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Factors Influencing Vietnamese High School Students' Remote Online Exams during the COVID-19 Pandemic

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Abstract:
The COVID-19 pandemic has had a significant impact on global education. Students were unable to attend school because of social distancing measures implemented by governments to prevent the spread of the pandemic. Consequently, online learning has emerged as the primary solution for ensuring students' learning processes are maintained. As a result, students' periodic testing has been transformed into remote online exams (ROEs). While the advantages of ROEs are widely acknowledged, the urgent use of this test poses problems and challenges for students and teachers. The purpose of this study was to investigate factors that may affect the results of online remote exams administered to high school students in Vietnam and to examine how these factors affect their test results when compared to the traditional testing method. The research used exploratory factor analysis (EFA) to identify five potential factors influencing the online remote exam results of Vietnamese high school students, with 17 items meeting statistical standards: attitude toward ROEs, preparedness, anxiety, technical problems, and perceived ROE software. According to one-way ANOVA, the male student group had higher perceived ROE software than the female student group; however, there was no difference between the remaining groups. This study provides a foundation for online education and online examination research communities and recommendations for educational practitioners, school administrators, and technical service providers on effectively supporting remote online examinations of Vietnamese high school students.

Keywords: remote online exams, online learning, COVID-19, Vietnam.

新冠肺炎大流行期间影响越南高中生远程在线考试的因素

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摘要:
新冠肺炎大流行对全球教育产生了重大影响。由于政府为防止疫情蔓延而采取的社交距离措施，学生无法上学。因此，在线学习已成为确保学生学习过程得以维持的主要解决方案。由此，学生的定期测试转变为远程在线考试（鱼子）。虽然鱼子的优点已被广泛认可，但该测试的迫切使用给学生和教师带来了问题和挑战。本研究的目的是调查可能影响越南高中生在线远程考试结果的因素，并研究与传统测试方法相比，这些因素如何影响他们的测试结果。该研究利用探索性因素分析（全民教育）确定了影响越南高中生在线远程考试成绩的五个潜在因素，其中17个项目符合统计标准：对鱼子的态度、准备情况、焦虑、技术问题和感知的鱼子软件。根据单向方差分析，男学生组对鱼子软件的感知高于女学生组；然而，其余组之间没有差异。本研究为在线教育和在线考试研究社区提供了基础，并为教育从业者、学校管理人员和技术服务提供商提供了有效支持越南高中生远程在线考试的建议。

关键词：远程在线考试、在线学习、新冠肺炎、越南。

1. Introduction

The outbreak of the COVID-19 pandemic in early 2020 triggered a global health emergency (World Health Organization, 2020) and resulted in significant changes to all socioeconomic aspects of all countries worldwide (Gradišek & Polak, 2021). According to UNESCO (2020), more than one billion students, accounting for more than 98% of the world's students, have been severely impacted by school closures because of SARS-CoV-2 virus prevention tactics.

In this urgent situation, global education has been rapidly changing to minimize disruptions to teaching and learning caused by the increased use of technology in educational activities (Chiu, 2022). Online learning has primarily been used since the start of the pandemic when measures such as social distancing and social isolation were implemented (Nguyen et al., 2021). Then, as a more appropriate approach for educational institutions to establish a "new normal" state for global education, blended learning was used (Thi Thu Dao & Thi Kim Le, 2020).

Since the outbreak of the COVID-19 pandemic in Vietnam, the schooling system has been shut down, with schools switching from face-to-face classes to online learning to ensure that no students' studies are disrupted and the school year plan is not disrupted. Schools in Vietnam urgently transformed from a traditional teaching environment to an online teaching environment and gradually adapted to the government's pandemic prevention and control regulations after suffering three waves of COVID-19 infection from March 2020 to February 2021. However, the outbreak of the fourth wave of infection at the end of April 2021 triggered a state of emergency in the education system because all Vietnamese high school students were scheduled to take final exams and university entrance exams at the time. An urgent question was raised: how should high schools organize second-semester evaluations for students in the context of social distancing? The Ministry of Education and Training studied and issued Circular No. 09/2021/TT-BGDT dated March 30, 2021, regarding regulations on the management and organization of online teaching in general education institutions and continuing education institutions, with the goal of adapting to the uncertainty and urgency of the pandemic and the new context of education. This regulation establishes a critical legal corridor for localities and schools to be proactive in online teaching and learning, including the issue of high school students taking online exams. As a result, many local high schools in outbreak-affected areas (such as Ha Nam, Hanoi, and Da Nang) were forced to switch from traditional, face-to-face testing to remote testing for final exams in order to proactively assess students' final-year learning results.

Researchers and experts in online education coined the term "emergency remote teaching" in the context of the pandemic-induced educational crisis (Bozkurt & Sharma, 2020). This approach has been associated with the term emergency remote learning (Hash, 2021) and has been proposed as an alternative way to maintain the teaching and learning process (Shamir-Inbal & Blau, 2021). Milman (2020) coined the term "pandemic pedagogy" to describe the situation, which encompasses both of the preceding processes. As a result, the "remote online exams" (ROEs) method was introduced and quickly gained popularity (Mastour & Ghalibaf, 2020). This method is defined as an assessment of students' learning progress through virtual or online platforms in which students conduct their own exams at home or in locations other than the school. Their performances are monitored by the school or teachers using online monitoring tools. In recent years, the effectiveness of ROEs has been studied in tandem with the development of online learning methods such as distance learning, remote emergency learning, blended learning, online learning, and e-learning (Butler-Henderson & Crawford, 2020). Because of the rapid growth of online education, this assessment method has grown in popularity over the years. Online examination, specifically remote online examination, has demonstrated its importance, particularly during the raging COVID-19 pandemic, as many countries around the world have forced the use of ROEs as the primary assessment of student learning during the pandemic (Mastour & Ghalibaf, 2020).

While the benefits of ROEs are widely acknowledged, their urgent use in the context of the

COVID-19 pandemic presents problems and challenges for learners worldwide. A number of studies reported that in addition to the benefits of ROEs, this approach has limitations and challenges that must be addressed appropriately, such as technical-related issues (Ngqondi et al., 2021), learner mental health (Elsalem et al., 2020), fraud or dishonesty (Li et al., 2021), and learner technology skills and competencies (Ngqondi et al., 2021). Furthermore, studies and publications on this topic have primarily focused on higher education, with little attention paid to general education. The transition to remote online exams in the form of synchrony may create certain advantages and disadvantages for Vietnamese high school students, which may affect their final-term test results. Recognizing that understanding these issues is necessary for providing appropriate solutions to improve the quality of remote online exams, this study aims to investigate specific factors that may affect the test results of high school students in the remote online testing environment and how these factors affect students' test results compared to before the use of ROEs.

The research questions are created as follows:

1) What factors may influence a student's exam results in an online remote exam environment?

2) Is there a gender difference in terms of the factors investigated?

Before the COVID-19 pandemic, high school students in Vietnam had never undergone remote online exams but were assessed only through paper-based exams. This study will determine factors influencing the remote online examination outcomes of high school students, which have not been previously investigated in studies focusing on assessing academic performance within this student group. Therefore, the study findings are expected to provide educators and educational administrators with a better understanding of the remote online exam method as well as the factors that may influence the test results of Vietnamese high school students. There are also recommendations for schools, families, and other stakeholders to take appropriate steps to improve the quality of ROEs.

2. Methodology

2.1. Instrument/Measurement

The survey was divided into two parts. The first section concentrated on students' demographic information and the number of times they performed ROEs. The second section of the survey includes items that investigate the factors that influence students' online remote exam results.

Twenty-two semi-structured interviews with students who participated in the ROEs for the mid- or end-term tests were conducted to develop items for the second part of the survey. The interviews were conducted between March 6 and 10, 2022. The transcripts of the interviews were then analyzed using the qualitative data analysis process (Saldaña, 2020, 2021). Based on the preliminary analysis results, the research developed 20 questionnaire items related to factors influencing students' results via ROEs from the students' perspective (Table 1). The Likert scale of 5 levels with specific values was used to assess 9 items (from I1 to I9): 1 - never, 2 - rarely, 3 - occasionally, 4 - regularly, and 5 - always. The remaining items (from I10 to I20) were also assessed using the 5-point Likert scale and specific values: 1 - strongly disagree, 2 - strongly disagree, 3 - neutral, 4 - agree, and 5 - strongly agree.

Table 1. Item list (Items developed by the authors)

Item codes	Items
I1	I often feel confused by the test questions
I2	I prefer the online exam compared to the face-to-face exam
I3	I like to take the remote online exam
I4	I feel quite comfortable taking the remote online exam
I5	I feel that the face-to-face exam is more stressful than the remote online exam
I6	I feel nervous when I take the remote online exam
I7	I am tired of taking the remote online exam
I8	I do not concentrate on answering the questions
I9	I feel excited when I take the remote online exam
I10	I am supported by the teacher in preparation for the remote online exam (knowledge and equipment)
I11	I review thoroughly to prepare for the online exam
I12	I practice with the software many times to prepare for the remote online exam
I13	I usually test the network connection and the devices for the online remote exam
I14	I often have sudden power outages
I15	I often have problems with unstable network connection
I16	The device for remote online exams helps me ensure test completion
I17	I do not have a monitoring device during the remote online exam
I18	I have difficulty using the remote online exam applications that the school uses to organize the test
I19	I find the software, which supports remote online exams effective and responding to my test taking
I20	For me, accessing the applications for remote online exam is easy

2.2. Sample

The survey respondents were high school students who had been studying online and taking remote online mid-term or final-term exams during the social distancing period. The convenience sampling method was chosen, which entails selecting individuals who are closest to the research requirements and then repeating the selection process until the ideal sample size is achieved (Ingleby, 2012). The questionnaire was completed by 158 students, but only 140 responses were valid (Hair et al., 2014). Table 2 describes the sample characteristics by gender, grade, and the number of online remote exams.

Table 2. Characteristics of the survey sample

Variable	Frequency	Percentage
Sex	*140*	*100.0*
Male	62	44.3
Female	77	55.0

Continuation of Table 2		
Others	1	0.7
Grade	*140*	*100.0*
10^{th}	104	74.3
11^{th}	36	25.7
Times of remote online exams	*140*	*100.0*
Never	17	12.1
Only once	4	2.9
Twice or more	119	85.0

Table 2 shows that male students (44.3%) participated in the survey at a lower rate than female students (55.0%). Furthermore, only one student selected "others" for gender preference, accounting for 0.7%. In this survey, the percentage of 10th graders was significantly higher than that of 11th graders (74.3% vs. 25.7%). In terms of student statistics regarding the number of times they took ROEs, there were 17 students who had never taken the test via remote online (accounting for 12.1%), and only 4 students (2.9%) had taken the test via remote online only once. The majority of survey participants (119 students, or 85%) took the midterm or final term exams remotely online twice or more.

Concerning the information on students' ROE results (Table 3), the majority of 140 students who responded agreed that the test results were either unchanged (44.3%) or higher (35.7%) than the pre-test expectations. Only 20.0% of the students said the ROE results were lower than their expectations before the test.

Table 3. The students' ROE results compared to pre-test expectations

Variable	Frequency	Percentage
Remote online exam results	140	100.0
Lower	28	20.0
No change	62	44.3
Higher	50	35.7

2.3. Data Collection

Google Forms was used to collect research data. To ensure that no questions were missed, all questions were made mandatory. The questionnaire link was sent to the appropriate subjects via Mail, Facebook, Messenger, and Zalo (a Vietnamese chatting app) in accordance with the research requirements. The information was gathered over the course of a week from March 29 to April 3, 2022. At the end of the data collection period, the data were downloaded in Microsoft Excel *.cvs format for later analysis in the SPSS software.

2.4. Data Analysis

Data analysis was done in three steps to answer the research questions. The exploratory factor analysis method was used first. During this stage, three observed variables were removed. Table 4 shows the five factor groups the remaining seventeen observed variables were formed by. Following that, descriptive statistics for each factor group and their observed variables were provided. The results of the analysis show the actual state of these factor groups in the ROE process (Tables 5-9). Finally, after identifying the factors that influence students' exam results in the remote online exam environment, we used the one-way ANOVA method to test statistically significant differences between groups of students by gender (Table 10).

3. Results

3.1. EFA

Based on the observed behaviors of Vietnamese high school students in remote online exams, five groups of influential factors were identified using exploratory factor analysis (EFA). The results of the exploratory factor analysis are shown in Table 4. As for the extraction methods, principal component analysis (Abdi & Williams, 2010) and varimax rotation method (Kaiser & Rice, 1974) were used. The Kaiser-Meyer-Olkin (KMO) and Bartlett tests show that this model is appropriate (KMO value = .682, df = 136, p.001). Furthermore, elements in the analytic model reveal 62.81% of data bias.

Table 4. Results of the exploratory factor analysis (Items developed by the authors)

Items	Components				
	1	2	3	4	5
I2	.748				
I3	.847				
I4	.700				
I5	.616				
I6			.745		
I7			.804		
I8			.760		
I9	.680				
I10		.671			
I11		.776			
I12		.684			
I13		.747			
I14				.833	
I15				.601	
I18				.782	
I19					.801
I20					.664

Notes: extraction method - principal component analysis; rotation method - varimax with Kaiser normalization

The factor analysis results in Table 4 show that the extracted groups of factors include: (1) attitudes towards accepting ROEs consisting of 05 observable variables; (2) preparation for ROEs consisting of 04 observable variables; (3) anxiety about ROEs consisting of 03 observable variables; (4) technical problems during ROEs consisting of three observable variables; (5) awareness of ROE software consisting of two observable variables.

3.2. Description of the Factors

The first group of factors in Table 5 demonstrates attitudes toward ROEs through 5 items (I2, I3, I4, I5, and I9). I5 ("I feel the face-to-face exam is more stressful than the remote online exam") (M = 3.64) was the most noticeable item, followed by I4 ("I feel quite comfortable taking the remote online exam") (M = 3.45). The two factors that received the most interest were Item I2 ("I prefer the online exam over the face-to-face exam") (M = 3.11) and Item I3 ("I like to take remote online exams") (M = 3.06). With a mean of 2.91, Item I9 ("I feel excited when I take the remote online exam") had the lowest average value in this group of factors. Overall, the first factor - high school students' attitudes toward ROEs - received an average mean of 3.23.

Table 5. The factor of students' attitudes toward ROEs (Items developed by the authors)

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Attitudes toward ROEs	140	3.23	.939	.211	.205	-.596	.407
I2	140	3.11	1.361	-.092	.205	-1.088	.407
I3	140	3.06	1.313	-.010	.205	-.982	.407
I4	140	3.45	1.159	-.355	.205	-.621	.407
I5	140	3.64	1.225	-.534	.205	-.678	.407
I9	140	2.91	1.306	.259	.205	-.950	.407
Valid N (listwise)	140						

Table 6 describes the factor of students' anxiety about ROEs, which is composed of three items (I6, I7, and I8). When compared to the first factor (student attitudes), this factor had a lower mean average (M = 2.45). Students felt particularly strongly connected to item I6 ("I feel nervous when I take the remote online exam") (M = 2.53). I7 ("I am tired of taking the remote online exam") came next, with a lower mean value (M = 2.49). I8 (I do not concentrate on answering the questions") had the lowest mean value, with an average mean of 2.34.

Table 6. The factor of students' anxiety about ROEs (Items developed by the authors)

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Anxiety about ROEs	140	2.4548	.918	.412	.205	.083	.407
I6	140	2.53	1.102	.204	.205	-.732	.407
I7	140	2.49	1.202	.559	.205	-.495	.407
I8	140	2.34	1.174	.439	.205	-.655	.407
Valid N (listwise)	140						

Table 7 depicts the third factor, which is students' readiness for ROEs, which consists of four items (I10, I11, I12, and I13). At M = 3.22, this factor group obtained the same average mean as the first factor (students' attitudes toward ROEs). Item I13 ("I usually test the network connection and the devices for the online remote exam") received the highest average mean value (M = 3.39) of all items in the group. Item I11 ("I thoroughly review to prepare for the online exam") had a high average mean of 3.35. The average score for the other two items, I10 ("I am supported by the teacher in the preparation for the remote online exam (knowledge and equipment)") and I12 ("I practice with the software many times to prepare for the remote online exam"), was 3.11 and 3.06, respectively. However, the average means of items in this factor group were significantly higher than those in the second factor group (students' anxiety about ROEs).

Table 7. The factor of student preparedness for ROEs (Items developed by the authors)

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Preparedness for ROEs	140	3.22	.953	.031	.205	-.690	.407
I10	140	3.11	1.290	-.243	.205	-.963	.407
I11	140	3.35	1.150	-.288	.205	-.628	.407
I12	140	3.06	1.259	-.123	.205	-.891	.407
I13	140	3.39	1.344	-.375	.205	-.975	.407
Valid N (listwise)	140						

Table 8 describes the fourth factor, technical issues with ROEs, which includes three items (I14, I15, and I18). The average mean of this factor was 2.8, which is higher than the second factor (student anxiety) but lower than the first and third factors (student attitudes and students' preparedness). The most noticeable problem is I15 ("I frequently experience problems with unstable network connections") with M = 3.00. The average mean for the other two items, I14 ("I frequently have sudden power outages") and I18 ("I have difficulty using the remote online exam applications that the school uses to organize the test"), was 2.79 and 2.62, respectively.

Table 8. The factor of technical-related problems regarding ROEs (Items developed by the authors)

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Technical Problems with ROEs	140	2.80	.893	.266	.205	.231	.407
I14	140	2.79	1.117	.120	.205	-.601	.407
I15	140	3.00	1.093	.000	.205	-.422	.407
I18	140	2.62	1.214	.323	.205	-.667	.407
Valid N (listwise)	140						

Table 9 describes the final factor, students' awareness of ROEs, which is composed of two items (I19 and I20). According to the statistics, the students were more likely to find "accessing the applications for remote online exam is easy" (M = 3.19) than I19 ("I find software which supports remote online exams effective and responding to my test taking"), which had a mean of only 3.00.

Table 9. The factor of perceived ROE software (Items developed by the authors)

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Perceived ROE Software	140	3.09	.988	.045	.205	-.177	.407
I19	140	3.00	1.157	.057	.205	-.675	.407
I20	140	3.19	1.125	-.050	.205	-.619	.407
Valid N (listwise)	140						

3.3. Gender Differences in the Factors Influencing the Online Remote Test Results of High School Students during the COVID-19 Pandemic

Figure 1 depicts male and female students' perceptions of each factor influencing their exam results because of the COVID-19 pandemic. The data show that the two groups' participants are similar in four areas, including attitudes toward ROEs (different mean (male, female) = 0.08), preparedness for ROEs (different mean (male, female) = 0.01), anxiety about ROEs (different mean (male, female) = 0.02), and technical problems with ROEs (different mean (male, female) = 0.04). Furthermore, there is a more significant difference for the factor Perceived ROE Software, where the male student group's mean value is 3.31, the female student group's mean value is 2.92, and different mean (male, female) = 0.39.

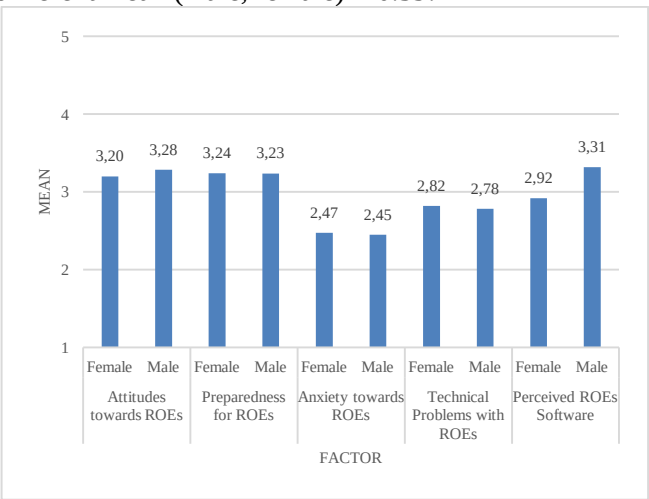


Figure 1. The perceptions of male and female students about each factor affecting their remote online exam results due to the COVID-19 pandemic (Factors developed by the authors)

To determine whether there is a statistically significant difference between groups of male and female high school students with the factors Attitudes toward ROEs, Preparedness for ROEs, Anxiety about ROEs, Technical Problems with ROEs, and Perceived ROE Software, we used one-way ANOVA (Table 10). The data indicated that there were four factors with no statistically significant difference between the two groups of students, including attitudes toward ROEs ($F(1, 137) = .266$, $p = .607$), preparedness for ROEs ($F(1, 137) = .266$, $p = .000$), anxiety about ROEs ($F(1, 137) = .026$, $p = .871$), and technical problems with ROEs ($F(1, 137) = .063$, $p = .802$). In contrast, only one factor had a statistically significant difference between the two groups: perceived ROE software ($F(1, 137) = 5.746$, $p = .018$).

Table 10. Results of the one-way ANOVA (Factors developed by the authors)

		Sum of Squares	df	Mean Square	F	Sig.
Attitudes toward ROEs	Between Groups	.238	1	.238	.266	.607
	Within Groups	122.476	137	.894		
	Total	122.714	138			
Preparedness for ROEs	Between Groups	.000	1	.000	.000	.985
	Within Groups	124.971	137	.912		
	Total	124.971	138			
Anxiety about ROEs	Between Groups	.023	1	.023	.026	.871
	Within Groups	116.732	137	.852		
	Total	116.755	138			
Technical Problems with ROEs	Between Groups	.051	1	.051	.063	.802
	Within Groups	110.775	137	.809		
	Total	110.827	138			
Perceived ROE Software	Between Groups	5.466	1	5.466	5.746	.018
	Within Groups	130.318	137	.951		
	Total	135.784	138			

4. Discussion

This paper investigated factors that may influence the ROE results of Vietnamese high school students and how these factors correlate with their test results compared to their pre-ROE expectations. The study used EFA to identify five factor groups influencing students' ROE results: attitudes toward ROEs, preparedness for ROEs, anxiety about ROEs, technical

problems with ROEs, and perceived ROE software. To assess the students' behaviors on ROEs, a description of each factor and its items was provided. The one-way ANOVA analysis showed that four factors did not have a significant difference between the gender group of male and female high school students (attitudes towards ROEs, preparedness for ROEs, anxiety about ROEs, and technical problems with ROEs); however, there was a significant difference between the two groups in terms of perceived ROE software. The findings of this study are discussed below.

In terms of the factors influencing high school students' ROEs, four items in this study reflected the students' attitudes toward ROEs. This factor assesses issues related to students' motivation, which may be derived from the theory of reasoned action's construct of attitudes toward behavior. The theory specifically contends that an individual's behavior is determined by their intention as well as their negative or positive feelings about performing such behavior (Fishbein & Ajzen, 1975). The analysis found that students' attitudes toward accepting the ROEs were moderate. According to Venkatesh et al. (2003), this factor is a construct that aids in the prediction of behavioral intentions.

Second, anxiety about ROEs is linked to students' mental health in the ROE environment, particularly in the context of social distancing. Anxiety is a mental phenomenon defined as a negative experience of individuals in their daily lives. Anxiety is defined by the American Psychiatric Association as "the anticipation of a future danger or a negative event, accompanied by feelings of dysphoria or physical symptoms of tension" (Perrotta, 2019). Exam anxiety, in particular, is a psychological response that consists of worry, stress, emotionality, lack of confidence, fear of failure, and interference that an individual can experience before, during, and after an exam or similar situations (Roos et al., 2021). During the COVID-19 pandemic, many studies found an increase in learner anxiety-related problems during ROEs (Arora et al., 2021; Mastour & Ghalibaf, 2020; Sakka et al., 2020). Anxiety is one of the most common mental health symptoms experienced by students in stressful situations, and it has been shown to influence their learning activities (Popovych et al., 2022). This study's findings indicate that anxiety influences students' ROE results, particularly in the context of social distancing caused by the pandemic. However, it should be noted that the students in this study only experienced mild anxiety on occasion.

Third, perceived ROE software referred to students' perceptions of using ROE software and was measured in this study by two items. This factor is as important as the "perceived ease of use" construct in the technology acceptance model. To be more specific, the factor is concerned with determining how students perceive the ease of use of ROE devices and applications. According to statistical analysis, students were confused about using the supporting software, and thus the "ease of use" and "responding" constructs were not preferred by the students. In other words, students may still be surprised when using the software to complete their ROEs.

Fourth, preparedness for ROEs, as measured by four items in this study, examines students' knowledge and technical equipment preparation for ROEs. Exam preparation is essential for students to perform well on the exam and achieve the best possible test results. According to Elsalem et al. (2021), students require adequate time and effort to be well prepared for ROEs in the context of the COVID-19 pandemic. The study confirmed that students' preparation had a significant impact on their performance. The current study results, however, revealed that students were still neutral and unsure about their preparation for the ROEs (at a mean of 3.00).

Fifth, the technical problems with ROEs factor includes three items that assess students' experiences with technical issues such as network connections, power supplies, and assisting devices used during ROEs. Previously, some studies have revealed other potential technical difficulties during ROEs, such as Internet connection speed, the quality of ROE supporting applications (e.g., Learning Management System, Zoom), and hardware infrastructure (Bishnoi & Suraj, 2020; Bisht et al., 2022). However, none of these studies examined how these technical flaws may have influenced students' ROE performances. Similarly, the findings show that not all students encountered technical issues, and on average, students in this study had a neutral experience with technical issues during ROEs.

Finally, the analysis results of the study show a significant difference in perceived ROE software between male and female high school students. The results showed that the male student group was more aware than the female student group in perceiving that using devices and applications to ROEs was easy to use. Some previous studies on perceived ease of use were more important for female students because male students were more accustomed to using technological devices (Kim, 2010; Ong & Lai, 2006). However, an empirical study by Terzis and Economides (2011) on the use of technology for assessment in the online environment did not confirm that there is a difference between the group of boys and girls in the perception of ease of use of these assessment tools. Thus, the results of this study will also contribute more evidence to this issue.

5. Conclusion

5.1. Practical and Academic Implications and Recommendations

In many countries around the world, including Vietnam, ROE is a commonly used method of assessment in the context of social distancing. This assessment method has proven to be useful in the context of Vietnam education as an urgent solution to deal with the effects of the COVID-19 pandemic to ensure that teaching and learning processes are not

disrupted. As a result, this research identifies the factors influencing the effectiveness of ROEs and how these factors correlate with students' pre-ROE results. The findings indicate that using ROEs has both advantages and disadvantages. The findings of this study are expected to provide a foundation for online education and online examination research communities and recommendations for educational practitioners, school administrators, and technical service providers on how to effectively support remote online examinations of Vietnamese high school students.

The findings of this study provide an initial foundation for larger-scale or more specific studies on the use of ROEs in the research community. This is an important reference in the field of research on student assessment in general and student assessment using online methods in particular. Studies on how to improve the effectiveness of ROEs or how to overcome the challenges of using ROEs are particularly important. The study also suggests that researchers continue to investigate how these newly discovered factors affect students' performances. If there are distinguishable effects, how does the use of ROEs benefit students' performances? Furthermore, research into whether the use of ROEs can coexist with traditional examination methods is strongly encouraged.

It is recommended for the larger education community that educators provide strategies and teachers provide appropriate support and learning activities to prepare students for ROEs. This is because these individuals have direct influences on students' learning processes and exam preparation (Brophy, 1986). They need to provide more assistance to female students to improve their ability to use devices and applications that support remote testing in an online environment.

As previously stated, problems with technical issues such as network connectivity, power supply, or a lack of technical equipment during ROEs may result in unsatisfactory experiences as well as influence students' exam results (Ali & Dmour, 2021; Guangul et al., 2020). As a result, in order to ensure effective ROE procedures, school administrators must be aware of any potential technical issues and challenges and provide students with immediate support during the ROE process. This could improve students' experiences, motivation, and attitudes toward the use of ROE. Furthermore, it is critical that schools maintain contact with technology service providers in order to maintain technical and software quality during the examination period.

5.2. Limitations

Although the study findings have contributed to the research field to some extent, the paper still has some limitations. For starters, the convenience sampling method is not easily generalizable (Jager et al., 2017). Second, the study did not compare different regions such as rural, urban, and mountainous areas to provide a more comprehensive picture of ROE use in Vietnam. As a result, as previously stated, larger-scale studies are desperately needed to further investigate this issue.

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Authors' Contributions

Trinh Thị Anh Hoa (20%) – main idea, discussion; Xuan-An Nguyen (20%) – main idea, concept, discussion; Tran Bich Hang (20%) – article format and revision; Thanh-Thuy Ngo (20%) – methodology, data analysis; Hai-Dinh Luong (10%) - data analysis, results; Tran My Ngoc (10%) – results, conclusion.

References

[1] ABDI, H., & WILLIAMS, L.J. (2010). Principal component analysis. *Wiley Interdisciplinary Reviews: Computational Statistics*, 2(4), 433–459. https://doi.org/10.1002/wics.101

[2] ALI, L., & DMOUR, N. (2021). The shift to online assessment due to COVID-19: An empirical study of university students, behaviour and performance, in the region of UAE. *International Journal of Information and Education Technology*, 11(5), 220–228. http://dx.doi.org/10.18178/ijiet.2021.11.5.1515

[3] ARORA, S., CHAUDHARY, P., & SINGH, R.K. (2021). Impact of coronavirus and online exam anxiety on self-efficacy: the moderating role of coping strategy. *Interactive Technology and Smart Education*, 18(3), 475-492. https://doi.org/10.1108/ITSE-08-2020-0158

[4] BISHNOI, M.M., & SURAJ, S. (2020). Challenges and Implications of Technological Transitions: The Case of Online Examinations in India. Proceedings of the 15th International Conference on Industrial and Information Systems, Rupnagar, 26-28 November 2020, pp. 540–545. https://doi.org/10.1109/ICIIS51140.2020.9342655

[5] BISHT, R.K., JASOLA, S., & BISHT, I.P. (2022). Acceptability and challenges of online higher education in the era of COVID-19: a study of students' perspective. *Asian Education and Development Studies*, 11(2), 401-414. https://doi.org/10.1108/AEDS-05-2020-0119

[6] BOZKURT, A., & SHARMA, R.C. (2020). Emergency remote teaching in a time of global crisis due to CoronaVirus pandemic. *Asian Journal of Distance Education*, 15(1), i-vi. https://doi.org/10.5281/zenodo.3778083

[7] BROPHY, J. (1986). Teacher influences on student

achievement. *American Psychologist*, 41(10), 1069-1077. https://psycnet.apa.org/doi/10.1037/0003-066X.41.10.1069

[8] BUTLER-HENDERSON, K., & CRAWFORD, J. (2020). A systematic review of online examinations: A pedagogical innovation for scalable authentication and integrity. *Computers and Education*, 159, 104024. https://doi.org/10.1016/j.compedu.2020.104024

[9] CHIU, T.K.F. (2022). Applying the self-determination theory (SDT) to explain student engagement in online learning during the COVID-19 pandemic. *Journal of Research on Technology in Education*, 54(sup1), S14-S30. https://doi.org/10.1080/15391523.2021.1891998

[10] ELSALEM, L., AL-AZZAM, N., JUM'AH, A.A., & OBEIDAT, N. (2021). Remote e-exams during Covid-19 pandemic: A cross-sectional study of students' preferences and academic dishonesty in faculties of medical sciences. *Annals of Medicine and Surgery*, 62, 326–333. https://doi.org/10.1016/j.amsu.2021.01.054

[11] ELSALEM, L., AL-AZZAM, N., JUM'AH, A.A., OBEIDAT, N., MAHMOUD, A., & KHEIRALLAH, K.A. (2020). Stress and behavioral changes with remote e-exams during the Covid-19 pandemic: A cross-sectional study among undergraduates of medical sciences. *Annals of Medicine and Surgery*, 60, 271–279. https://doi.org/10.1016/j.amsu.2020.10.058

[12] FISHBEIN, M., & AJZEN, I. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research.* Reading, Massachusetts: Addison-Wesley.

[13] GRADIŠEK, P., & POLAK, A. (2021). Insights into learning and examination experience of higher education students during the Covid-19 pandemic. *Journal of Contemporary Educational Studies*, 72(138), 286–307. Retrieved from https://www.sodobna-pedagogika.net/en/articles/01-2021_insights-into-learning-and-examination-experience-of-higher-education-students-during-the-covid-19-pandemic/

[14] GUANGUL, F.M., SUHAIL, A.H., KHALIT, M.I., & KHIDHIR, B.A. (2020). Challenges of remote assessment in higher education in the context of COVID-19: a case study of Middle East College. *Educational Assessment, Evaluation and Accountability*, 32(4), 519–535. https://doi.org/10.1007/s11092-020-09340-w

[15] HAIR, J.F., BLACK, W.C., BABIN, B.J., & ANDERSON, R.E. (2014). *Multivariate Data Analysis.* 7th ed. Upper Saddle River, New Jersey: Pearson Education.

[16] HASH, P.M. (2021). Remote Learning in School Bands during the COVID-19 Shutdown. *Journal of Research in Music Education*, 68(4), 381–397. https://doi.org/10.1177/0022429420967008

[17] INGLEBY, E. (2012). Research methods in education. *Professional Development in Education*, 38(3), 507-509. https://doi.org/10.1080/19415257.2011.643130

[18] JAGER, J., PUTNICK, D.L., & BORNSTEIN, M.H. (2017). II. More than just convenient: The scientific merits of homogeneous convenience samples. *Monographs of the Society for Research in Child Development*, 82(2), 13–30. https://doi.org/10.1111/mono.12296

[19] KAISER, H.F., & RICE, J. (1974). Little Jiffy, Mark Iv. *Educational and Psychological Measurement*, 34(1), 111–117. https://doi.org/10.1177/001316447403400115

[20] KIM, Y.M. (2010). Gender role and the use of university library website resources: A social cognitive theory perspective. *Journal of Information Science*, 36(5), 603-617. https://doi.org/10.1177/0165551510377709

[21] LI, M., LUO, L., SIKDAR, S., NIZAM, N.I., GAO, S., SHAN, H., KRUGER, M., KRUGER, U., MOHAMED, H., XIA, L., & WANG, G. (2021). Optimized collusion prevention for online exams during social distancing. *npj Science of Learning*, 6(1), 5. https://doi.org/10.1038/s41539-020-00083-3

[22] MASTOUR, H., & GHALIBAF, A.M. (2020). Remote online exams anxiety during the COVID-19 crisis: A cross-sectional study among medical students. *Research Square*. https://doi.org/10.21203/rs.3.rs-144112/v1

[23] MILMAN, N.B. (2020). Pandemic pedagogy. *Phi Delta Kappa International*. Retrieved from https://kappanonline.org/pandemic-pedagogy-covid-19-online-milman/

[24] NGQONDI, T., MAONEKE, P.B., & MAUWA, H. (2021). A secure online exams conceptual framework for South African universities. *Social Sciences & Humanities Open*, 3(1), 100132. https://doi.org/10.1016/j.ssaho.2021.100132

[25] NGUYEN, X., PHO, D., LUONG, D., & CAO, X. (2021). Vietnamese students' acceptance of using video conferencing tools in distance learning in COVID-19 pandemic. *Turkish Online Journal of Distance Education*, 22(3), 139–162. http://dx.doi.org/10.17718/tojde.961828

[26] ONG, C.S., & LAI, J.Y. (2006). Gender differences in perceptions and relationships among dominants of e-learning acceptance. *Computers in Human Behavior*, 22(5), 816-829. https://doi.org/10.1016/j.chb.2004.03.006

[27] PERROTTA, G. (2019). Anxiety disorders: definitions, contexts, neural correlates and strategic therapy. *Jacobs Journal of Neurology and Neuroscience*, 6(1), 042. Retrieved from https://www.researchgate.net/profile/Giulio-Perrotta/publication/344425850_Anxiety_Disorders_Definitions_Contexts_Neural_Correlates_And_Strategic_Therapy/links/5f74184d92851c14bca04303/Anxiety-Disorders-Definitions-Contexts-Neural-Correlates-And-Strategic-Therapy.pdf

[28] POPOVYCH, I., KOKORINA, Y., PYSLAR, A., PALCHYNSKA, M., PAVLIUK, M., RAIEVSKA, Y., & TOROP, K. (2022). Research of the Mental States of Anxiety of Fourth-Graders in Secondary Schools during the Progression of the COVID-19 Pandemic. *Revista Romaneasca pentru Educatie Multidimensionala*, 14(1), 32–51. http://dx.doi.org/10.18662/rrem/14.1/506

[29] ROOS, A.-L., GOETZ, T., VORACEK, M., KRANNICH, M., BIEG, M., JARRELL, A., & PEKRUN, R. (2021). Test anxiety and physiological arousal: a systematic review and meta-analysis. *Educational Psychology Review*, 33(2), 579–618. https://doi.org/10.1007/s10648-020-09543-z

[30] SAKKA, S., NIKOPOULOU, V.A., BONTI, E., TATSIOPOULOU, P., KARAMOUZI, P., GIAZKOULIDOU, A., TSIPROPOULOU, V., PARLAPANI, E., HOLEVA, V., & DIAKOGIANNIS, I. (2020). Assessing test anxiety and resilience among Greek adolescents during COVID-19 pandemic. *Journal of Mind and Medical Sciences*, 7(2), 173–178. http://dx.doi.org/10.22543/7674.72.P173178

[31] SALDAÑA, J. (2020). Qualitative data analysis strategies. In: LEAVY, P. *The Oxford Handbook of Qualitative Research*. Oxford University Press.

[32] SALDAÑA, J. (2021). *The Coding Manual for Qualitative Researchers*. Sage Publications.

[33] SHAMIR-INBAL, T., & BLAU, I. (2021). Facilitating Emergency Remote K-12 Teaching in Computing-Enhanced Virtual Learning Environments during COVID-19 Pandemic - Blessing or Curse? *Journal of Educational Computing Research*, 59(7), 1243–1271. https://doi.org/10.1177/0735633121992781

[34] TERZIS, V., & ECONOMIDES, A.A. (2011). Computer based assessment: Gender differences in perceptions and acceptance. *Computers in Human Behavior*, 27(6), 2108-2122. https://doi.org/10.1016/j.chb.2011.06.005

[35] THI THU DAO, H., & THI KIM LE, T. (2020). Transitioning from Traditional Learning to Blended Learning at Some Public Universities in Vietnam after the Covid-19 Pandemic. Proceedings of the 4th International Conference on Advances in Artificial Intelligence, London, 9-11 October 2020, pp. 85–91. https://doi.org/10.1145/3441417.3441429

[36] UNESCO. (2020). *COVID-19 Educational Disruption and Response*. Retrieved from https://www.unesco.org/en/articles/covid-19-educational-disruption-and-response

[37] VENKATESH, V., MORRIS, M.G., DAVIS, G.B., & DAVIS, F.D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425–478. https://doi.org/10.2307/30036540

[38] WORLD HEALTH ORGANIZATION. (2020). *Rolling updates on coronavirus disease (COVID-19)*. Retrieved from https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen

参考文：

[1] ABDI, H. 和 WILLIAMS, L.J. (2010)。主成分分析。威利跨学科评论：计算统计学，2(4), 433–459。https://doi.org/10.1002/wics.101

[2] ALI, L. 和 DMOUR, N. (2021)。由于新冠肺炎，向在线评估的转变：对阿联酋地区大学生、行为和表现的实证研究。国际信息与教育技术杂志，11(5), 220–228。http://dx.doi.org/10.18178/ijiet.2021.11.5.1515

[3] ARORA, S.、CHAUDHARY, P. 和 SINGH, R.K.（2021）。冠状病毒和在线考试焦虑对自我效能的影响：应对策略的调节作用。交互技术与智慧教育，18(3), 475-492。https://doi.org/10.1108/ITSE-08-2020-0158

[4] BISHNOI, M.M., & SURAJ, S. (2020)。技术转型的挑战和影响：印度在线考试的案例。第15届工业和信息系统国际会议论文集，鲁普纳加尔，2020年11月26-28日，第 540-545 页。https://doi.org/10.1109/ICIIS51140.2020.9342655

[5] BISHT, R.K.、JASOLA, S. 和 BISHT, I.P.（2022）。新冠肺炎时代在线高等教育的可接受性和挑战：学生观点研究。亚洲教育与发展研究，11(2), 401-414。https://doi.org/10.1108/AEDS-05-2020-0119

[6]博兹库特，A.，和夏尔马，R.C.（2020）。在冠状病毒大流行导致的全球危机时期进行紧急远程教学。亚洲远程教育杂志，15(1)，i-vi。https://doi.org/10.5281/zenodo.3778083

[7]布罗菲，J.（1986）。教师影响学生的成绩。美国心理学家，41（10），1069-1077。https://psycnet.apa.org/doi/10.1037/0003-066X.41.10.1069

[8] 巴特勒-亨德森，K.，＆克劳福德，J.（2020）。在线考试的系统回顾：可扩展的身份验证和完整性的教学创新。计算机与教育，159, 104024。https://doi.org/10.1016/j.compedu.2020.104024

[9] 赵德坤（2022）。应用自决理论(特殊测试)解释新冠肺炎大流行期间学生参与在线学习的情况。教育技术研究杂志，54（超级1），S14-S30。https://doi.org/10.1080/15391523.2021.18919

98
[10] ELSALEM, L.、AL-AZZAM, N.、JUM'AH, A.A. 和 OBEIDAT, N. (2021)。新冠肺炎大流行期间的远程电子考试：对医学系学生偏好和学术不诚实行为的横断面研究。医学与外科年鉴，62，326-333。https://doi.org/10.1016/j.amsu.2021.01.054
[11] ELSALEM, L.、AL-AZZAM, N.、JUM'AH, A.A.、OBEIDAT, N.、MAHMOUD, A. 和 KHEIRALLAH, K.A.（2020）。新冠肺炎大流行期间远程电子考试的压力和行为变化：医学本科生的横断面研究。医学与外科年鉴，60，271-279。https://doi.org/10.1016/j.amsu.2020.10.058
[12] FISHBEIN, M. 和 AJZEN, I. (1975)。信念、态度、意图和行为：理论和研究简介。马萨诸塞州雷丁：艾迪生韦斯利。
[13] GRADIŠEK, P. 和 POLAK, A. (2021)。深入了解新冠肺炎大流行期间高等教育学生的学习和考试经历。当代教育研究杂志，72（138），286-307。摘自https://www.sodobna-pedagogika.net/en/articles/01-2021_insights-into-learning-and-examination-experience-of-higher-education-students-during-the-covid-19-pandemic/
[14] GUANGUL, F.M.、SUHAIL, A.H.、KHALIT, M.I. 和 KHIDHIR, B.A.（2020）。新冠肺炎背景下高等教育远程评估的挑战：中东学院案例研究。教育评估、评估和问责，32(4), 519–535。https://doi.org/10.1007/s11092-020-09340-w
[15]头发，J.F.，布莱克，W.C.，巴宾，B.J.，＆安德森，R.E.（2014）。多变量数据分析。第7版。新泽西州上萨德尔河：培生教育。
[16]哈希，P.M.（2021）。新冠肺炎停课期间学校乐队的远程学习。音乐教育研究杂志，68(4), 381–397。https://doi.org/10.1177/0022429420967008
[17]英格莱比，E.（2012）。教育研究方法。教育专业发展，38(3), 507-509。https://doi.org/10.1080/19415257.2011.643130
[18] JAGER, J., PUTNICK, D.L., & BORNSTEIN, M.H.（2017）。二.不仅仅是方便：同质方便样品的科学优点。儿童发展研究学会专着，82（2），13-30。https://doi.org/10.1111/mono.12296
[19] 凯撒 H.F. 和赖斯 J. (1974)。小吉菲，马克四世。教育和心理测量，34(1), 111–117。https://doi.org/10.1177/001316447403400115
[20] KIM, Y.M.（2010）。性别角色与大学图书馆网站资源的使用：社会认知理论的视角。信息科学杂志，36（5），603-617。https://doi.org/10.1177/0165551510377709
[21]李明、罗立、西克达尔、尼扎姆、高新、单红、克鲁格、米、克鲁格、U.、穆罕默德、夏、L.，& 王, G. (2021)。优化了社交距离期间在线考试的串通预防。npj学习科学，6(1), 5。https://doi.org/10.1038/s41539-020-00083-3
[22] MASTOUR, H., & GHALIBAF, A.M.（2020）。新冠肺炎危机期间的远程在线考试焦虑：医学生的横断面研究。研究广场。https://doi.org/10.21203/rs.3.rs-144112/v1
[23]米尔曼，N.B.（2020）。流行病教育学。披德尔塔卡帕国际。检索自https://kappanonline.org/pandemic-pedagogy-covid-19-online-milman/
[24] NGQONDI, T.、MAONEKE, P.B. 和 MAUWA, H. (2021)。南非大学的安全在线考试概念框架。社会科学与人文开放，3(1), 100132。https://doi.org/10.1016/j.ssaho.2021.100132
[25] NGUYEN, X., PHO, D., LUONG, D., & CAO, X. (2021)。越南学生在新冠肺炎大流行期间接受使用视频会议工具进行远程学习。土耳其在线远程教育杂志，22(3), 139–162。http://dx.doi.org/10.17718/tojde.961828
[26]王春生，赖俊勇（2006）。电子学习接受度的主导者之间的认知和关系存在性别差异。计算机在人类行为中的应用，22(5), 816-829。https://doi.org/10.1016/j.chb.2004.03.006
[27]佩罗塔，G.（2019）。焦虑症：定义、背景、神经相关性和策略治疗。《雅各布斯神经病学和神经科学杂志》，6(1), 042。摘自https://www.researchgate.net/profile/Giulio-Perrotta/publication/344425850_Anxiety_Disorders_Definitions_Contexts_Neural_Correlates_And_Strategic_Therapy/links/5f74184d92851c14bca04303/Anxiety-疾病-定义-背景-神经-相关性和策略治疗.pdf
[28] POPOVYCH, I.、KOKORINA, Y.、PYSLAR, A.、PALCHYNSKA, M.、PAVLIUK, M.、RAIEVSKA, Y. 和 TOROP, K. (2022)。新冠肺炎大流行期间中学四年级学生焦虑心理状态的研究。罗马尼亚多维教育杂志，14(1), 32–51。http://dx.doi.org/10.18662/rrem/14.1/506
[29] ROOS, A.-L.、GOETZ, T.、VORACEK, M.、KRANNICH, M.、BIEG, M.、JARRELL, A. 和 PEKRUN, R. (2021)。测试焦虑和生理唤醒：系统评价和荟萃分析。教育心理学评论，33（2），579-618。https://doi.org/10.1007/s10648-020-09543-z
[30] SAKKA, S.、NIKOPOULOU, V.A.、BONTI, E.、TATSIOPOULOU, P.、KARAMOUZI,

P.、GIAZKOULIDOU, A.、TSIPROPOULOU, V.、PARLAPANI, E.、HOLEVA, V. 和 DIAKOGIANNIS，一、（2020）。评估新冠肺炎大流行期间希腊青少年的考试焦虑和恢复能力。心灵与医学科学杂志， 7(2), 173–178。http://dx.doi.org/10.22543/7674.72.P173178

[31]萨尔达尼亚，J.（2020）。定性数据分析策略。见：LEAVY, P.《牛津定性研究手册》。牛津大学出版社。

[32]萨尔达尼亚，J.（2021）。定性研究人员编码手册。圣人出版物。

[33] 沙米尔-因巴尔，T.，＆布劳，I.（2021）。在新冠肺炎大流行期间促进计算增强型虚拟学习环境中的紧急远程K-12教学-是福是祸？教育计算研究杂志， 59(7), 1243–1271。https://doi.org/10.1177/0735633121992781

[34] TERZIS, V. 和 ECONOMIDES, A.A.（2011）。基于计算机的评估：认知和接受方面的性别差异。计算机在人类行为中的应用，27(6), 2108-2122。https://doi.org/10.1016/j.chb.2011.06.005

[35] THI THU DAO, H., & THI KIM LE, T. (2020)。新冠肺炎大流行后，越南一些公立大学从传统学习过渡到混合学习。第四届人工智能进展国际会议论文集，伦敦，2020年10月9-11日，第 85-91 页。https://doi.org/10.1145/3441417.3441429

[36]联合国教科文组织。（2020）。新冠肺炎教育中断和应对。摘自https://www.unesco.org/en/articles/covid-19-educational-disruption-and-response

[37]文卡特什，V.，莫里斯，M.G.，戴维斯，G.B.，＆戴维斯，F.D.（2003）。用户对信息技术的接受度：走向统一的观点。《管理信息系统季刊》，27(3)，425–478。https://doi.org/10.2307/30036540

[38]世界卫生组织。（2020）。关于冠状病毒疾病(新冠肺炎)的滚动更新。摘自https://www.who.int/emergcies/diseases/novel-coronavirus-2019/events-as-they-happen