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E-learning Over Covid-19 Pandemic in Hung Vuong University: A Case Study From a Multidisciplinary Local Public University In Vietnam

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Abstract : HVU is a multidisciplinary public local university, so they have specific characteristics to deploy e-learning in the general context of Vietnam. The pressure of implementing e-learning based on the appearance of Covid-19 leads to surprise and unexpected successes. The amount of work after Covid-19 occurred is many times more than before 2019, including implementing an e-learning system and the use of related users such as administrators, lecturers, and students. The research objective is to introduce the process of applying e-learning in HVU to the stakeholders. The experimental results are conducted by 508 surveys on students and 62 surveys on lecturers. The surveyed information includes (1) The interaction of students when using MS Teams; (2) The feedback from students when using HVU LMS; and (3) The habits of the lecturers when using e-learning tools. All of those results verify the reached goal of the e-learning implementation of HVU.

Keywords : E-learning; Vietnamese university; Covid-19

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Abbreviation	Meaning
HVU	Hung Vuong University
MS	Microsoft
LMS	Learning Management System
FoET	Faculty of Engineering Technology

1. Introduction

There are about two and half years since the first identified Covid-19 case from an outbreak in Wuhan, China, in December 2019 [1]. Caused by SARS-CoV-2, it was declared a Public Health Emergency of International Concern on 30 January 2020 and a pandemic on 11 March 2020 by the World Health Organization. More than 514 million cases and 6.23 million deaths have been recorded in this one of the deadliest pandemics in human history. Its worldwide effects on every aspect of society will be considered one of the most outstanding problems in the third decade of the XXI century. Vietnam has experienced 4 waves of covid [2]. After the surprising success of the policy "zero covid" in the first Covid-19 wave [3], the government decides to provide vaccine coverage [4], [6], [5] when (1) the number of cases increases out of control and (2) the pressure on the economy becomes concerning after a long time of shutting down the country. Phu Tho is one of the safest provinces in the first 3 waves but has many problems in the next wave.

As one of the oldest educational institutions in the northern mountainous region of Vietnam, Hung

Vuong University (HVU) was established in 2003 by upgrading from Phu Tho pedagogical college. Over 20 years of development, HVU has successfully expanded the scope of training from teachers to a wide range of majors. Although strongly promoted the application of information technology in operations and teaching, HVU experiences a big turning point when it is forced to train online during the Covid-19 pandemic. The main goal is remaining the learning progress and the quality of learning while students can not go to class continuously.

Survey results from lecturers and students show that the e-learning of HVU during this period brought positive meanings for both lecturers and students. In the earlier stage, the classes are implemented using MS Teams under the close supervision of the Department of Academic Affairs and Faculties. Students, especially last-year students, should not be delayed in their studies, which may affect their employment. After that, the HVU Learning Management System (LMS) is built to optimize the learning organization as class creation, document providing, and examination results analytically.

After this first section, the rest of the article is as follows: The following section presents a research context, including information about HVU and the Covid-19 pandemic in Vietnam. The next 2 sections are about how e-learning systems are applied, including MS Teams and the LMS of HVU. Section 6 discusses threats to validity. The last section summarizes works, introduces suggestions to the stakeholders, and proposes a few promising ideas.

2. Research Background

A. Hung Vuong University

HVU [7] is a multidisciplinary public local university located in Phu Tho province, Vietnam:

- There are public and private universities in Vietnam. In a public university, the government provides resources such as salary, infrastructure, etc. Private universities need social investments.
- Administratively, there are government and local universities. The Ministry of Education and Training of Vietnam controls the government university. The province governor, who represents the local government, supervises the provincial university.

i. History

HVU was established on April 29, 2003, under Decision No. 81/2003/QD-TTg of the Prime Minister. Figure 1 illustrates the historical process of HVU. The university upgraded directly from Phu Tho pedagogical college, whose function is to train teachers at all levels for Phu Tho province.

Before the upgrade, the college incorporated several schools of various kinds in the historical timeline. The 3 levels of teacher training lead to the 3 colored corresponding types of schools. Blues is a kindergarten school for training kindergarten teachers. Green is the pedagogical school for training primary teachers. Red is the pedagogical college for training junior teachers. The other purple school is a professional training school for teachers and educational administrators whose function is to foster teachers and educational administrators.

The part of the school name (Vinh Phu, Phu Tho, and Vinh Phuc) is the province name. In history, the pedagogical schools belong to and train teachers for the province. There were 2 historical events: On 26/1/1968, Vinh Phu merged from Phu Tho and Vinh Phuc; and on 6/11/1996, Vinh Phu divided to re-establish Phu Tho and Vinh Phuc provinces. From 1968 to 1996, each province had its school: Phu Tho junior pedagogical school and Vinh Phuc junior pedagogical school.

The meaning of the phrase "a+b" in the school name, e.g. Vinh Phu 12+2 pedagogical school, is based on the educational situation in Vietnam in the 1980s. In 1981, the Vietnamese education system changed from a 10-year to a 12-year. Before 1981, Vietnamese students had to go through 3 levels of education: primary school from grade 1 to grade 4, junior school from grade 5 to grade 7, and high school from grade 8 to grade 10. After 1981, those class range intervals changed to 1-5, 6-9, and 10-12. After graduating from high school, students had to study for 2 (3) more years to be eligible to teach in primary (junior) school. So the phrase "12+2" means the input of the school is graduated high school students while the output is primary teachers.

After the upgrade, HVU was qualified to train education bachelors who can teach in high schools. In addition, HVU expanded the training scope to new majors such as bachelor of accounting, electric engineer, veterinarian, etc. So now, HVU has 38 bachelor/engineer/doctor and eight master's majors.

ii. Organization

Figure 2 presents the organization of HVU. The Director board administrates all the aspects of the university comprehensively. There are 4 related organizations whose functions are as follows:

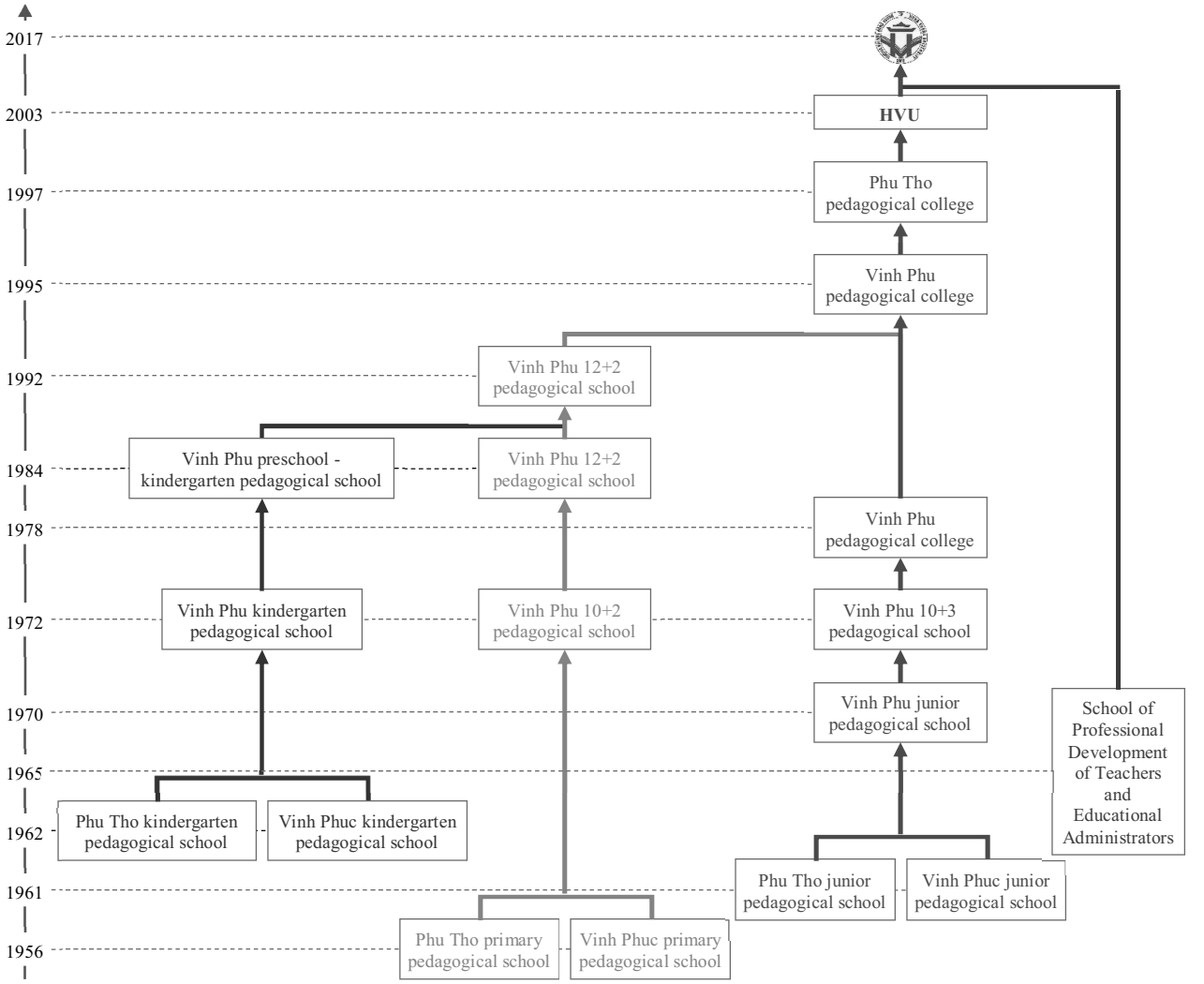


Fig. 1 : HVU history

University Council approves all major university issues [8] before being executed by the Director board.

Science Academic Council and Quality Assurance Council are 2 professional councils that support the Director board on specific issues.

Union is an organization of workers operating under the public policies of Vietnam [9].

There are 3 groups of affiliated units of HVU:

7 departments in blue focus on administrative activities.

7 centers and institutes in green provide commercial services to stakeholders, staff, lecturers, and students.

9 faculties in orange are the teaching units. Each faculty manages different majors. The faculty contains departments. For example, the FoET - Faculty of Engineering Technology includes 4 departments: the Department of Software Engineering, the Department of Network and Communication, the Department of Electric and Electronic Engineering, and the Department of Mechanic Engineering. Those departments manage the majors of Information Technology, Electric and Electronic Engineering, and Mechanic Engineering, respectively.

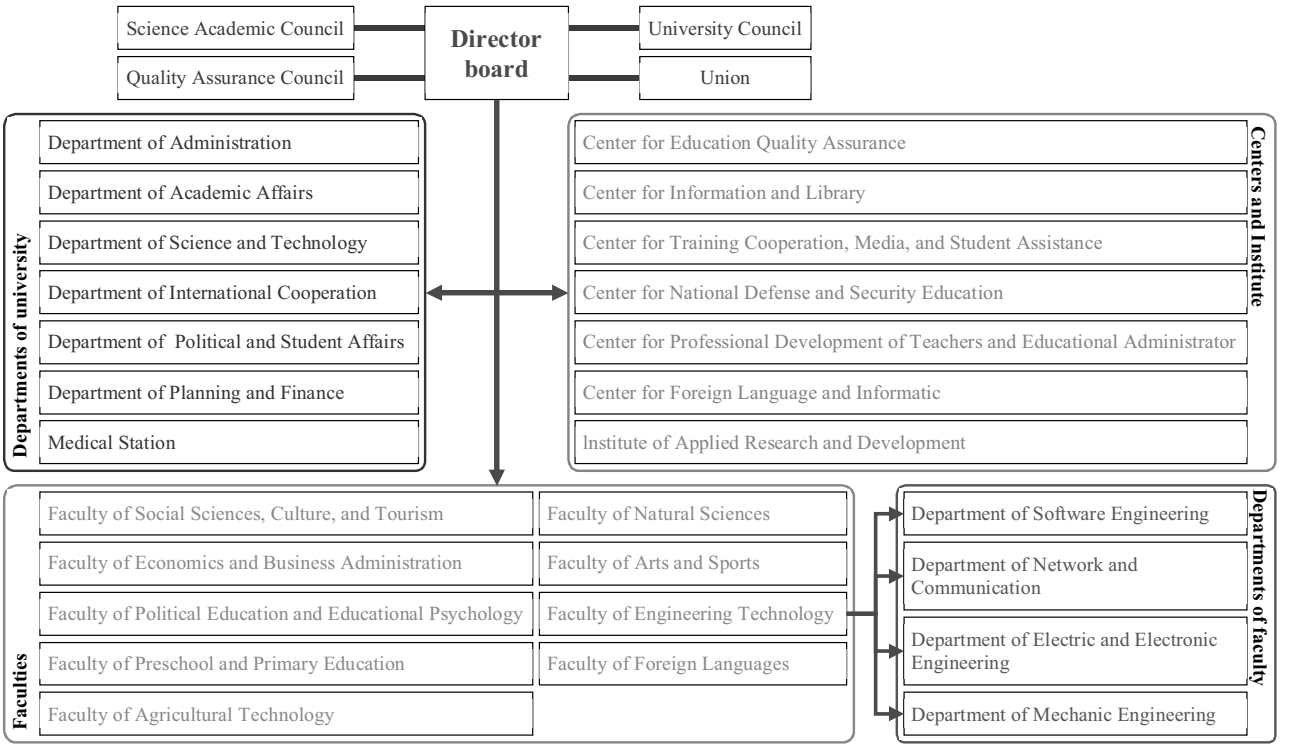


Fig. 2 : HVU organization

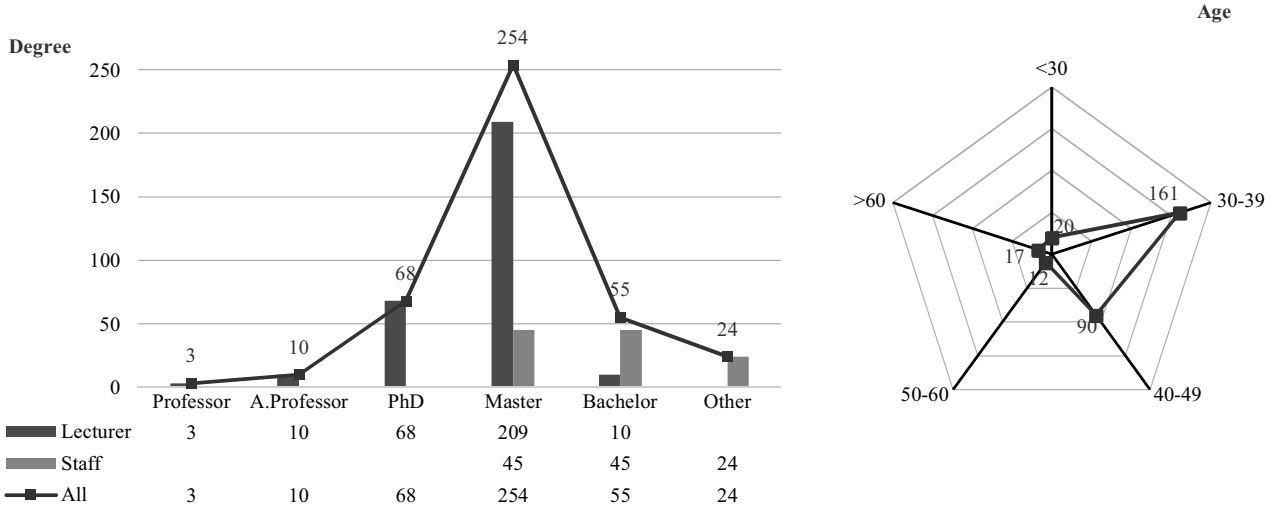


Fig. 3 : Lecturer and staff

Note the difference between the department of university (focus on official activities) and the department of faculty (focus on teaching).

iii. Lecturer and staff

At Vietnam University, the mission of lecturers is to do research and teach. The official and support activities belong to the staff. In some cases, the university can promote staff to become a lecturer when passing the exam. The rate between lecturer and staff in HVU is 0.38 supporting staff per lecturer.

The required degree for a lecturer is a master's degree. As in Figure 3, the biggest group is the master with 254 lecturers. This situation leads to the problem

that HVU has the motivation to let lecturers do Ph.D. to improve the quality of teaching. Ten lecturers that do not reach this requirement have to be teaching assistants with a lower salary. In the group of staff, there are some masters but most are a bachelor or lower.

Professor and Associate Professor are not working positions in the university. In Vietnam, they are types of rank in the higher education system, similar to Lecturer or Teaching Assistant. The degree requirement for those ranks is a Ph.D., except for some majors such as Art, Sport, etc.

At the right of Figure 3, it is easy to realize that HVU has a very young team. The distortion of the radar chart shows an imbalance in the age distribution of the lecturers. 161 (38.9%) of them are between the ages of 30 and 39; 90 (21.74%) are 40-49. It is the result of the scale-up process from 2003 to now.

iv. Student

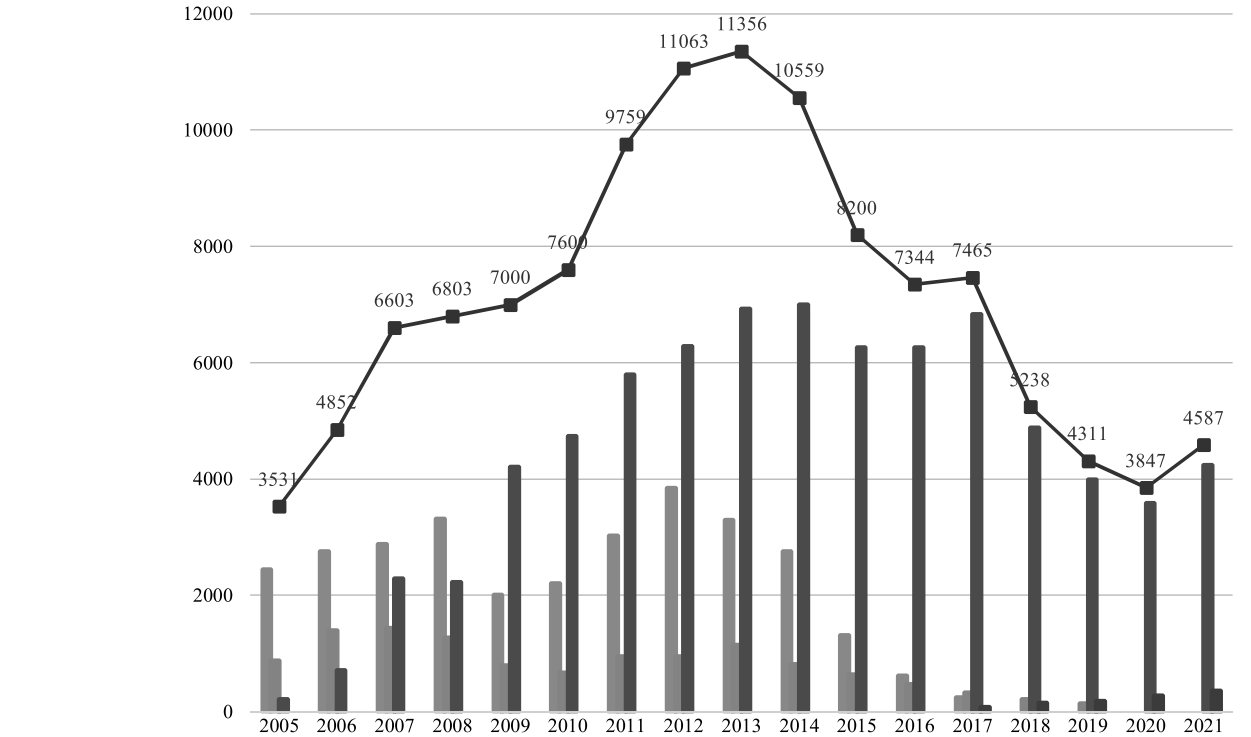
Figure 4 shows the number of HVU students in which the total number of students is in the blue line and the number of different types of students is in the column.

· HVU has taught master's since 2017 and the number of master's students grows year by year.

· Undergraduate students increases continuously since the establishment of the university until 2014. After that period of growth, the number of those students remained stable, although there is a slight decrement.

· There are 2 types of students retained before upgrading to university, which was in large numbers a few years ago but are not in demand today:

Most of the 2-year students are pedagogical students. The highest amount was 3838 students in 2012. The last students of this type were in 2017. This number shows that (1) Vietnam still needs more teachers, and (2) the trend of teacher training at HVU is still sustained for more than ten years after upgrading to university.



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Middle school student	2440	2751	2877	3310	2000	2200	3019	3838	3291	2757	1309	614	237				
College student	879	1396	1438	1273	795	669	944	950	1142	809	631	474	327	207	139		
Undergraduate student	212	705	2288	2220	4205	4731	5796	6275	6923	6993	6260	6256	6829	4879	3991	3578	4233
Master													72	152	181	269	354
Total	3531	4852	6603	6803	7000	7600	9759	11063	11356	10559	8200	7344	7465	5238	4311	3847	4587

Fig. 4 : Students

College students include several majors like Accounting, Pedagogical, Information technology, etc. These student types had a large number from 2006 to 2013 and decreased significantly before disappearing in 2019.

From the above data, we draw the following remarks:

- When upgrading to a multidisciplinary university, HVU lost the source of low-level pedagogical students. But other types like undergraduate and master's students can not fill the remaining gap.
- The undergraduate students have remained at around 4000 - 6000. In Vietnam, this type of student is still the core audience of universities.
- Local universities like HVU face a big obstacle when expanding their graduated training system, which is the problem of highly qualified lecturers.

B. Covid-19 waves and social distancing in Vietnam

Figure 6 illustrates the timeline of the Covid-19 waves [4] and social distancing in Vietnam and Phu Tho. The response of Vietnam to the Covid-19 pandemic has 2 points worth noting [4] [5]:

- In the earlier phase, Vietnam has a policy of "zero Covid" and get a surprising success [3]. The activities of the government to apply this policy includes:
- Separating from the outside includes closing the border and international flights.
- Social distancing on different scales includes nationwide, the province, the city, etc.
- Close some non-essential services such as tourism, resorts, entertainment, etc.
- After 4 waves of Covid-19, Vietnam decides to end the "zero covid" policy and increases vaccine coverage for the people. To 24/4/2022, Vietnam has injected 212,390,774 doses of the Covid-19 vaccine [10] into more than 97 million people. This result is based on the activities of the government and the knowledge about the Covid-19 vaccine of people [6].

C. Context of e-learning in HVU

i. Digital transformation in HVU before Covid-19 pandemic

After the upgrade, HVU applies information technology in all the aspects of the operation illustrated in Figure 5. HVU focuses on commercial software from big-name providers such as Nam Viet, CMC, MISA, and Anh Quan. There are 2 exceptions: the grade management system is developed by the own HVU lecturer and the English LMS is transferred from Hanoi University of Industrial. Most of the used software is paid application, except .hvu.edu mail is free and based on Gmail.

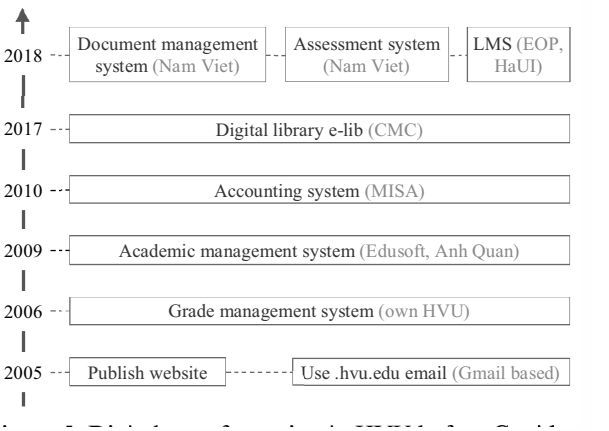


Fig. 5: Digital transformation in HVU before Covid-19

ii. Learning in HVU over Covid-19

The first time online learning at HVU is in only 1 month. It starts when the Vietnam government decides to social distancing in the first wave. But it ends after this wave ends 2 weeks. The second online learning lasts very long that takes place for more than 7 months. HVU decides to take students to come back step by step. HVU has to extend the new year holiday 2 times because of the waves.

iii. Timeline applying e-learning in HVU after the Covid-19 pandemic occurs

Figure 6 presents the process of applying e-learning in HVU after Covid-19 occurred. The first work is to decide which software to use among several considered applications such as MS Team, Google Meet, Zoom, etc. After considering its popularity in other universities, the cost to be paid, and compatibility with other systems, HVU decides to use MS Team. After this choice, HVU lecturers are trained about the MS Teams use before starting using it on 1/4/2020.

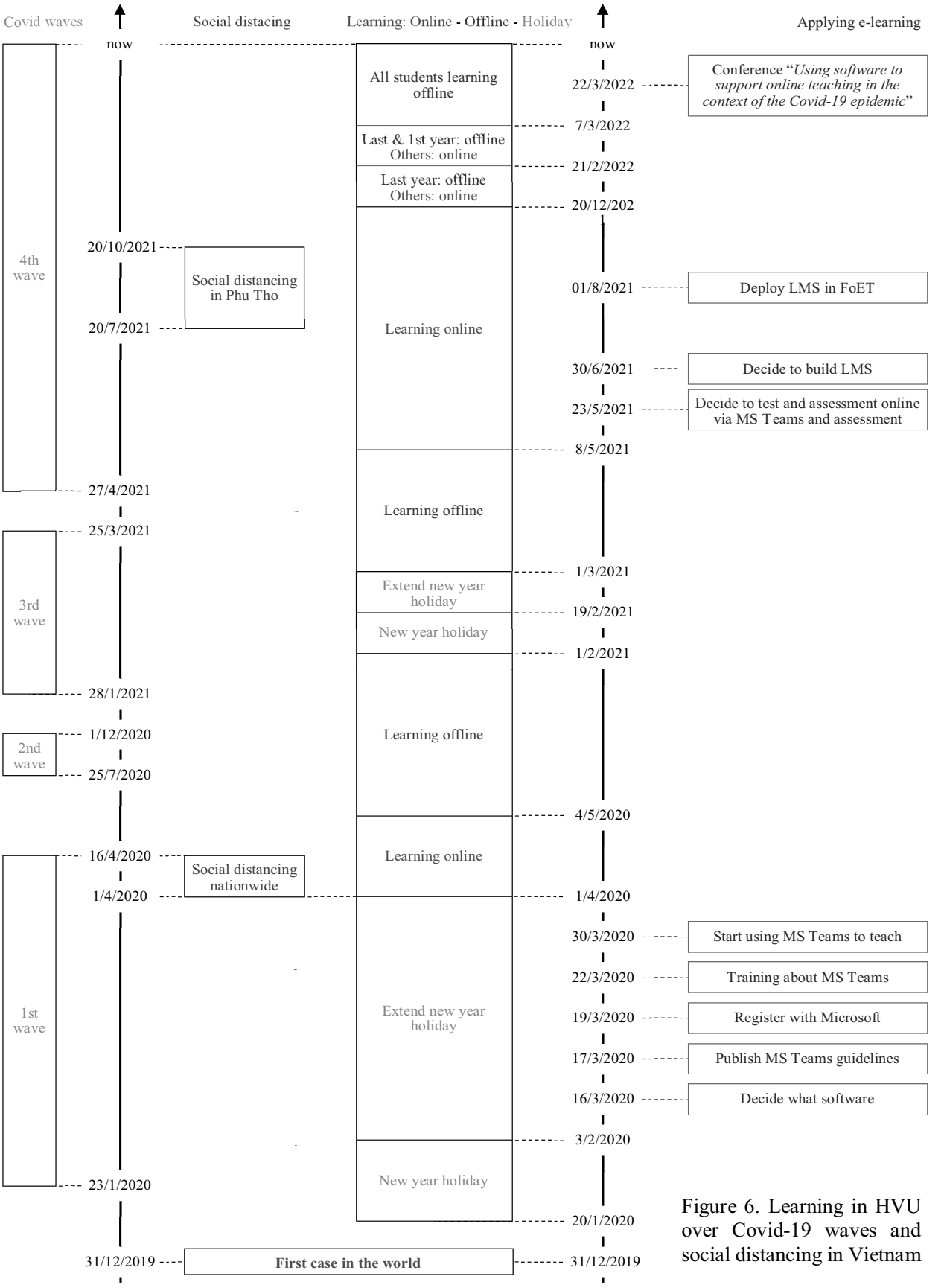


Figure 6. Learning in HVU over Covid-19 waves and social distancing in Vietnam

The second period is about the LMS building process. The decision to build this system is on 30/6/2021. After 2 months of deployment, the system has piloted in FoET first.

3. Ms Teams Deployment

A. Training the lecturers

Before training, FoET prepares a guideline for use. HVU divides lecturers into 2 groups based on faculty. The first group includes lecturers from the Faculty of Social Sciences, Culture, and Tourism; Faculty of Natural Sciences; Faculty of Preschool and Primary Education; and Faculty of Arts and Sports. The second group contains lecturers from the remaining faculties.

HVU trains lecturers to manage students in class, upload documents, teach via meeting tools, take the practices, and assess students by MS Teams.

B. Class creation

In the beginning, the Department of Academic Affairs staffs organize classes manually. They create the class and then add the required member by the tool MS Teams. After that, they use the LMS tool to create the classes and add members.

The name of the class in MS Teams is illustrated in Figure 7 and contains 7 parts as followings:

- The first 2 characters are the year.
- The next symbol is the semester.
- The following phrase is the course ID.
- The following number (if needed) is the group index if there is more than 1 group in this course.
- The next is the course name.
- The next is the lecturer's name.
- The last is the lecturer ID.

Those phrases are separated by the underline symbol (_). This naming convention gives some advantages as follows:

- Supporting generates a class automatically from

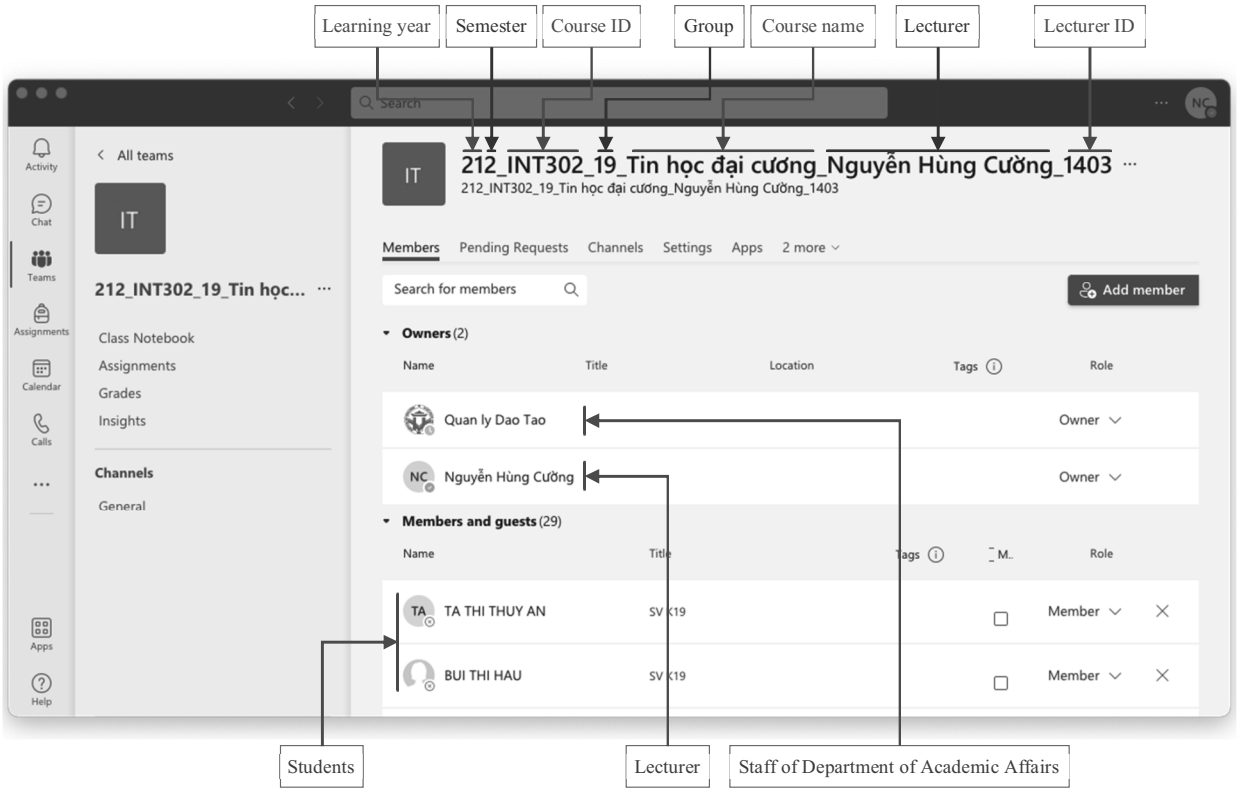


Fig. 7 : Class naming convention when deploy in MS Teams

the list of classes that are stored in an MS Excel file.

- Related partners, i.e. academic affairs, lecturers, or students, can easily manage classes, including search and access classes.

C. Requirements of university

To ensure the quality of teaching, HVU requires:

- Only theoretical content, exercises, and discussion. Not practice, experimental, or physical activities.
- The Faculty must review all courses.
- Go to university to teach.
- The lecturer must send to students via Zalo, Facebook messenger, and email:

- Before class: Course outline, References.

- In class: Discussion; Practice; Experimental; and Exercise.

- After class: Exercises.

This requirement of sending also is a motivation to (1) deploy LMS, and (2) collected the list of useful tools that are used by lecturers.

D. Class member

As mentioned in Figure 7, the class must contain (1) a Lecturer and academic staff of the Department of Academic Affairs as owners; (2) Students. It takes advantage of the permissions of classes in MS Teams. The accounts of lecturers and students are the email provided by Gmail. The lecturer account reuses academic management system id, e.g. 1403@hvu.edu.vn. The system generates a student account from the student id, e.g. 215D050003 @hvu.edu.vn.

Each faculty has their requirement. E.g. FoET requires the lecturer to add the:

- Dean of Faculty,
- Head of Department,
- Studying consultant of class,
- and Academic staff

to the class as members.student types had a large number from 2006 to 2013 and decreased significantly before disappearing in 2019.

E. Interaction in class

The experimental result in Figure 8 is collected from 148 first-year students of primary school teacher majors. There are 97 women and 51 men. The evaluated interactions include the Lecturer - student inside the class, the Lecturer - student outside the class, and the Student - student outside the class. From the top of Figure 8, the level of interactions is similar

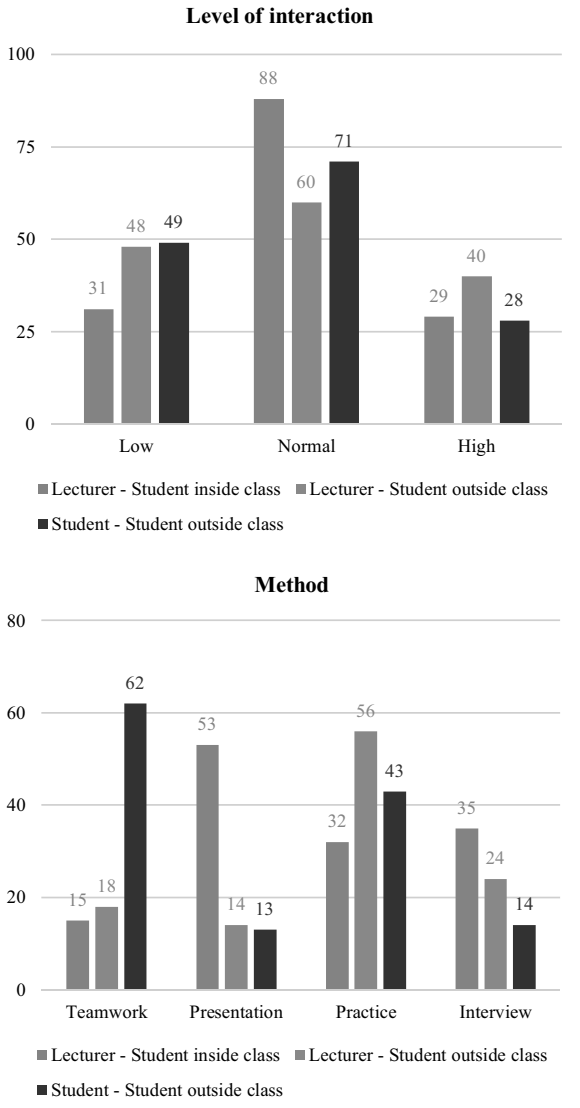


Fig. 8 : Interaction in class

between the 3 types of interactions. The rest of the figure shows that Teamwork has an advantage over the work between students, Presentation is often used in class by lecturers and students, and they use Practice and Interviews commonly.

4. Lms Deployment

The Director board decide to build the LMS in 6/2021 through Information technology lecturers in FoET.

A. Software

The LMS is based on Moodle 3.0. The Operating system is Ubuntu Server 18.04 LTS.

B. Hardware

3 systems deploy the LMS:

- The first system is the server in the library whose configuration is Intel Xeon E7520 2 processors 1.87GHz, 16GB RAM, Window Server 2007 Service Pack 2 64-bit. This system deploys the LMS from 01/8/2021 to 12/8/2021.

- The second system is the personal computer. This system deploys the LMS from 13/8/2021 to 01/3/2022.

- The third system is a server with CPU Intel(R) Xeon(R) E-2234 CPU @ 3.60GHz, 8 cores; 1TB HDD; and 16GB RAM. This system deploys the LMS from 02/3/2022 to now.

Table 1 : System failures

From	To	Description
10/8/21	23/8/21	**Problem**: Can not access LMS via local network **Solution**: Resolved by the Internet provider
08/9/21	09/9/21	**Problem**: Lost power, error in dynamic IP **Solution**: Set static IP
23h00 25/9/21	07h00 26/9/21	**Problem**: Lost power, the server can not auto restart **Solution**: Manual restart
04h00 08/10/21	07h00 08/10/21	**Problem**: Lost power, the server can not auto restart **Solution**: Manual restart
12h00 13/10/21	13h30 13/10/21	Network maintenance

There are some system failures mentioned in Table 1.

C. Using stats

Firstly, lecturers and students in FoET test the LMS. In the first semester of this learning year, there are 38 classes with 790 accounts (31 lecturers and 759 students). The resources include 278 documents and 1293 examinations. From 2021 September to 2022 January, there are more than 500.000 access and 16.534 logins.

FoET requires each class must organize at least 1 examination via LMS with quiz type. There are 19 (50%) classes that implement more than this requirement. The highest numbers were 14 (INT307 - Data Structures and Algorithms) and 9 (INT326 - English for IT students).

D. Feedback of students

i. Feedback about the interface and business process

This work surveys 148 students of Information Technology major, including 137 men and 11 women, from 2021 September to 2022 January. 30 third-year students, 43 second-year students, and 75 first-year students give good evaluations of the graphic user interface and the system business process:

- Evaluation of the system's interface and presentation: To find out and evaluate the appropriateness of the layout of the interface of the learning material system so that it is convenient for users, we ask the student's opinions on the interface layout of the system based on the following 4 aspects:

- How to arrange the content on the website?

- Typography, presentation font;

- Language of presentation;

- The balance and harmony between image content and text content.

The results of the consultation show that regarding the layout of the content on the website, 53.5% of the

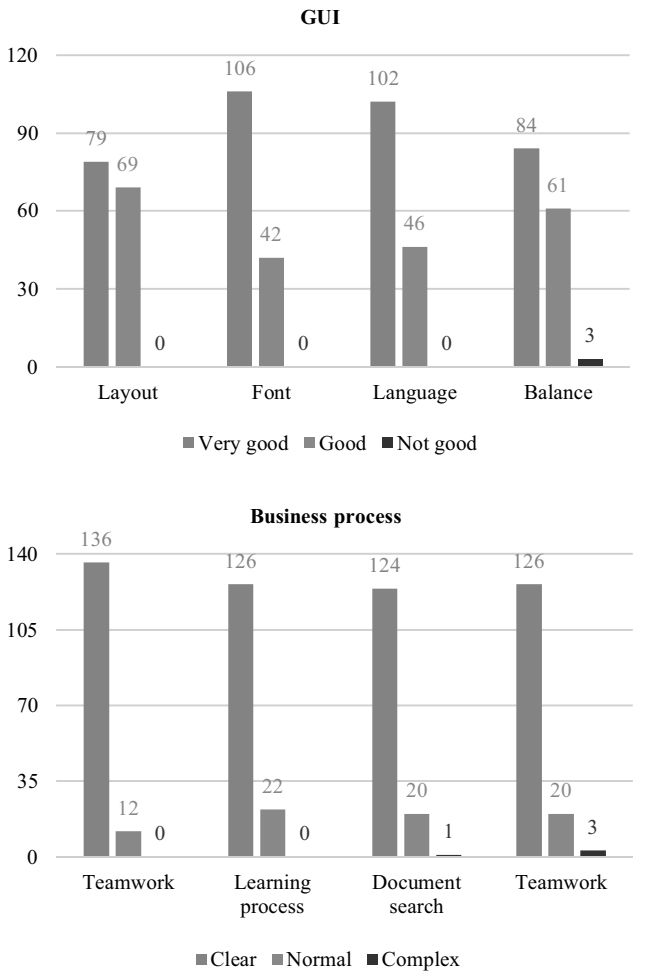


Fig. 9 : Feedback about the GUI and business process

comments are appropriate, and 46.5% of the comments are relatively suitable. Regarding the typeface, the presentation font has a 71.3% suitable rating and a 28.7% relatively suitable rating. The language presented on the website is rated by 69.1% as easy to understand, and the remaining 30.6% rate it as relatively easy to understand. Evaluation of the balance and harmony between the text content (text channel) with the illustrated content (picture channel) has a 57.0% rating as assured, 40.9% saying it is relatively secure and 2, 1% of the assessment is not balanced and harmonious.

The above evaluation results show that the interface and presentation of the LMS are designed and built to be suitable for students, and there are no inappropriate comments.

- General evaluation of the system: The LMS is designed and built to support and meet the needs of teaching-learning and online assessment of students. Therefore, asking for students' opinions on the elements of the system will help the research team make appropriate adjustments to the student's learning needs. The research team asks for comments on the following issues:

- Instructions for registering to participate in the study;

- Guide the learning steps;

- Guide to search for learning materials;

- Guide to making friends, and forming a learning group (virtual learning community).

For each content to be evaluated, the research team divides it into 3 levels: clear, relatively clear, and unclear. Figure 9 illustrates this evaluation.

ii. Feedback about the need for the system

The authors survey 212 students of FoET by the tool in LMS. Table 2 is the survey includes 8 questions in 3 groups:

- The first group (Q1 and Q2) evaluates the personal condition of accessing e-learning.

- The second group (Q3, Q4, and Q5) evaluates the use of students.

- The last group (Q6, Q7, and Q8) is the student evaluations.

Table 2: Survey form to evaluate the e-learning process of studentsTable 3 shows the results which are exported by MS Excel. The answer to the first group of questions (Q1 and Q2) is that students can use the tool (including devices and applications) smoothly to learn online. It may depend on the situation that (1) Technical students usually have a PC/laptop when learning; (2) Technical students use the software more often than other majors.

Questions 3 to 5 let the fact that students are satisfied when learning online. The difficulty is about infrastructure, the objective aspect, not about the aspirations of students. The network speed of Vietnam is one of the best in developing countries, but MS Teams does not have a server in Vietnam. Data must be sent to Taiwan (the nearest server) before sending back via an international network. Furthermore, users

Table 2: Survey form to evaluate the e-learning process of students

Questions				**Note: * is required question**
Q1*. Are you proficient in using computer/mobile/tablet devices?				
Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Q2*. Do you have enough skills to learn online?				
Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Q3. What difficulties have you encountered when participating in online learning recently?				
1. The poor network, unstable connection, sometimes can not see			2. Hot equipment after long-time use	
3. Learn by mobile	4. Learning environment		5. No opinion	
Q4. What are the things you are most satisfied with when participating in online learning?				
1. More enthusiastic lectures, easy-to-grasp knowledge, answers, and exam software			2. Get more useful things	
3. Have plenty of time to re-learn based on recorded meetings and downloadable documents				
4. Easy to use, convenient, stress-free		5. Flexible time, learning from anywhere, do not have to go to class, safety		
Q5. What are the things you are not satisfied with when participating in online learning?				
Network access	Satisfied	Unfamiliar, difficult to use	Others: Slideshow, GUI, software error	
Q6*. Do you believe in using the E-learning system for your learning?				
Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Q7*. Is it easy for you to use the E-learning system?				
Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Q8*. Do you think that using the E-learning system improves your learning?				
Strongly agree	Agree	Neutral	Disagree	Strongly disagree

often do not answer the unrequired questions (more than half of the students do not answer Q3, Q4, and Q5) is a popular behavior of Vietnamese users.

The last 3 questions show the positive thoughts of students toward online learning. Almost all of them need an LMS to learn online.

Table 3 : Survey result

Required question							
No.	**SA**	**A**	**N**	**D**	**SD**		
Q1*	61	113	30	5	3		
Q2*	51	107	47	4	3		
Q6*	72	118	17	2	3		
Q7*	49	109	45	7	2		
Q8*	61	110	33	5	3		
Unrequired question							
No.	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**Empty**
Q3	49	3	3	5	28		124
Q4	6	2	9	35	5	23	132
Q5	14	47	7	9			135

5 Other Tools

Table 4 provides the results of 62 surveying lecturers at the conference "Using software support online teaching in the Context of the Covid-19 Pandemic". There are some evaluations obtained from these results as follows:

· There is a big demand for quiz software with 44 uses. It may be because of the advantages of quizzes besides other types of assessment when the evaluation process takes less effort:

- The lecturer can deploy assessments easier. If a student takes an essay, the process of collecting documents online is quite complicated. If students practice an example, the examination process requires much effort.

- In many tools, the choices of quizzes can shuffle automatically to let the assessments become better.

- Although creating questions process takes quite an effort when the required number of multiple choice questions is often large, the grading process is simple with the help of automated tools.

Table 4 : The survey results of 62 lecturers

Software	Number of use	Software	Number of use
Meeting		**Note**	
MS Teams	50	Padlet	10
Zoom	12	Inkodo	1
Google Meet	10	Xournal	1
Office		**Present**	
MS Office	9	Scrble ink	2
Google Docs	3	Ultraview	1
ChemOffice	2	Youtube	1
Google Sheets	1	Zoomit	1
Gmail	1		
Quiz		**Other**	
Quizizz	22	Kahoot	9
Google form	10	Canva	5
Azota	9	Zalo	4
Mentimeter	2	PickerWheel	1
Quizlet	1	HyperChem	1
LMS		Maple	1
HVU LMS	2	Crocodile Chemistry	1
Nearpod	2		
Flipgrid	1		
Polly	1		
SHub Classroom	1		
Wordwall	1		

The lecturer still does not feel familiar with the teaching software. For example:

- HVU requires lecturers and students to use MS Teams in studying, but only 50 lecturers listed MS Teams in the used applications. 12 lecturers forgot it despite having to use it every day.

- It is similar to office software, where lecturers must use at least word processors to edit documents. But only 12 lecturers can remember those types of software (9 MS Office, 3 Google Office).

· Most of the software is free except for MS Office, Canva, HyperChem, and Maple (4/33 = 12.12%). Among that software:

- There are 2 applications used by many lecturers when 9 of them use MS Office (despite mentioning above, they forgot about office tools), and 5 lecturers used Canva.

- Only 1 person uses HyperChem and Maple.

In developing countries such as Vietnam, users would like to use free software instead of commercial application.

- Lecturers become active in using teaching support software. There is a total of 33 used applications.

- Besides the required MS Teams, 22 lecturers (35.48%) need to use other meeting tools. It may depend on the habit of the lecturers.

6. Threats To Validity

There are several threats to the validity of this work as follows:

- The comprehensiveness of investigated work, i.e. unforeseen factors can affect the quality of e-learning.

- The bias of surveyed candidates: Lecturers and students can provide biased feedback because of their position in the university. However, this is bound to happen. Furthermore, because HVU is a multidisciplinary university, some lecturers can focus on applications that are famous in their major.

- The correctness of tools: data is collected by LMS, filtered by MS Excel, and illustrated by MS Excel. So the correctness of software and hardware should be considered.

7. Conclusions And Future Works

A. Summaries

This manuscript provides an overview of the process by which HVU applies e-learning during the Covid-19 pandemic. Face the reality that staff, lecturers, and students can not go to school continuously, HVU prepares and implements the e-learning works with unexpected success. Almost every aspect of work is not affected, including the learning process and learning outcomes.

The analysis shows that HVU has certain advantages in terms of experience in implementing

digital transformation. They make good use of those advantages when providing online learning during the pandemic. Those uses and deployments should be seen as a success:

- The adaptation of lecturers and students is higher than expected: (1) They use those tools proficiently and (2) The feedback is positive.
- MS Teams is a suitable tool for learning online face-to-face. It can be deployed and organized easily.
- LMS is an efficient approach to e-learning with many useful features.
- The big number of used applications, 33, reflects the need and the dynamism of lecturers over e-learning.

B. Suggestions

For HVU and other universities, we recommend that digital transformation be given due attention: (1) This is a real trend because of the surprising development of the Internet and handheld digital devices; (2) There is an open learning environment whose many related parties such as lecturers, students, company, etc. (3) The teaching-learning process can be affected by unexpected and unpredictable factors, of which the Covid-19 pandemic is a classic example. (4) Digital transformation is a long-term and complex process that requires a large amount of effort.

Companies that consider e-learning in universities in Vietnam should take care: (1) The international internet bandwidth of Vietnam is not good and stable. So server should be located inside Vietnam. (2) Behaviors, skills, and infrastructure of users in Vietnam are very different, so the GUI and use of the application should focus on the easy. (3) The economic conditions of the user in developing countries like Vietnamese are not high, so the product should be free to use but has an advertisement.

C. Improvements

Future works should focus on the need of lecturers and students when learning online, which is helpful to HVU when providing the new online learning policies.

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