The Effectiveness of Chemistry e-Teaching and e-Learning during the COVID-19 Pandemic in Northern Viet Nam

Truong Dinh Duc, Nguyen Quang Hop, Tran Manh Dung, and Vi Thanh Ha

***Abstract*—In the appearance of the COVID-19 pandemic, many governments had to use the adoption of severe measures to counteract the spread of the infection. Social distancing and lockdown measures have led to a sudden change in people's habits. People are restricted from traveling and gathering in larger numbers to prevent the COVID-19 pandemic. In that context, the internet plays an important role in supporting e-teaching, remote working, online collaboration, online selling, video streaming, gaming, etc. E-learning in the schools and universities in Viet Nam began at the beginning of school closure after the Tet holiday. E-learning has been carried out simultaneously in all provinces with all educational levels and all available information technology resources. Despite being a low-middle-income country with limited resources, the simultaneous implementation of online learning in Viet Nam has achieved remarkable achievements, contributing to fighting the COVID-19 pandemic in Viet Nam. In this research, we study the effectiveness of chemistry e-teaching and e-learning during the COVID-19 pandemic in northern Viet Nam.**

***Index Terms*—E-teaching, e-learning, Covid-19, social distancing.**

I. Introduction

An unprecedented outbreak of pneumonia of unknown aetiology emerged in December 2019 in Wuhan City, Hubei province in China. The causative agent was identified by a novel coronavirus and this virus was subsequently termed COVID-19 by the World Health Organization (WHO) [1].

The COVID-19 pandemic has had a serious impact on people's habits and lives in the world from its beginning in late 2019 [2]. The countries most affected by the virus COVID-19 spreading are facing an unprecedented health crisis, whose effects are expected to impact their social and economic structures for a long time. In order to effectively prevent the virus COVID-19 from spreading, authorities all over the world are required to respect social distancing and lockdown measures. This led to supply of a wide number of services. Some examples include the increased usage of home delivery services, the adoption of remote working solutions and especially the shift to online lessons. Viet Nam has been among the first countries hit by COVID-19. The first case was identified in the south of Viet Nam on January 23rd [3]. As of 6:00 on June 5th, 2020 Viet Nam recorded 329 cases, of which 307 patients were discharged and no deaths due to infection were reported [4].

Viet Nam has implemented stringent measures such as isolation, surveillance, and restriction of people from virus COVID-19 affected areas, border closures, and implementation of a health declaration. Many activities that attracted a lot of people in all provinces were limited, and many places implemented measures such as measuring body temperature, equipping disinfectants, distributing masks for free in public places, tightening control of travel, shutting down schools, and classes at universities. Domestic trade is also limited [5], [6].

After a few weeks of school closure, and the situation of the COVID-19 pandemic in Viet Nam and the world had not been settled yet, it had started to have taught online for pupils and students. Despite the correction, the change in the educational system caused significant side effects and was unforeseen [7].

All grades in Viet Nam, from grade 1 to post graduate, took place in e-learning activities depending on local conditions. Although the level of information technology, telecommunication infrastructure, as well as the level and ability to use information technology in different regions are not the same, they had tried to give online classrooms in all schools and classes at universities in Viet Nam since the virus COVID-19 epidemic.

During the school year and holidays, learners' learning habits are not the same. While a decrease in formal learning habits of learners is seasonal and predictable during holidays [8], the adjustments in their learning habits during a sudden pandemic such as the virus COVID-19 epidemic are not still investigated.

As a country is besides China, Vietnam dealt with the COVID-19 outbreak very early and productively. This country is a notable case study of instantaneous and effective collaboration between the government and citizens [9].

E-teaching in all localities has obtained important achievements, contributing to keeping learners indoors and helping to early combat the COVID-19 pandemic in Viet Nam.

Relating to the topic research, Kartimi *et al.* (2021) concluded the positive attitude of chemistry teachers about the implementation of online distance learning in their class viewed from attitudes and the teachers' technological, pedagogical, content knowledge. These teachers create interactive classes by various technologies such as chemistry learning applications or social media [10]. Based on open educational resources (OER), a "virtual chemistry lab space" (VCLS) was made for easier learning in the pandemic lockdown and the learners participated in an introductory undergraduate practical chemistry course at the Open

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University of Sri Lanka were administered via the university learner management system (LMS) [11]. Babinčáková & Bernard (2020) delivered information on chemistry teachers' practices and satisfaction of students mainly on questions concerning oarious approaches to the experiment used in online classes [12]. Pho et al. (2020) indicated that external factors such as computer playfulness and subjective norm had an important impact on most technology acceptance model (TAM) constructs. Further, output quality was discovered to positively have an influence on students' perceived usefulness and acquiesce of video conferencing tools (VCTs) in distance learning in Vietnam [13].

To adapt to new conditions during the COVID-19 pandemic, on March 13th, 2020, the Vietnam Ministry of Education and Training (MoET) issued Official Letter No. 795 guiding universities and academies; pedagogical colleges and intermediate schools deploy distance learning for formal training courses, working while studying in order to cope with the situation of COVID-19 pandemic [14]. On March 23rd, 2020, MoET issued Official Letter No. 988 on ensuring the quality of rural training during the time of COVID-19 epidemic prevention [15].

II. Methods and Materials

A. Study Design

A questionnaire for learners was applied to investigate the perception and the receptive ability on online chemistry course. The teachers who had taught online chemistry courses were also interviewed in order to clarify the e-learning behavior of learners.

B. Participants

There were 1,498 learners from grade eight to undergraduate students studying online chemistry during the social distancing period who participated in the survey. All learners have participated in the survey in northern Viet Nam. In addition, we also interviewed 72 education experts and lecturers who had taught chemistry during the social distancing period. 72 education experts and lecturers are very knowledgeable about the research topic. They directly teach many online chemistry classes during the period of social distancing due to the COVID-19 pandemic.

C. Data Collection

The survey was conducted from May to June 2020 after one month finished nationwide school closures due to COVID-19. Online questionnaires were sent to learners by teachers who were alumni at the Faculty of Chemistry (Ha Noi Pedagogy University 2).

D. Statistical Analysis

Based on the data collected, we employ techniques of analysis, synthesis, comparison, and evaluation together with using Tables to demonstrate the data and research topic.

III. Results

A. Participants

1) Grades of learners and teacher

Based on the results obtained, the number of junior high school pupils is 77 (5.14%), mainly high school pupils are 1250 (reaching 83.71%) and undergraduate students are 171 (11.15%) (See Table I).

Similarly, the age of the surveyed teachers is different from 23 to 52 years old (See Table II). In addition, without age restrictions in the guidelines of the Ministry of Education and Training, some of the older teachers (over 50) also give online chemistry lectures even though their proficiency in IT application is not proficient. Thus, in the period of social distancing due to the COVID-19 pandemic, the majority of chemistry learners and teachers surveyed had made plans to ensure the content and schedule set by the school administration, following the motto of the Ministry of Education and Training (Viet Nam): "closing school, not stopping learning".

TABLE I: Grade of Learners

	Frequency	Percent	Valid Percent	Cumulative Percent
Grade 8	40	2.67	2.67	2.67
Grade 9	37	2.47	2.47	5.14
Grade 10	325	21.7	21.7	26.84
Grade 11	541	36.1	36.1	62.95
Grade 12	384	25.6	25.6	88.58
1st year Student	90	6.01	6.01	94.59
2nd year Student	35	2.34	2.34	96.93
3rd year student	38	2.54	2.54	99.47
4th year student	8	.53	.53	100
Total	**1,498**	**100**	**100**	

TABLE II: Age of Chemistry Experts and Teachers

	Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Under 25	6	8.333	8.333	8.3333
25-30	11	15.28	15.28	23.611
30-35	22	30.56	30.56	54.167
35-40	21	29.17	29.17	83.333
40-45	8	11.11	11.11	94.444
> 45	4	5.556	5.556	100
Total	**72**	**100**	**100**	

2) Living area

From Table III, it can be seen that all areas from urban to mountainous areas and the northern border of Viet Nam have implemented e-learning during the period of social distancing. The results show that rural area has the largest number of learners. This is also consistent with the distribution of population in the North of Viet Nam mainly in the delta provinces.

B. Means and Tools USED for e-Teaching and e-Learning

From Table IV, the device adopted for e-teaching and e-learning mainly consists of four types including desktops, laptops, smartphones, and tablets. In particular, smartphones are the most used: 68 teachers choose to use (42.5%), learners have 1255 options to use (66.297%), followed by laptops: teachers have 40 options (25%); learners have 428

choices to use (22.609%), the lowest are desktops and tablets. This shows that, in the era of rapid technology development, smartphones and laptops are two devices being applied a lot to serve the daily work of the family and individual. Not only are these two devices used for work, but they are also very useful devices for learners' e-learning in the COVID-19 pandemic. Desktops and tablets are not popular, as desktops do not have as much convenience as carrying them to work, and tablets are also inconvenient during use even though their functionality is no different from smartphones and laptops.

With the results of using the devices for e-teaching and e-learning chemistry, the internet connection service also includes 4 main types. Wifi connection is the highest: teachers have 70 options to use (49.65%), learners have 1274 options to use (70.62%); followed by 3G/4G networks: teachers have 46 options to use (32.62%), learners have 442 options to use (24.5%); the wired network and Bluetooth are the lowest. This is consistent with the results of using online teaching devices, smartphones and laptops, mainly using wifi and 3G/4G connection services. Desktop use wired networks.

TABLE III: LIVING AREA OF LEARNERS AND TEACHERS

	Frequency		Percent		Valid Percent		Cumulative Percent	
	Teacher	*Learner*	*Teacher*	*Learner*	*Teacher*	*Learner*	*Teacher*	*Learner*
Big cities	27	290	37.5	19.4	37.5	19.4	37.5	19.36
Towns	18	326	25	21.8	25	21.8	62.5	41.12
Rural area	18	551	25	36.8	25	36.8	87.5	77.90
Mountainous area	9	308	12.5	20.6	12.5	20.6	100	98.46
Border area	0	23	0	1.54	0	1.54		100
Total	**72**	**1,498**	**100**	**100**	**100**	**100**		

TABLE IV: DEVICES USED FOR E-TEACHING AND E-LEARNING

	Frequency		Percent		Valid Percent		Cumulative Percent	
Hardware device								
	Teacher	*Learner*	*Teacher*	*Learner*	*Teacher*	*Learner*	*Teacher*	*Learner*
Desktop	35	151	21.875	7.977	21.875	7.977	21.875	7.977
Laptop	40	428	25	22.609	25	22.609	46.875	30.586
Smart phone	68	1255	42.5	66.297	42.5	66.297	89.375	96.883
Tablet	17	59	10.625	3.117	10.625	3.117	100	100
Total	**160**	**1893**	**100**	**100**	**100**	**100**		
Internet connection								
	Teacher	*Learner*	*Teacher*	*Learner*	*Teacher*	*Learner*	*Teacher*	*Learner*
Wifi	70	1274	49.65	70.621	49.65	70.621	49.65	70.621
Wired network	24	79	17.02	4.379	17.02	4.379	66.67	75
3G/4G	46	442	32.62	24.501	32.62	24.501	99.29	99.501
Bluetooth	1	9	.709	.499	.709	.499	100	100
Total	**141**	**1804**	**100**	**100**	**100**	**100**		
Software								
	Teacher	*Learner*	*Teacher*	*Learner*	*Teacher*	*Learner*	*Teacher*	*Learner*
LMS	1	21	0.637	1.08	0.637	1.08	0.637	1.08
Zoom	59	1004	37.58	51.65	37.58	51.65	38.22	52.73
TEAM	13	210	8.28	10.8	8.28	10.8	46.5	63.53
Facebook	24	302	15.29	15.53	15.29	15.53	61.78	79.06
Zalo	23	60	14.65	3.09	14.65	3.09	76.43	82.15
Television	10	317	6.369	16.31	6.369	16.31	82.8	98.46
Google meet	15	18	9.554	.92	9.554	.92	92.36	99.38
youtube	12	12	7.643	.62	7.643	.62	100	100
Total	**157**	**1944**	**100**	**100**	**100**	**100**		

The number of Facebook and Zalo accounts is also the highest. Thus, the use of these two softwares used for online teaching is also fully exploited with 47 options (29.94%) of teachers and 362 options (18.62%) of learners.

C. Difficult to Teach Online Chemistry

Based on the survey results, 50% of teachers have difficulties in e-teaching chemistry during the social distancing of the COVID-19 pandemic.

In particular, the unstable internet connection is a cause with 24.63% of teachers polled, 18.72% of teachers said that learners do not have enough devices to participate in e-learning; learners are not proficient in e-learning (12.808%); difficulties in direct communication with learners (10,345%); The duration of one lesson is too long to cause fatigue for teachers and learners (8.867%); Not managing and controlling what learners are doing, studying or not (21,182%). In addition, to the above difficulties, a number of difficulties are presented in Table V. This is similar to the difficulty of the learners because the internet connection

quality is still not enough for learners to attend, such as being frequently out of internet connection (18.49%) and some time out of internet connection (51.47%).

Regarding the results of the survey on the difficulties encountered in the implementation of e-teaching chemistry, we can see that the infrastructure and home economics in the rural, mountainous, and border areas are still facing difficulties. This greatly affects the quality of e-learning.

D. E-Teaching Method

The method of organizing e-learning class is mainly by Facebook, Zalo, Zoom... Thus, teachers assign homeworks to learners in various forms such as sending via email, Zalo, and Facebook groups. These are three main forms, respectively, accounting for 27.91%, 32.56% and 23.26% of teachers used to assign e-learning tasks to learners in the process of e-teaching chemistry (See Table VI). This is also consistent with the current situation of using information technology and social networks as analyzed above. Moreover, the forms of checking and controlling learners' fulfillment of learning tasks assigned to them are also different, diverse and abundant.

In addition to asking learners to complete and send the results of assigned e-learning tasks through Email, Facebook and Zalo, most teachers have also applied the positive teaching methods, suggesting and aiming to formulate and develop some peculiar competences of learners when asking them to complete e-learning tasks on the internet or present their own learning products or complete topics or projects by a small group.

TABLE V: DIFFICULTIES ENCOUNTERED DURING E-TEACHING

	Frequency	Percent	Valid Percent	Cumulative Percent
Teachers				
Network speed of teachers and learners is not stable	50	24.631	24.631	24.631
All students do not have the equipment to support online learning	38	18.719	18.719	43.35
Students are not proficient in using equipment and software, so it takes a lot of time to prepare	26	12.808	12.808	56.158
Parents of learners do not facilitate their children's e-learning	4	1.970	1.970	58.128
Difficulties in direct communication with learners	21	10.345	10.345	68.473
Teachers are not confident when learners' parents are seated together with their children to help when needed	2	.985	.985	69.458
The duration of one lesson is too long to cause fatigue for teachers and learners (attendance takes about 15-20 minutes)	18	8.867	8.867	78.325
Not managing and controlling what learners are doing, studying or not.	43	21.182	21.182	99.507
Learners do not cooperate with teachers	1	.493	.493	100
	203	**100**	**100**	
Learners				
Frequent out of Internet connection	277	18.49	18.49	18.49
Sometimes out of Internet connection	771	51.47	51.47	69.96
Rarely out of Internet connection	206	13.75	13.75	83.71
Never been out of Internet connection	244	16.29	16.29	100
Total	**1,498**	**100**	**100**	

TABLE VI: HOW TO TEACH AND LEARN ONLINE CHEMISTRY

	Frequency	Percent	Valid Percent	Cumulative Percent
Assigning home works for learners of teachers				
Email the group	36	27.91	27.91	27.91
Send via Zalo group	42	32.56	32.56	60.47
Send via Facebook group	30	23.26	23.26	83.72
To each student	5	3.876	3.876	87.6
Send via form	3	2.326	2.326	89.92
Other	13	10.08	10.08	100
Total	**129**	**100**	**100**	
Checking and controlling learners completing home works				
Ask learners to email the results to the teachers	234	9.622	9.622	9.6217
Ask learners to send the results via zalo or facebook group for both teachers and classmates to see	771	31.7	31.7	41.324
Teacher prepares multiple choice task on docs.google.com/forms ... and ask learners to complete it within the allotted time	561	23.07	23.07	64.391

During the online chemistry class, some learners are required to present the result of the homeworks to the teacher and the whole class	494	20.31	20.31	84.704
Teachers use open-oriented tests such as assigning projects, topics, essays, ect. Learners complete and send to the teacher in the allotted time.	372	15.3	15.3	100
Total	**2,432**	**100**	**100**	

E. The Effect of e-Teaching Chemistry

1) Assessment of teachers

The volume of the chemistry program in the second semester of the 2019-2020 school year was completed when studying online during social distancing for more than a month (see Table VII).

We see that the majority of teachers (65.28% of the surveyed teachers) have completed the volume of chemistry programs for the second semester of the 2019-2020 school year from 10-30% of the program in more than a month.

The program volume reaches 30-60% (26.39%) and 60-100% (8.334%), which shows that it is very unlikely because, over a month, this result can only solve. There are two reasons: Firstly, the surveyed teachers have not read carefully and do not understand the question, leading to misunderstandings of the question.

Secondly, according to the research team, in Ha Noi, there are some schools that close until June 1st, 2020 due to the COVID-19 pandemic. This is also the end of the school year so the length of e-learning time and the volume of chemistry programs have been completed (100%).

In fact, the capacity to use IT applied to teaching online has so far been a limitation to the majority of teachers (see Table VIII). But the recent COVID-19 epidemic conditions have prompted teachers to teach online subjects in general and chemistry in particular. This is reflected in the results of the survey on the ability to use IT in teaching chemistry at the school level. The results show that the majority of teachers are at the proficient and basic levels.

Especially the level of "not proficient" (from 33.3 to 39.7%) is designing e-learning lectures and designing video lectures / chemical experiments. These are also two new issues for teachers and are rarely used. Therefore, the majority of teachers answered no and were also in line with the survey results about whether teachers conducted online experiments for learners or not. The results showed that only 19.4 % of teachers were asked to do online experiments.

TABLE VII: THE VOLUME OF THE CHEMISTRY PROGRAM COMPLETED WHEN E-TEACHING CHEMISTRY

	Frequency	Percent	Valid Percent	Cumulative Percent
0-20%	26	36.11	36.11	36.11
20-30%	21	29.17	29.17	65.28
30-40%	10	13.89	13.89	79.17
40-60%	9	12.50	12.50	91.67
60-80%	4	5.556	5.556	97.22
80-100%	2	2.778	2.778	100
Total	**72**	**100**	**100**	

TABLE VIII: TEACHER'S IT SKILLS GAINED AFTER ONLINE CHEMISTRY COURSE (%)

	Proficient	Basic	Not proficient	Not known yet
Prepare a slideshow using Power-point to teach	43.84	52.05	2.74	1.37
E-learning lesson design (by Adobe presenter /Ispring)	8.219	41.1	39.7	11
Design lecture videos / chemical experiments	13.89	47.22	33.3	5.56
Organize learning systems / learning management systems for learners (via Moodle, Teams, Facebook, Shoology)	18.92	59.46	17.6	4.05
Skill using computers, projectors	50	47.22	1.39	1.39

The survey results show that e-learning in schools is a completely new issue for the majority of learners and schools in Viet Nam and especially schools in mountainous or border areas (See Table IX). Therefore, the results show that the number of learners who have good ability in e-learning is limited and concentrated mainly in schools in developed areas such as Hanoi and Vinh Phuc.

2) Assessment of learners

The result of a survey of learner satisfaction and opinions on the effectiveness of online chemistry is listed in Table X. Learners' evaluation in "Comments of learners about online chemistry" with normal, interesting, and very interesting levels is 62.82%, 22.36%, and 6.275% respectively. 128 students (8.54% of learners) rated this indicator as uninteresting. During the COVID-19 pandemic, when students are not allowed to go to school or participate in crowded activities, online learning in general and online chemistry learning, in particular, is also a therapy to reduce stress. These results show that online chemistry lessons are interesting enough to attract learners.

TABLE IX: TEACHER EVALUATION OF LEARNERS' E-LEARNING (%)

	Good	Rather good	Medium	Weak
Determine learning goals	4.167	58.33	36.1	1.39
Identify known knowledge / skills related to the learning content	2.778	56.94	40.3	0
Determine the time for learning and expected results	6.944	45.83	43.1	4.17
Searching / gathering information via the Internet and other sources	20.83	48.61	25	5.56

Analyze and process the information found to solve learning problems raised by teachers or proposed by themselves.	6.944	41.67	48.6	2.78
Communicating with teachers and cooperating with classmates during e-learning due to COVID-19 pandemic	12.5	50	36.1	1.39
Record knowledge or show learning products in various creative forms	5.556	50	43.1	1.39
Evaluate learning outcomes (determine level of achievement of learning goals)	8.333	40.28	48.6	4.17
Learn from experience and adjust the learning in the next lesson and next time	6.944	58.33	34.7	0

TABLE X: LEARNER ASSESSMENT OF ONLINE CHEMISTRY EFFICIENCY

Comments of learners about online chemistry			
Very interesting	Interesting	Normal	Not interested
94 (6.275%)	335 (22.36%)	941 (62.82%)	128 (8.545%)
Assess the effectiveness of online chemistry learning			
Very effective	Effective	Normal	Inefficient
66 (4.406%)	418 (27.9%)	875 (58.41%)	139 (9.279%)
The comprehension level of learners when studying online			
Very understandable	Understandable	Understand the part	Not understand
98 (6.542%)	698 (46.6%)	625 (41.72%)	77 (5.14%)
Learners' opinion on whether or not to continue studying online chemistry			
Yes	Combined online and offline	No	
195 (12.45%)	711 (45.4%)	660 (42.15%)	

In particular, only 139 students (accounting for 9.28 % of learners) rated the item "Evaluating the effectiveness of online chemistry learning" as ineffective. Meanwhile, there are 875 students who rated this item as normal, accounting for 58.41 %. There are 418 students, accounting for 27.90 % of the respondents, rating the online chemistry class as effective. 66 students rated the online chemistry class as very effective, accounting for 4.41 % of the learners. This shows that the interaction level of an online chemistry classroom is not much different from a normal classroom.

With the content "The comprehension level of learners when studying online", only 5.14 % of learners (77 students) answered that they could not understand the online chemistry lesson. 625 students (accounting for 41.72 % of the learners) replied that they understand the lesson partially. There are 698 students (accounting for 46.60 % of the learners) understanding the lesson. Especially, 98 students (accounting for 6.54 % of the respondents) understand it very well.

Based on the above results, the study of online chemistry is assessed at a high level of satisfaction, excitement, and efficiency. Specifically, the high effective assessment ranges from 4.41 % to 6.54 %, but learners rate the comprehension, effectiveness, and excitement levels as 22.36 % - 46.60 % and the average level (latent form) from 41.72 % to 62.82 %.

With the content "Learners' opinion on whether or not to continue studying online chemistry", only 12.45 % of learners want to continue chemistry e-learning while 42.15 % of learners would like to study chemistry offline. Up to 45.40 % of learners want to combine online and offline learning. This shows that, in the context of the complicated development of the COVID-19 pandemic, the number of students who want to combine online and offline chemistry learning is larger than the number of students who want to study offline. Besides, the number of students who want to learn chemistry online is 3 times smaller than the number of students who want to learn it online. This shows that the combination of online and offline chemistry learning has attracted interest from a large number of learners.

During the weakened COVID-19 epidemic, school administrators can consider combining online and offline learning to alternately send learners to class. If done well, alternating offline learning will just implement the social distancing to prevent diseases and achieve the training results as expected.

With the efforts of both teachers and learners, the attention of the education administrators and the whole society, the advancement to study online all subjects in general and chemistry, in particular, can be considered as one of the important steps for the education sector in the time of the COVID-19 pandemic.

F. Proposing Some Measures to Improve the Effectiveness of Online Chemistry

In the current situation, because the COVID-19 pandemic is still complicated and it is also an indispensable trend of life, bringing IT applications into teaching online all subjects in school in general and chemistry, in particular, are concerned and invested [10]-[13]. Based on the survey results obtained from teachers and learners in e-teaching and e-learning chemistry, we give some proposals to improve the efficiency of e-teaching and e-learning of chemistry as below:

First, the network infrastructure needs to be improved to ensure the online learning process with a stable connection. 10% of students said that the main problem is a slow internet connection. Actually, the internet connection is a real limiting factor in online courses during the COVID-19 pandemic [12].

Second, it is necessary to have training courses or instructions on how to teach and learn online for teachers and learners so that they can approach methods and applications effectively. The research [10] shows that there is a negative attitude of some teachers towards the technology used in their courses. They are senior teachers with more than ten years of teaching experience on average.

Third, teachers provide and guide full reference materials related to the online lesson before e-learning so that all learners can easily access it on general applications and especially free applications.

Fourth, ensuring the duration of a lesson and the distance between classes, avoiding the fact that learners have to study online for many hours a day, reducing concentration and causing fatigue for learners. This can lead to ineffective results for the next class.

Fifth, teachers should apply more and more active teaching methods and techniques to improve the classroom atmosphere to avoid boredom and ineffectiveness.

Sixth, parents need to support and facilitate the most in terms of time and equipment to enable learners to attend classes fully and uninterrupted.

Seventh, teachers should have a plan for learners to study online at home. Ensuring the number of learners who can go to the classes to attend offline classes will ensure social distancing while the rest learn online.

IV. Conclusion

The survey on the status of e-teaching and e-learning of chemistry during social distancing due to the COVID-19 pandemic in Vietnam has obtained results from 1,498 learners and 72 teachers and education experts in chemistry in northern regions of Vietnam. The results show that most schools have implemented e-teaching including chemistry when learners could not go to school. Thereby we can see the difficulties and advantages in the e-teaching and e-learning process of chemistry, based on which we have proposed a number of measures to improve the effectiveness of chemistry e-teaching and e-learning.

In some emergency situations such as during the COVID-19 pandemic, school administrators should consider the possibility of alternating online and offline learning to ensure the safety of learners and teachers and still achieve training results as usual.

This is one of the right directions of the education sector in Vietnam in the recent COVID-19 pandemic and also the current and future development trend. In the future, when the COVID-19 pandemic is repelled, educational strategists should study online and offline methods of combined education for those who have worked or those with difficult circumstances who cannot go to class regularly.

However, if teachers participating in the survey are with a larger number of samples, the results obtained would be more reliable.

In the future, a comparative study on the effectiveness of online learning of different subjects during the COVID-19 pandemic as well as the influence of online learning on skill formation of learners should be conducted [16].

Conflict of Interests

We declare that they have no conflict of interests.

Author Contributions

Dr. Truong Dinh Duc, Dr. Nguyen Quang Hop, and Assoc. Prof. Tran Manh Dung are the principal researchers of this study. Ms. Vi Thanh Ha helped us prepare the questionnaire.

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