

# Impact of Emergency Remote Education in the 2021 COVID-19 Pandemic: A Case of Higher Education Students in the Department of Mechanical Engineering

Yi-Chu Hsu<sup>1</sup>

<sup>1</sup> Department of Mechanical Engineering, Southern Taiwan University of Science and Technology, Taiwan, Republic of China

Correspondence: Yi-Chu Hsu, Department of Mechanical Engineering, Southern Taiwan University of Science and Technology, Tainan, Taiwan, Republic of China. Tel: 886-6253-3131. E-mail: yichu@stust.edu.tw

Received: January 12, 2022

Accepted: March 23, 2022

Online Published: March 25, 2022

doi:10.5539/hes.v12n2p71

URL: <https://doi.org/10.5539/hes.v12n2p71>

## Abstract

The higher education in Taiwan was forced to begin an unprecedented large-scale distance teaching emergently due to the outbreak of the COVID-19 pandemic in May 2021. This research accordingly intended to realize what the students had been experienced and the mechanical engineering at a private university of technology was investigated. There are five aspects surveyed and quantitatively their satisfying order from high to low is the following: learning resources, synchronous distance teaching, final assessment, learning effectiveness, and school equipment. Next, the qualitative data shows that most students embraced freedom and liberation at the beginning of the sudden implementation of the six-week emergency distance education, and soon discovered that the pressure of learning had become greater. Reasons include easy distraction at home, increased assignments, and relatively difficult online communication, etc. In summary, the participants have the highest satisfaction with "learning resources", although there are still students who complained that they can only access the visual classroom by poor facilities, like mobile phones (6% of the participants who cannot access computers/laptops for learning), old-fashioned computers, or no internet at home. It shows the limitations of unfair resources to online learning. Furthermore, the learning effect is the second-worst, showing that although the students have mastered the skills for synchronous remote education in the six weeks, most of them still prefer to return to the familiar and reliable face-to-face classroom, owing to the difficulties in communication, hardware, and software conditions. Finally, some suggestions for the college students to prepare for the uncertain future are provided based on the study conclusions.

**Keywords:** remote learning, distance learning, COVID-19 pandemic, higher education, online learning, emergency remote education

## 1. Introduction

In 2020, when advanced countries such as Europe and the United States were struggling with the new crown virus epidemic, the effectiveness of Taiwan's epidemic prevention was regarded as a global model and the Taiwanese seemed to live in relatively smooth space. However, a sudden outbreak of the epidemic in May of the following year brought Taiwan into the trend of the global epidemic. It brought great anxiety into our daily life and education system. A suspension of classes was announced and executed immediately six weeks before the end of the semester. This kind of educational transformation, suddenly changed from traditional classroom learning to distance learning, which may be one of the largest educational experiments to date (Almuraqab, 2020). Even under the global pandemic environment of 2020, the author and most of the colleagues had finite preparations, but are not ready for complete remote teaching. However, on Saturday, May 15, 2021, our school, like most universities in Taiwan, suddenly announced that it would start remote teaching in the following Monday. The LINE group discussion room of the department teachers exploded. Most of the online software announced by the school had had not been used. (Accurately speaking, all online meeting software had had not been used). After a few weeks of the attempts, everything slowly settled. However, what did we go through at the site of our own university in the six weeks? This sudden worsening of the epidemic caused the temporary announcement of remote teaching for six weeks, which parts are precious experiences for the students of our department. What are the difficulties which were experienced and encountered by the students? Accordingly,

three relative terms of remote learning were first explained in the next section, including emergency remote education, online learning, and distance learning. Then some works of literature were reviewed about the situations of the higher education students globally during the COVID-19 pandemic period.

### *1.1 Three Types of Remote Learning*

Emergency remote education (ERE) is a temporary change of education delivery method due to crises (for example, epidemics, wars, local conflicts, and other types of natural disasters) (Alvarez, 2020). The new coronavirus pandemic that began in 2020 requires the change of the ways of courses from the traditional classroom to distance learning. Also, many typical educational activities had to change to a new way and opened eyes to many people around the world, including online oral examinations for masters and doctoral graduates, online admissions and final exams, online academic seminars, and so on. Meanwhile, these online academic works have demonstrated that they are as effective and meaningful as the works are done in a "real" way (Strielkowski, 2020). University institutions have practiced and realized that the use of educational technology can create virtual classrooms, live lectures, online tests/quizzes or exams, file sharing, and the potential for effective communication and interaction.

Secondly, emergency remote education is not equal to online learning. Online learning is a new type of interdisciplinary field that has evolved in response to technological progress. In recent years, it has been continuously developing over time. It can quickly meet the needs of learners different from traditional and non-traditional learners and lead to open education of different scales. In the sense of the basic need and origin, online learning and the definition of emergency remote education are not the same things (Elfirdoussi et al., 2020).

Thirdly, the meanings of online learning and distance learning are more ambiguous. Distance learning is an educational situation that requires teachers and students to communicate through modern audio-visual communication technologies through a variety of educational media. Distance learning has historically been mainly to meet the needs of adult learners, who cannot spend several years studying full-time in universities. For these learners, the cost of education is too high, and for the adult learners with families, studying in another town is not always an option. Therefore, distance education is the need in remote rural areas. The corresponding online learning can be defined as the learning experience through different devices and tools (for example, mobile phones, tablets, laptops) in a synchronous or asynchronous environment. With current internet technology, students can study anywhere, interact with teachers and share their ideas with colleagues (Lassoued, Alhendawi, & Bashitialshaaer, 2020). It can be said that online learning is a new type of remote learning that can be advanced and operated after the advancement of science and technology that brings the convenience of tools.

Therefore, online courses are not a new concept or teaching method, but an extension of distance learning. Generally, it can be divided into two modes: synchronous and asynchronous. Due to the improvement of technology-driven tools, there was a global upsurge in asynchronous remote/online teaching since 2000. Many universities have built their own online courses. However, due to the gap in teaching effectiveness and the limitation of internet access, the enthusiasm gradually faded. Past studies showed that compared with 2002, teachers' enthusiasm for online teaching had gradually decreased in 2016 because more teachers had the opportunity to implement online courses when online learning was popular and found that "separation of time and location" can easily cause a transactional gap (Perry & Steck, 2019). In addition, other negative factors are also more sensitive, such as in areas with the poor network coverage. A study of higher education teachers in India found that due to problems such as network connectivity, and lack of training and personal contact, the actual benefits of virtual teaching were lower than expected, limiting the adoption and success of virtual classrooms (Arora & Srinivasan, 2020).

Based on the definitions of the three types of remote teaching described above, emergency remote education, online learning, and distance learning, this research should belong to the first one, ERE; even through the text below could alternatively use the terms of remote teaching, distance teaching and online teaching like some popular literature (Hodges, Stephanie, Barb, Trust, & Bond, 2020; Simonson, 2016).

### *1.2 Higher Education Students*

After clarifying the differences among the three types of remote learning, emergency remote education, online learning, and distance learning, this section would look at the works of literature regarding how the students in higher education coped with the 2020 coronavirus pandemic.

First, Octaberlina et al. (Octaberlina & Muslimin, 2020) used the students' perspective of EFL (English as a Foreign Language) courses to explore the obstacles and solutions in using online classrooms such as Moodle or

Google Classroom in the coronavirus epidemic. The obstacles found in the research are 1 unfamiliar with the online learning situation; 2 technology and the internet; 3 physical barriers such as eye fatigue. The solution to obstacle 1 is to create a more personalized online learning classroom; secondly, teachers can convert videos into sound files to deal with the second obstacle; finally, the solutions to the physical obstacles, in addition to students adjusting the learning environment lighting, could have broken every hour in the class time to reduce students' overuse of their eyes.

Adnan et al. (Adnan & Anwar, 2020) emphasized that emergency remote education (ERE) has other problems for higher education, including lack of face-to-face interaction between students and teachers, response time, and lack of traditional classroom social interaction. 42.9% of students said that the lack of intramural social interaction makes it difficult to conduct group work in the distance learning mode. 50.8% of the students questioned the possibility that online learning can effectively complete the entire course. When comparing the effectiveness of traditional learning and online learning, 78.6% of students believed that face-to-face contact with teachers is important for effective learning, while the distance learning model lacks this contact (Adnan & Anwar, 2020).

Aristovnik and others conduct comprehensive and large-scale research to understand how students view the first wave of the COVID-19 crisis in early 2020 and its impact on various aspects of life around the world. The study conducted a sample survey of 30,383 students from 62 countries or regions. The results showed that students are most satisfied with the support provided by teachers and university public relations under the global lockdown and online learning transition. Nevertheless, insufficient computer skills and insight into the increase in the workload of learning make them unable to feel whether their performance in the new teaching environment has improved. The students are mainly concerned about the boredom, anxiety, and depression experienced in current life, and issues related to their future career and learning (Aristovnik, Keržič, Ravšelj, Tomaževič, & Umek, 2020). In addition, the epidemic is not fair to all students. The COVID-19 crisis has a greater impact on men, part-time students, undergraduates, applied science students, students with lower living standards, and students from underdeveloped regions (Aristovnik et al., 2020).

Taiwanese scholars such as Mo (Mo, Hsieh, Lin, Jin, & Su, 2021) investigated the factors affecting college students' willingness to continue using online learning and came to the following conclusions: (1) The easier the online learning platform is, the more students are willing to use it. (2) The ease of use and usefulness are related to the teacher's choice of platform and the degree of matching of course design and platform navigation, thereby affecting students' learning outcomes and attitudes to use. (3) Teachers' positive attitude towards teaching improves students' perceived ease of use in online learning. (4) Family support (such as parents urging students to follow the teacher's instructions to study and complete online learning tasks) is the main support for teachers' online teaching. Improving teachers' attitudes and willingness to provide online teaching will also affect students' habits, adaptation, and recognition of online learning.

Hsiao (Hsiao, 2021) recruited 18,085 students from a science and technology university in Taiwan and used baseline data from the past three academic years before COVID-19 (2016-2018) to explore the impact of course type and gender on distance learning performance. The results showed that compulsory courses are more suitable for distance learning courses, while physical courses are more suitable for elective and general education courses. The learning performance of men and women are also different: physical courses are more suitable for men, while women have no significant difference. This research showed that not all courses offered by universities are suitable for distance learning courses, and not all students are good at distance learning. Based on these results, it is recommended to establish a new teaching model for the post-COVID-19 era.

Because of the goodwill of "suspending classes and not stopping school", all departments of Taiwan Universities had to transit from physical courses to distance learning to continue the learning, including the author's school. However, will this necessity harm students? For example, during distance courses, because of lack of interaction and communication leading to student isolation, on top of the limitations of online examinations, traditional education habits, homework burden, and student time management (Tümen, 2020). Also, what about the future after the end of the distance course? Some western questionnaires for students found that even those who completed the course midway would feel anxious. How will their courses and learning outcomes be evaluated after the epidemic crisis? Compared with students who study normally, many people in the COVID-19 student population worried that they would suffer long-term adverse effects when they enter another level of study or the labor market. Higher education institutions state that they will apply admission criteria "compassionately", but it may not always be reassuring (Daniel, 2020).

## 2. Methods

### 2.1 Participants

The purpose of this research is to find out the short-term and long-term impact caused by the temporary announcement of the distance teaching for six weeks on the students of the department where the author teaches. Therefore, the research subject is the student population of the private university of science and technology where the author teaches, to understand the actual situation of emergency remote learning. There were 11 courses chosen in total, including 3 elective courses and 8 compulsory courses of the department. There are 3 classes in the first grade, 5 classes in the second grade (including 1 class of Training Department studying at night), and 2 classes in the third grade. The graduating class of the fourth grade was not included because they are not the scope of this research. The 11 classes had a total of 471 students, 23 women (5%), and 448 men (95%). The assessment methods of these 11 classes mainly include three types: written examination, written report, and oral report. The written test can be roughly divided into online written tests and FlipClass tests (FlipClass is the flipped classroom teaching platform provided by the school). Oral reports all used PPT, but they are divided into online real-time reports or oral reports handed in pre-recorded videos.

### 2.2 Research Tools

The data collected in the research mainly consisted of a questionnaire: six-week remote teaching student opinion survey, including both qualitative and quantitative parts. Refer to the questionnaire of Yueh, H.-P., & Liang, C. (Yueh & Liang, 2015), and convert it into questions suitable for the students of the department, and then cross-check the appropriateness, accuracy, and needs of the questions with each course instructors to establish a questionnaire dedicated to each class. The questionnaire is divided into six aspects, including 1. school equipment resources, 2. teaching resources, 3. synchronous remote teaching, 4. final course assessment, 5. learning effectiveness, and 6. others. The quantitative topic is a six-point scale. The Cronbach's  $\alpha$  values for the quantitative data of the aspect 1 to 5 are .912 (7 items), .881 (4 items), .925 (7 items), .830 (4 items), .861 (5 items) respectively by SPSS reliability statistics. It shows that the  $\alpha$  values of the questionnaire range from good (higher than 0.8) to excellent (higher than 0.9). The questionnaire was filled out online, and the student opinion survey was filled out after the end of the corresponding course final evaluation (in the week 17-18 of the semester). Most questions are closed, and some are open to collect students' ideas and suggestions on the temporary implementation of the six-week online course. This registered questionnaire was also used to facilitate some follow-up interviews for the participants to clarify some issues for a few ambiguous qualitative answers. Quantitative data were analyzed using narrative statistics, Pearson correlation analysis, and independent t test. The student questionnaire was administered to 11 classes, the total number of students was 471, and 378 completed the form, reaching 80% of the questionnaire completion rate. Excluding 22 people who missed or incompletely filled in the questions, the valid questionnaire is 356, which is 76% of the number of students taking the course.

## 3. Results and Discussion

This section is divided into the quantitative and the qualitative results of students' opinions. The results and analytical details are discussed next.

### 3.1 Quantitative Results

There are 30 common items in the six-week distance teaching student questionnaire, which are divided into 6 major items, including school equipment resources, teaching resources, synchronous remote teaching, final assessment, learning effectiveness, and others. There are 356 valid questionnaires. The average value and standard deviation of the first 5 items are 4.47 and 1.16. The average values from high to low are teaching resources (4.81), synchronous distance teaching (4.79), final assessment (4.46), learning effectiveness (4.28), school equipment resources (4.22). It is worth mentioning that the teaching resources not only have the highest average value of 4.81, but also the lowest standard deviation of 1.10, which shows that students are quite affirmative of teaching resources (including instructors, course notices, and website materials). Quantitative data for all questions are compiled in Table 1.

Table 1. Integration of the quantitative data of the six-week distance education student questionnaire

Aspects	Questions	Mean	S.D.
1. Satisfaction with the following school equipment resources during the 6-week distance learning	1.1 Campus environment safety	4.34	1.15
	1.2 Parking lot planning	3.94	1.24
	1.3 Facility maintenance level	4.09	1.25
	1.4 School dining restaurant	4.04	1.19
	1.5 Library resources	4.47	1.19
	1.6 Other online systems	4.22	1.26
	1.7 The overall evaluation score of the school	4.44	1.03
2. Satisfaction with the following teaching resources of the course during the 6-week distance learning	2.1 Remote teaching hardware	4.66	1.15
	2.2 The instructor	4.96	1.04
	2.3 Notification of the course	4.81	1.12
	2.4 Website teaching materials	4.81	1.09
3. Please refer to the synchronous remote teaching (the teacher teaches classmates online), the degree of agreement of the following sentence	3.1 The teacher tried to interact with remote students.	4.97	1.03
	3.2 Teachers answered questions online well.	4.98	1.07
	3.3 The teacher paired attention to the learning reaction of remote students.	4.87	1.14
	3.4 The synchronous remote teaching materials were designed appropriately.	4.83	1.07
	3.5 Website teaching materials and online learning activities were designed appropriately	4.86	1.04
	3.6 The content planning of the course website was well organized.	4.82	1.09
	3.7 I love synchronized remote teaching.	4.19	1.44
4. Compared to the previous physical final course assessment, this final assessment of this semester is	4.1 The assessment method was fair to all students.	4.79	1.13
	4.2 The questions were very simple.	4.78	1.13
	4.3 I could easily implement the assessment method.	3.68	1.19
	4.4 It could measure my real subject ability.	4.54	1.23
5. The learning effect of this distance course	4.32	1.19	
	5.1 I have learned practical application skills from this course.	4.46	1.19
	5.2 Let me expand the ability of the original professional field.	4.40	1.18
	5.3 I think synchronous remote teaching can replace traditional courses.	4.51	1.11
	5.4 Compared with physical classroom courses, my learning effectiveness was high during the 6 weeks of distance teaching.	3.83	1.43
6. Others	5.5 Compared with physical classroom courses, my learning "will" was high during the 6 weeks of distance teaching.	4.13	1.06
	6.1 This course, when I was in the physical classroom, the percentage of my attention to the course (0 means not listening at all, 100 means listening to the teacher totally when I was in the classroom)	4.21	1.20
	6.2 This course, the current online course, the percentage of my attention to the course.	4.28	1.20
	6.3 Percentage of semester grade ranking*	78.23	15.82
		44.98	26.91

\* It is not a question in the questionnaire, but the final grades provided by the instructor at the end of the semester, and then converted into a percentage of the ranking of the whole class (the lowest grade of the whole class is 100% in the ranking)

The following is an analysis of each aspect. Among the 5 aspects Students' opinions, "1. school equipment resources" got the lowest satisfaction. Among the 7 school equipment resources, "1.5 library resources" was the highest at 4.47, and "1.2 parking lot planning" was the lowest at 3.94. This was consistent with the qualitative questions, and quite a few students mentioned parking lot problems. For example, when the school suddenly closed, a large number of parents rushed to the dormitory to pick up the students home, causing chaos in the traffic flow. Next, "2. teaching resources" got the highest satisfaction for the students among the five projects. "2.2 the instructor" had the highest 4.96, while "2.1 remote teaching hardware" (such as mobile phones, computers, or tablets) was the lowest 4.66. This result of high satisfaction with teaching resources and teachers is comparable to the comprehensive and large-scale research conducted by Aristovnik and others (Aristovnik et al., 2020). It shows the supports for ERE (for example, providing sufficient and sufficient information about examinations or examination procedures during a crisis) were high satisfied (Aristovnik et al., 2020). It further proves that teaching staff and support staff play a key role in maintaining student satisfaction with the university.

In the second-highest satisfaction aspect "3. synchronous remote teaching", "3.2 teachers answering questions online" was the highest at 4.98, and "3.7 I love the synchronous remote teaching" was the lowest at 4.19; for "4. final assessment" implemented during remote teaching, "4.1 The evaluation method was fair" had the highest evaluation of 4.78, and "4.2 The question was very simple" got the lowest of 3.68, indicating that the tested students generally accept the fairness of the evaluation method, and do not agree the assessments easier in the distance learning. Another indicator question is "4.4 It could measure my real subject ability", which is 4.32 lower than the average.

In "5. learning effectiveness", "5.2 Let me expand the ability of the original professional field" had the highest degree of approval (4.51), "5.3 I think synchronous remote teaching can replace traditional courses" was the lowest 3.83, and another issue worthy of attention is "5.4 Compared with physical classroom courses, my learning effectiveness was high" with a low average of 4.13, which is also lower than the average. This result is consistent with most research results. For example, a survey of 15 universities in Morocco by El Firdoussi found that compared to online courses, most (69.65%) students prefer face-to-face teaching (Elfirdoussi et al., 2020); During the COVID-19 pandemic, Yilmaz Ince et al. conducted a study on students from the Isparta University of Applied Sciences in Turkey. They found in 1011 survey questionnaires that when comparing traditional education with distance education, they determined that traditional education is more efficient (Yilmaz Ince, Kabul, & Diler, 2020). Lassoued (Lassoued et al., 2020) believes that the students interviewed are less motivated for distance learning, and because of the lack of classroom interaction and direct (traditional) learning, students have difficulties in understanding certain subjects and indicate the rejection to the distance learning system. From his point of view, students' resistance to distance learning shows that they lack understanding of the importance of distance learning in higher education. However, the opposite result was shown in a study by the University of Dubai, where 55% of students prefer distance learning. The analysis shows that 26% of students are willing to learn 100% online, while 49% of most students support learning through a blended learning system that combines online and classroom learning (Almuraqab, 2020).

Finally, in the aspect of "6. Others", there is no significant difference between students' self-evaluation in 6.1 physical and 6.2 online course attendance percentages (78%, 77%). The average "6.3-semester grade percentage" is 44.98% instead of 50. %, showing that there are slightly more students who are in the top half of the semester's grades, fill out this questionnaire.

To understand the overall satisfaction of the questionnaire, the average score of each item is divided into five levels: low, medium-low, medium, medium-high, and high. A five-point system is adopted for scoring. The value of each interval is  $5/5=1$ , and the degree of difference is: (1) 1 to less than 2 points for "low degree" performance; (2) 2 to less than 3 points "Medium to low level" performance; (3) 3 to less than 4 is classified as "moderate" performance; (4) 4 to less than 5 is classified as "medium to high level" performance; (5) 5 or more is classified as "high" performance Degree" performance. Results The quantitative analysis of the average of the questionnaire in five levels is shown in Table 2.

Table 2. The Performance of a Six-Point Scale and the Numbers of the Means of the Aspects and Items within the Performance

Performance	Value Range	Numbers of Aspects	Numbers of items (Percentage)
Low	From 1 to less than 2	0	0
Medium-low	From 2 to less than 3	0	0
Medium	From 3 to under 4	0	3(10%)
Medium-high	From 4 to under 5	5	26(90%)
High	5 points or higher	0	0
Total		5	29(100%)

Overall, the students do not have low, medium-low, or high satisfaction items, but 90% of the items are medium-high satisfaction, 10% of the items fall into the medium satisfaction, plus the average of all quantitative questions of 4.47, medium-high level. It indicates that the students are satisfied with the six-week distance education generally. In addition, among the 5 aspects, the students are most satisfied with the teaching resources provided by teachers during the six weeks. They also have the second-highest satisfaction with the status of synchronous remote teaching. They affirm the fairness of the final assessment but feel that the questions of the final assessment were not simpler because of distance teaching. Satisfaction with the learning effect of distance courses is lower than the overall average, and it is especially not believed that synchronous distance teaching can replace traditional courses. Finally, from the physical course to the online course, students self-evaluated that there is little difference in the percentage of attending classes.

### 3.1.1 Pearson Correlation Analysis

Pearson's correlation analysis was done on a total of 31 quantitative questions from 29 6-level and 2 percentile student quantitative questions. The following will explain the numerical analysis of three topics: students' satisfaction with the instructor, learning effectiveness from students' point of view, and final grade ranking.

During the 6-week distance teaching period, the tested students' "2.2 the instructor " was correlated from high to low as the following: "2.4 website teaching materials", "2.3 notifications of the course ", "3.5 website materials and online learning activities", "3.2 Teachers answering questions online" and "3.6 the content planning of the course website. " These five items demonstrated high positive correlations to the satisfaction of the instructor with the values greater than .7, and their Pearson correlations were .81, .74, .71, .70, .70, as listed in Table 3. As a result, the instructors probably could pay more attention to these items to make students more satisfied.

Table 3. Correlation Statistics of "2.2 the instructor " Satisfaction in the Questionnaire

		2.3 notifications of the course	2.4 website teaching materials	3.2 Teachers answering questions online	3.5 website materials and online learning activities	3.6 the content planning of the course website
2.2 the instructor satisfaction	Pearson correlation	.742**	.810**	.702**	.713**	.702**
	Significance (two-tailed)	.000	.000	.000	.000	.000

\*\* The correlation is significant at the 0.01 level (two-tailed)

During the 6-week distance teaching, the five items in the aspect "5. learning effectiveness" of the questionnaire all had a moderate correlation with each other. For example, they agreed that "5.3 synchronized distance teaching can replace traditional courses" had the highest correlation to the self-assessment of "5.1 learning practical application skills" and "5.2 expanding the ability in the original professional field", with a moderate correlation of .54 and .51. In addition, there is a high correlation value of .79 between "5.1 learning practical application skills" and "5.2 expanding the ability of the original professional field." There is also a high correlation value of .75 between "5.4 learning effectiveness" and "5.5 learning willingness", as listed in Table 4.

Table 4. Correlation Statistics of "5. learning effectiveness"

		5.1 I have learned practical application skills from this course.	5.2 Let me expand the ability of the original professional field.	5.3 I think synchronous remote teaching can replace traditional courses.	5.4 learning effectiveness	5.5 Willingness to learn	5.1 I have learned practical application skills from this course.
5.1	Pearson correlation	1	.769**	.540**	.511**	.459**	
	Significance (two-tailed)		.000	.000	.000	.000	
5.2	Pearson correlation	.769**	1	.505**	.545**	.463**	
	Significance (two-tailed)	.000		.000	.000	.000	
5.3	Pearson correlation	.540**	.505**	1	.575**	.536**	
	Significance (two-tailed)	.000	.000		.000	.000	
5.4	Pearson correlation	.511**	.545**	.575**	1	.750**	
	Significance (two-tailed)	.000	.000	.000		.000	
5.5	Pearson correlation	.459**	.463**	.536**	.750**	1	
	Significance (two-tailed)	.000	.000	.000	.000		

\*\* The correlation is significant at the 0.01 level (two-tailed)

Next, are there items related to the objective "6.3-semester grade ranking percentage" in the student questionnaire self-evaluation? Among the 30 items, the only significant things are the two numbers of "percentage of lectures in the classroom" and "percentage of online courses" with a low degree of negative correlation. It shows that the students with lower grades have a lower attendance rate. In other words, those with higher grades have higher attendance percentages, but there is only a low degree of correlation. However, there is no statistically significant correlation between semester grades and students' recognition of teachers, teaching materials, learning effectiveness, willingness, etc. In addition, the correlation between the percentage of classroom and online lectures is .67, showing that there is still considerable consistency for their attention

between physical and online learning, as listed in Table 5.

Table 5. Correlation Statistics of " 6. others "

		6.1 Attention percentage in the physical classroom	6.2 Attention percentage for online courses	6.3 Percentage of semester grade ranking
6.1	Pearson correlation	1	.672**	-.212**
	Significance (two-tailed)		.000	.000
6.2	Pearson correlation	.672**	1	-.184**
	Significance (two-tailed)	.000		.000
6.3	Pearson correlation	-.212**	-.184**	1
	Significance (two-tailed)	.000	.000	

\*\* The correlation is significant at the 0.01 level (two-tailed)

This section of the quantitative results provides the following details:

- (1) Students' satisfaction with instructors is highly positively correlated with the following items in order: "website teaching materials", "course notifications", "online learning activities", "teachers answering questions online", and "course website planning".
- (2) The five questions of "learning effectiveness" have a moderately positive correlation with each other.
- (3) "Semester grade ranking" only shows a low degree of negative correlation with the two numbers of "percentage of the attention to the lectures in the classroom" and "percentage of the attention to the lectures of online courses". In other words, those with high grades have a high percentage to pay attention to the class materials either in a real or visual classroom, but there is only a low degree of correlation. However, there is no statistically significant correlation with the degree of identification with either the satisfaction to the instructor, teaching materials, learning effectiveness, willingness, etc.
- (4) The correlation between the classroom and online lecture attendance percentage is .67, showing considerable consistency.

### 3.2 Qualitative Results

This section analyzes the qualitative results of students' opinions and outlines the students' state and mood on the remote learning scene. First, it can be expected that at the very beginning, most of the students were delighted. For example, a second-degree master student, who had completed all courses, told the author regrettably: My courses were completed in the last semester, therefore I haven't had the chance to "play" the distance learning this time. In the past, students had to sit in the classroom obediently without freedom and to follow many requirements from the instructor. Now, the online course has changed the situation. As long as students hide behind the screen, instructors will not know what they are doing, whether they do attend the class, or not. At first glance, the students do feel that it is like coming to heaven on earth. The following is the student's narrative:

- In remote teaching, the teacher can't see what the students are doing, and even if they ~~can't~~ sleep immediately after roll call, and just keep the online meeting on without their participation. [E090]

- It's great to stay at home. [F075]

The narrative of E090 echoes the experience of many teachers. Many teachers said that when the online course was over, there were still many students who were not offline and hang in the online meeting room of Teams or Google Meet. However, online learning seems less stressful, most smart students quickly figured that something is wrong. They found that more learning pressure returns to the students themselves in fact:

- I think this kind of teaching method should be very self-disciplined, otherwise, it is easy to oversleep, and therefore I still hope to go back to school. [C044]

Except for a few students who were probably blind about their learning situation, of course, there are still some fans of online courses. Such as otaku and people with social fears are still in favor of online learning.

- It's great not to face the crowd. Because there is no social pressure, the overall learning efficiency is improved by remote learning. [I905]

Basically, the sudden implementation of six-week distance teaching seems free and liberating. In fact, for most college students, the pressure on learning has increased. The following three aspects are used to explore students' learning reality according to the qualitative responses: distraction or concentration, increased homework, online communication.



### 3.2.1 Distraction or Concentration-a Challenge to Student Self-discipline

Among the 356 student questionnaires, there were 50 qualitative responses related to distraction/concentration issues, which can be regarded as the most concerning statements in the student's self-reports. Table 6 shows their statements and the quantified number of responses sorted by distraction or concentration. It demonstrated that many students in different classes felt that online courses are less effective because they are easier to be distracted. There are 43 distraction-related narratives, accounting for 86% of this category. On the contrary, there are 7 students (14%) who said that free time and space make them more attentive.

Table 6. The students' self-reports about distraction/concentration

	Student's Statement	Total Number Percentage
Distraction	-No one can control me and it makes me sleepy. [G067]	43
	-Unable to concentrate in online class due to a lot of temptation, which makes the content of the course even more ignorant [A006]	86%
	-Some factors need to be overcome to concentrate on the online course, and I feel more tired than the physical class. [I066]	
Concentration	Because the distance teaching teacher does not necessarily look at the learning condition of the students, and the students do not know the teacher's assessment method. Therefore, we are a little nervous and it instead makes the students more active to listen to the class. [I017]	7
	When I go to school, I may be lazy even to look at the blackboard. But at home, because I use a computer for class, it is more proficient to use a computer for class [I057]	14%
	Long-distance traveling time between the home and classroom can be saved for me. It makes me feel that the whole day of courses was not too tight, and I can face the class in a relaxed mood, which can relatively improve my concentration. [F027]	

Overall, the reasons for the distraction are the temptation and uncontrollability of homeschooling. When extra energy is required for the students to be self-disciplined, it makes online learning more tiring. At the same time and space, those who are attentive to the online course said: 1. We are not under control, because we have the right to choose (we can choose to listen to a class or hang up online). Hence, the self-discipline is improved; 2. Without traffic labor and energy consumption, there is more time and energy to concentrate on studying. In short, the big challenge for most students at distance learning is personal self-discipline, but for self-disciplined students, it is a free and time-saving choice. In addition, from the fact that the percentage of class attendance in the student self-assessment in the previous section has not changed due to the transition to online, it can be imagined that our students must make considerable efforts to avoid distractions. Strielkowski (Strielkowski, 2020) also proposed that even those young people who do not have much time in "real life" and prefer to play video games or interact with others on social networking platforms admit that they are more willing to spend time in real classrooms and classes in the university. Sometimes this is just a feature of habit, but usually this can be attributed to the difficulties of personal time management and procrastination when students study online at their comfortable homes. Another researcher also stated Hsiao (Hsiao, 2021) that the key to online learning is that learners have a higher level of autonomy. It's agreeable to the statements of the self-disciplined students in this study. Accordingly, due to the lack of teacher supervision, online learners must be able to start learning on their own. Therefore, if schools want to implement online learning in the future, they must enhance students' autonomous learning ability to promote effective learning. Finally, in addition to self-discipline in learning to overcome distractions, Daniel (Daniel, 2020) warned that if families are confined to their homes due to COVID-19, parents, and guardians may be deeply anxious about their financial prospects, so studying at home is not easy, especially for under motivated learners. These families often lack the equipment and connections that affluent families take for granted, making the situations of ERE even more complicated.

### 3.2.2 Increase in Homework

On top of the self-discipline challenge to the students themselves, the reasons for the increased pressure of study also include that many students mentioned that the teacher assigned more homework, such as:

- After distance teaching, homework is given to almost every class every week. [A033]
- There are more Reports and online exams. [B099]
- More homework for all subjects [D096]
- Schoolwork pressure suddenly increased very much. [F004]
- Poor efficiency, but flexible class time, saving school time, but more homework [G118]

The author's course did not have "excessive homework", but the distance teaching took place in the last six weeks of the semester, and there are more homework and assessment at the end of the semester usually. Does this make students feel more homework? Or is the student's feeling correct? Due to the sudden changes in the teaching method and the increased uncertainty, is it possible that the teachers assigned more homework to ensure the quality of teaching and strengthen the learning effect?

The author used the final department meeting held in the 19th week of the 109-2 semester. After describing that the students felt more homework and quizzes during the six-week long-distance semester, the author asked the teachers of the department through online voting: Did I give out more assignments? The answers were 18 Yes (64%) and 10 No (36%) replies. Therefore, the feeling of students is not vain. Indeed, more than half of the teachers require more homework and exercises in response to the needs of the teaching site. This is one message from a colleague.

- Yes, to encourage students to concentrate on learning (M11)

### 3.2.3 Online Communication

Is it possible that there is a third reason why the pressure to ERE study increases is due to the sudden change in communication methods? This part of the students' text narrative is focused on asking questions. Similarly, most students mentioned that they found it more difficult, and there were very few outliers who felt benefited. The narratives related to the students' questions are organized in Table 7.

Table 7. Student self-reports related to online questioning

	Student's Statement	Total Number Percentage
Difficulty	-It is difficult to tell what your problem is behind the screen. [A113]	25
	-Some questions still need to be explained in person by the teacher for the students to understand [D003]	96%
	-Nowadays, it is not easy to find a teacher. If you encounter a problem that is not easy to solve, you may mail the teacher, and the teacher still does not know what your problem exactly is. [G036]	
Easy-	Because of distance teaching, I am more daring to ask questions. [G903]	1 4%

From the students' responses, most of them feel that communication has become difficult after being converted to online courses, but the author wants to clarify whether it has become difficult to ask questions, or whether we are not used to new communication methods? The difficulty of questioning listed in Table 7 is sometimes difficult to speak out clearly in a face-to-face situation. It is often necessary to clarify the key point back and forth several times usually for complex questions. What is the actual meaning of each other? And we often misunderstand, right? When the problem is inherently difficult to communicate, on top of a new online communication mode, does make the questioning even more difficult? However, this increased difficulty part is due to the inertia of our communication, or the software not easy to use and therefore cannot achieve the purpose of communication? After all, the words were spoken by the mouth and the hand-drawn diagrams in online communication are the same as face-to-face. Both can reach the other side. The major difference is our inability to adapt to a new way of communication.

Another difficulty with questioning is that the students can't respond in time:

- It's so troublesome that I can't get an immediate response when I have a question that I want to ask. [B079]

There are many negative responses to asking questions like this. Similarly, is the problem "unable to respond in time"? Or are teachers and students not used to "online interaction" yet? After all, online courses are synchronized. The situation should be taught and students present online together during class time. Or they can meet each other easily online without the limit of the locations where they are. It should be more possible to respond in a "timely" manner. What happened could be that the new options to ask questions offline are now "added". These options were not so popular in the past. Or even if there was a time difference in the discussion, it should not be a problem caused by online teaching. Because the time lag also existed in the previous classroom mode teaching.

In addition, some students do not think that asking questions is an obstacle to communication, but they miss the intangible part of communication in the real classroom:

- It's a bit unreal without a sense of presence. [A040]

- It's like taking a class with a robot. [B104]

- I feel emptiness when I can't see my classmates and teachers. [A068]

-Very uneasy, uncertain [A003]

- I'm so lonely, I'm just laying in the room and staring at the screen. To be honest, I don't have much energy. Even though I listen to the class obediently, I always feel that something is missing. Apart from the teacher's class, there is only silence in my room. [I092]

A total of 18 students expressed similar content. Marek (2021) also warned in his research: Many students abandon online classrooms because they miss face-to-face conversations and learning in a classroom environment and are eager for a campus social environment.

The finding of asking questions online is that a few people were more daring to ask and participate, and they were benefited from the ERE; but for those who hesitated to ask, they would find that their 3D colorful learning life was reduced to a 2D screen. Many senses used in the past classroom were blocked, including eye contact, physical messages (yawning, playing with mobile phones). In addition, the teacher usually stopped to confirm whether the students understand the teaching materials and need any assistance. Right now, the students can only miss these silent communications and care. Next, in the past, the on-site teacher would take the initiative to walk off the podium and talk with the students when they sensed the students' problems or troubles. The online mode makes it the instructors harder to care for the students freely; nevertheless, the students are still passive and hesitant as usual. As a result, the responsibility of learning indeed would fall on the students themselves.

#### 4. Summary

COVID-19 has a global impact. Taiwan is fortunate to be able to operate normally in a "parallel space-time" approach in 2020, but unexpectedly the epidemic got out of control in 2021, allowing the entire society to enter a new mode of life that has never been experienced by the epidemic. The impact was in all aspects, and it is difficult to assess in a short period. Under the authorization of the Ministry of Education, the university stopped attending physical classes at school, and fully entered the online learning mode under the condition of suspension of classes without suspension of learning and handled course teaching and evaluation methods flexibly and diversely. The transformation from traditional classroom learning to distance learning is one of the largest higher education experiments in Taiwan. In this way, this study used the author's teaching department as a sample to explore the changes that have occurred in the higher education scene during the COVID-19 pandemic and university lockdowns, revealing the perspectives of students, and understanding their preferences for emergency distance education and worry. To understand the situation, in this study, 11 courses were surveyed to reveal the actual situation of teaching and online learning in the virtual teaching site. The study found that the statistical results of the quantitative questions of the students' opinions in the six-week distance learning showed that the overall satisfaction is medium to high. Among the five major aspects, the most satisfactory order for students is teaching resources, synchronous remote teaching, final assessment, learning effectiveness, and school equipment resources. Secondly, their "semester final grades" were only correlated with the "percentage of the lecture attention." And the percentage of students' self-assessed lecture attention dropped only from 78% of physical courses to 77% of online courses. From the qualitative response, the sudden implementation of six-week distance teaching is ostensibly free and liberating. Soon most students discovered that learning pressure is increasing. Factors include easy distraction at-home study, increased homework, and difficulty of online communication.

#### 5. Suggestion

The research results showed that even the students have mastered the skills for distance teaching after the six weeks of distance teaching. However, due to the limitations of communication and hardware and software conditions, they still hope to return to familiar and reliable physical teaching. However, this may be the result of their old "habit", and everyone felt that "this is just a transition period". Because of the endless pandemic, is it possible that the "transition" gradually becomes the new norm? And everyone needs to learn or teach in this new way. After a long period of online learning, is it possible that teachers and students may become accustomed to the online style and no longer think that physical courses are a better way?

In addition, distance has the unmatched advantages of physical courses, such as effectiveness (you can review videos for review or learn at your own comfortable speed, space, and time), convenience (no traffic, easy, and time-saving), etc., After everyone has experienced these time- and labor-saving experiences, some things cannot be returned! After the throes of the epidemic, the trend to integrate the advantages of online learning into mainstream education will intensify, which will be beneficial for students and the development of higher education. As a result, universities, faculties, and students should be better prepared to meet the new generation of teaching and learning.

Next, according to the qualitative results of students' opinions, whether the issue is about distraction or concentration, online questioning, and other topics, most students felt that online learning is more difficult, but a few participants felt beneficial. Under the same teachers, teaching materials, and lecture methods, the participants have the opposite learning effects. Is the key to causing the different results in the environment, or the personal abilities and attitudes?

Of course, the sudden change in the way of course teaching due to the epidemic has indeed caused everyone's anxiety, especially the more vulnerable, the more likely they become the direct victims of the impact. This is a social reality that cannot be ignored. But these are the minority of our students who need special care and assistance, like the 6% of the participants who can only utilize the cellular phone to attend the online course. For the rest of the majority, if this change becomes a new routine, should we continue to complain about the loss of learning effectiveness caused by distance? Or should we change ourselves and embrace the new benefits that online learning can provide to increase self-competitiveness? Some recommendations to the college students to prepare themselves from the inner attitude are provided below.

- (1) Recognize power and responsibility of being a student: The autonomy of the online class is returned to the hands of the students. Initially, it seems to be free especially for those who are reluctant to participate in the course activity. Nevertheless, when the autonomy and power come to the online students, more responsibility is back to themselves too. The learning will not be easier, because of hiding and no teacher to supervise you.
- (2) Improve self-discipline: Students must have sufficient autonomous learning ability before they are allowed to learn online (Hsiao, 2021). Otherwise, the advantages of distance will not be achieved, but the learners will suffer first.

### Acknowledgments

The authors would like to thank the financial support from the Ministry of Education, Republic of China, Taiwan (Contract number: PEE1100841).

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