platform, mode preference and online learning duration. The second, third, fourth and fifth parts investigate the respondents from the perspectives of students, teachers, platform and curriculum.

Student scale. There are 13 questions about the measurement of students' satisfaction. The options range from very unwilling / dissatisfied / little influence / small to very willing / satisfied / great influence / large. They are assigned 1-5 respectively. The higher the value, the stronger the students' satisfaction.

Table 5. Student scale

Variable	Questions
Student	My satisfaction with the online learning atmosphere
	My satisfaction with the discussion of problems among my classmates
	Would I recommend online learning to others
	I think the improvement of learning ability
	I think the impact of online learning on promoting learning
	I am satisfied that online learning can improve my knowledge and ability
	My satisfaction with the overall learning process
	Do I agree with this way of learning
	Am I willing to continue online learning
	Would I like to share my online experience with others
	My confidence in online learning

Teacher scale. There are 4 questions in total. The options range from very unwilling / dissatisfied / little influence / little to very willing / satisfied / great influence / big. They are assigned 1-5 respectively. The higher the value, the higher the teacher's satisfaction.

Table 6. Teacher scale

Variable	Questions
Teacher	My satisfaction with the communication between teachers and students
	My satisfaction with the support provided by teachers
	The influence of teachers' style on my enthusiasm in class
	My overall satisfactions with teachers

Platform technology scale. There are 4 questions in total. The options range from very unwilling / dissatisfied / low impact / low to very willing / satisfied / high impact / high, with values of 1-5 respectively. The higher the value, the stronger the platform technology.

Table 7. Platform technology scale

Variable	Questions
Platform technology	My satisfaction with online teaching network My satisfaction with the interface design of learning platform My satisfaction with the ease of use of the learning platform My satisfaction with online learning platform

Curriculum scale. There are 4 questions in total. The options range from very unwilling / dissatisfied / little influence / little to very willing / satisfied / great influence / big. They are assigned 1-5 respectively. The higher the value, the higher the course satisfaction.

Table 8. Curriculum scale

Variable	Questions
Curriculum	My expectations for online teaching activities My satisfaction with online teaching assessment methods My satisfaction with the presentation of learning resources Is the sequence of courses consistent with my learning process

3. RESULTS AND DISCUSSION

3.1 Sample Description Statistics

In descriptive statistical analysis, the average value and standard deviation are generally used to measure the index level of each variable. The higher the average value is, the higher the average level of the sample is to this index, and the standard deviation is the difference of different samples on the same index. In this questionnaire, likert 5-level scale is adopted for scale observation. The higher the score is, the higher the degree of agreement is. As can be seen from the above table, the score of teacher satisfaction, platform satisfaction and curriculum satisfaction are around 3.5, indicating that the subjects are quite approving of it. The score of student satisfaction is greater than 3, indicating that most students choose satisfaction. The standard deviation value is about 0.6, indicating that the subjects who participate in the survey have a relatively consistent view, and the fluctuation of the score is not large. To sum up, online learning have a high level of satisfaction.

Table 9. Basic Characteristic Analysis

variable	classification	number of cases	Percentage
My gender	Male	24	30%
	Female	56	70%
High school student or college student	High school student	11	13.75%
	College student	69	86.25%
The online learning platform I've used	Daxuemuke	42	52.50%
	Zhihuitree	21	26.25%
	mooc	39	48.75%
	Chaoxinerya	27	33.75%
	Others	40	50%
Which learning mode do I like best	Online learning	10	12.50%
	Mix online and offline learning	51	63.75%
	Offline learning	19	23.75%

Table 10. Mean Description Analysis

	average value	standard diviation
Student	3.238	0.6413
Teacher	3.550	0.6345
Platform	3.550	0.5932
Curriculum	3.450	0.5489
Valid sample number		

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3.2 Reliability Analysis

Reliability analysis is to measure whether the measurement results are stable, consistent and reliable. In order to ensure the accuracy of the measurement results, reliability analysis of the valid data in the questionnaire should be carried out before analysis. Cronbach's α coefficient is usually used for analysis. Generally speaking, if the reliability coefficient is above 0.9, it indicates that the reliability is very good. If between 0.8 and 0.9, it is good; Between 0.7 and 0.8, it is preferably; 0.6~0.7 indicate acceptable. A value below 0.6 indicates the need for revision. As can be seen from the following table, the reliability coefficient of scale items is relatively high. The reliability of the total questionnaire is 0.9. The reliability of student, teacher, platform and curriculum are 0.886, 0.745, 0.819 and 0.652 respectively. Therefore, the survey data are considered to be relatively reliable.

Table 11. Reliability Analysis

scale	Cronbach Alpha	number of term
student	0.886	13
teacher	0.745	4
platform	0.819	4
curriculum	0.652	4
questionnaire	0.917	25

3.3 Valid Test

In general, the smaller the Bartlett sphericity test significance level (P<0.05) is, the more likely there is a meaningful relationship between the original variables. The KMO value is used to compare the simple correlation and partial correlation coefficients between items, and the value is between 0 and 1. bigger than 0.9 mean very suitable; 0.7-0.9 is more suitable ; 0.6-0.7 mean less suitable; Not suitable between 0.6-0.5; Below 0.5 means abandon. Bartlett sphericity test value is used to test whether the correlation coefficient between items is significant. If the significance is less than 0.05, it indicates that each item is strongly correlated. KMO and

Bartlett sphericity test are used to test validity. Sphericity test is used to verify whether variables are independent of each other. The KMO value is 0.837 which is greater than 0.7, and the statistical significance of Bartlett sphericity test is 0.000<0.01, indicating the validity of questionnaire data is good.

Table 12. KMO and Bartlett's test of sphericity

Kmo		0.837
Bartlett's test of sphericity	approximate chi-square	1244.454
	Degree of freedom	300
	Sighnificance	0.000

The survey data are obtained in the form of personal self-report. Each questionnaire is completed by one investigator, and there may be common method deviation. Therefore, Harman single-factor test is used for homologous variance test to determine whether it significantly affects the research results. Without rotation, factors with eigenvalues greater than 1 are extracted, and data test results show that the first principal component explains 38.69% of the variation, less than 40%. Therefore, there is no serious common method deviation in this questionnaire. At the same time, according to the principle that the default eigenvalue of principal component method in factor extraction is greater than 1, the cumulative variance contribution rate reaches 60%, indicating that the common factor retains most information of the original data and the extraction effect is good.

Table 13. Total Variance Explanation

composition	Initial eigenvalue			Extract the sum of squares of loads			Sum of squares of rotational loads		
	tataol	Percentage of variance	Cumulative %	tataol	Percentage of variance	Cumulative %	tataol	Percentage of variance	Cumulative %
1	9.672	38.690	38.690	9.672	38.690	38.690	6.920	27.680	27.680
2	2.123	8.492	47.182	2.123	8.492	47.182	3.088	12.352	40.032
3	1.736	6.944	54.126	1.736	6.944	54.126	2.640	10.558	50.590
4	1.596	6.382	60.508	1.596	6.382	60.508	1.717	6.866	57.457
5	1.285	5.139	65.647	1.285	5.139	65.647	1.600	6.399	63.855
6	1.052	4.206	69.853	1.052	4.206	69.853	1.500	5.998	69.853
7	0.977	3.908	73.761						
8	0.890	3.560	77.321						
9	0.812	3.247	80.568						
10	0.675	2.701	83.269						
11	0.520	2.079	85.348						

12	0.498	1.992	87.341		
13	0.450	1.799	89.139		
14	0.420	1.682	90.821		
15	0.334	1.336	92.158		
16	0.319	1.276	93.433		
17	0.305	1.219	94.652		
18	0.265	1.062	95.714		
19	0.250	1.000	96.714		
20	0.200	0.801	97.515		
21	0.179	0.715	98.230		
22	0.148	0.593	98.823		
23	0.119	0.475	99.299		
24	0.102	0.408	99.707		
25	0.073	0.293	100.000		

3.4 Correlation analysis

Table 14. Correlation Analysis

		student	teacher	platform	curriculum
student	correlation	1	0.453**	0.384**	0.484**
	significance		0.000	0.000	0.000
teacher	correlation	0.453**	1	0.397**	0.480**
	significance	0.000		0.000	0.000
platform	correlation	0.384**	0.397**	1	0.513**
	significance	0.000	0.000		0.000
curriculum	correlation	0.484**	0.480**	0.513**	1
	significance	0.000	0.000	0.000	

**. At 0.01 level (two-tailed), the correlation is significant.

Correlation analysis refers to the process of describing and analyzing the nature and degree of correlation between two or more variables. Significance is less than 0.05, marked * in the upper right corner of the correlation coefficient, indicating a relationship; Otherwise, there is no relationship between any two variables. When the correlation coefficient is greater than 0, it indicates that there is a positive correlation between the two variables; when the correlation coefficient is less than 0, it indicates that there is a negative correlation between the two variables.

As can be seen from the table above, there is a significant correlation between four dimensions (students, teacher, platform and curriculum) . The correlation coefficients of all variables are greater than 0, indicating a significant positive correlation. To sum up, when students' satisfaction with the teacher, platform and curriculum is high, the satisfaction and willingness to continue using have an upward trend on the overall level, indicating that improving the satisfaction with the teacher, platform and curriculum will strengthen students' willingness to use

4. CONCLUSION

This study investigated students' satisfaction degree and influencing factors of online teaching, and established an analysis model of influencing factors of online teaching. In addition to the main index of online teaching satisfaction, there are 15 secondary indicators that affect the satisfaction. These 15 indicators mainly include four dimensions. The first dimension is student dimension, including learning style, learning ability, use intention, learning motivation, perceived ease of use. Second, the teacher dimension, including timely communication, teaching methods and homework progress. The third dimension is platform, including sense of use and interaction. Fourth, curriculum dimension, including course evaluation, course length, course schedule, practice explanation and content details.

For the students' satisfaction degree of online teaching, this paper uses the perception dimension to measure. From the perspective of direct indicator, student satisfaction dimension, student satisfaction has reached the basic satisfaction. From the perspective of indirect indicator, continuing online learning, most students are basically willing to continue learning. Combining the above two aspects, students are basically satisfied with online teaching. What's more, teacher dimension, platform dimension and curriculum dimension are all important factors affecting student satisfaction. Data analysis results show that these dimensions are significantly correlated. These important factors all have positive impacts on satisfaction.

4.1. Suggestions

Combined with the previous model and data analysis, strategies to improve students' satisfaction with online teaching can be gradually proposed from four dimensions of students, teachers, platforms and courses.

4.1.1. From the perspective of students

Learning motivation must be an important factor in the investigation. According to the different learning styles of students, let students perceive the knowledge useful or give them appropriate external learning motivation, such as assessment methods, learning rewards, etc.

4.1.2. From the perspective of teachers

Teachers should combine teaching with practice and pay attention to their own teaching ability and style. It can be seen from the model of influencing factors of network teaching satisfaction that teachers' teaching style has a great influence on students' enthusiasm in class. Teachers should adjust their teaching methods according to different teaching contents and students' experience. Besides, teachers also should communicate with students in a timely manner to provide help. In addition to the proper teaching style of teachers, online teaching mode also needs good and timely communication with students, whether it is live teaching or recorded teaching, so as to accurately understand the actual needs of students, so as to improve students' learning enthusiasm and improve the teaching effect.

4.1.3. From the perspective of platforms

Although statistics show that students are generally satisfied with online learning software. School administrators should still put forward personalized optimization and improvement requirements for online teaching platform according to students' actual needs. After the outbreak of the epidemic, a large number of online teaching platforms entered colleges and universities, and some problems were exposed after the use of some of the functions of these platforms. This requires timely and effective communication between colleges and universities and platform providers, so that the platform can constantly improve relevant functions according to the needs of colleges and universities, and timely improve the effect of online teaching.

4.1.4. From the perspective of courses

Students of different ages need different types of course resources. At the same time, differences in the way resources are presented also have an impact. So it should Improve the characteristics of course resources and pay attention to the pertinence of resources.

Beyond that, according to the data analysis of students' satisfaction with online assessment, it can be seen that course assessment has a great impact on students' learning. Therefore, there should be detailed assessment methods and standards before the development of the course, so that students can master their learning progress in time after completing a period of study.

4.2. Deficiencies of research

The selection and number of research samples are limited, which has an impact on the analysis results of the whole influencing factor model to some extent. Besides, there are too many research factors in the study, and the measurement of each variable has not been further discussed. The last deficiency is that the ratio of male to female is not equal, which is close to 3:7. It may cause some error in conclusion analysis.

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