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COVID-19: A Factor Pushing HEI towards Online Learning and Resulting in Academic Achievement

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ABSTRACT
Following the outbreak of COVID-19, all of HEIs have continued their learning using online approach. This study aims at assessing the academic achievement, whether students are satisfied with the mass online learning. Two experiments were performed. The first one, three pairs of online-traditional, online-hybrid, and traditional-hybrid learning in three semesters were analyzed and compared in terms of learning achievements by T-test comparison analysis. Results showed that there are no statistically significant differences between online and traditional learning but there are differences between both pairs of online-hybrid and traditional-hybrid learning. The mean scores of traditional learning is the highest one among them. The second experiment was conducted for measuring students' knowledge by both of online and traditional examination under hybrid learning. Results from T-test comparison analysis, showed that there is no difference on examination in the treatment of online and traditional exams. And short-time-limited online exam was proved in effectively through online learning. Moreover, online questionnaire was offered to IT and non-IT students. Both of them have a lot in common. The findings highlight the negative response to online learning and hybrid learning. However, if an emergency online learning is well-planned-structured, then it could result an equivalent learning to traditional learning. Together with the current disruptive IT innovative, it's probably key in adjusting the level of education. The shift towards online learning as digital education/digital university, don't seem too far-fetched. HEIs should prepare and adjust themselves in this regard.
Keywords – COVID-19, online learning, traditional learning, hybrid learning, academic achievement, HEI

I. INTRODUCTION

Due to the rapid changes in IT, the education system has changed accordingly. New educational models have been proposed by taking advantage of IT. It is found that top universities in the world such as Harvard, MIT, Oxford, Yale, Cambridge, etc., are moving in the direction of online learning or E-learning [3]. More than a hundred programs online could be found via Google search. Rangsit University (RSU), Thailand over the past decade has also provided programs online. An increasing enrollment every year is a good reason to expand online learning programs to support the growth of market demand.

In early 2020, the COVID-19 pandemic has been a sudden major concern across. The globe affects nation's socio-economic development including education. The World Health Organization (WHO) declared COVID-19 as a global public health emergency of international concern on 30th July 2020[4]. The university sector with global has been called to lock down. "Most academic heads are now promoting online education

as a solution to this crisis." (UNESCO, 2020) in [3]. Online education refers to electronic learning without physical peer learners and there is freedom of space and time. Therefore, COVID-19 is an important factor pushing every educational institute towards online learning as forceful. This is to ensure for continuing the learning process.

Following the outbreak of COVID-19, Thai university was first hit hard by COVID-19 in January, 2021 (The beginning of semester 2/20). University was closed nationwide to prevent the spread of the virus. This gave a first-hand experience of Thailand's online learning. However, COVID-19 could be controlled and schools backed to traditional learning in February 2021. But the second wave returned in April. Consequently, hybrid learning (switching between online and traditional learning) was implemented in semester 2/20. Finally, summer semester(S/21) in June thru August, 2021 has been implemented by completely online learning because of the intense violence of the 3rd wave.

Due to the above, the forced situation and the growth of IT are fueling a transition into a real online learning paradigm. Therefore, this research

aims to study for the result of academic achievement by experimental approach in RSU. This research addresses three research questions:

(1) Are there any differences in academic achievement between online learning, traditional learning, and hybrid learning?

(2) Can online exams be used to measure knowledge and How?

(3) What is the satisfaction of IT-related and non-IT related students about online learning?

II. REVIEW LITERATURES

2.1 Rangsit University (RSU)

The impact of modern technology could not be ignored. RSU is a private university in Thailand, rushing to offer many programs online for the past decade. Today, RSU Cyber University has been established to support the need of online degrees or certificates for students who can't be physically available to attend classes. Management of RSU provides some academic staffs who know of online learning and some of the platforms like LMS, UCC Moodle platform, M/S Teams, and Google classroom. Therefore, RSU has had a robust online platform. However, all of online programs, offering now are only for graduate study. But as an urgent response to the COVID-19 pandemic, in early January 2021, all schools in RSU stopped traditional learning (face-to-face) and started to use the existing internet platforms to deliver online learning in the form of lecturers giving live lectures while students watch them and learn. All of lecturers in undergraduate programs have to adapt the pace of online teaching to take into a new environment completely different from that of a classroom. Fortunately, there is RSU Cyber University to provide knowledge and advice on tools used in online teaching.

RSU provides one academic year with two regular semesters and one summer semester, as shown in the Fig. 1
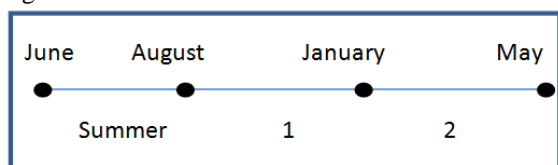

figure1. Timeline for one academic year in RSU

Semester 1/20 was conducted by all traditional learning. Semester 2/20 was hybrid learning and S/21 was all online learning, as shown in Fig. 2.
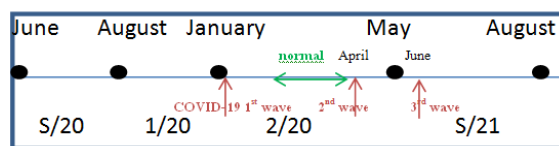

figure2. Timeline with COVID-19 Pandemic in RSU

2.2 Online Learning

Hasnan (2020) pointed that "Online learning refers to an electronic learning environment where, unlike traditional learning, there are no physical peer learners, and there is freedom of time and space."[1] Online learning emphasizes internet-based courses offered synchronously and asynchronously [5].

Rasmitadila, et.al (2020) explained that "Synchronous learning is a form of learning with direct interaction between students and teachers whole simultaneously using online forms such as conferences and online chat. Meanwhile, asynchronous learning is a form of learning indirectly (not at the same time) using an independent learning approach."[5] Students have access to the lecturers synchronously, asynchronously, or both.

Online instructional strategy includes instructional media (content delivery), learning tools, instructional method (lecture, quiz, assignment, and discussion), student's assessment, and virtual events. Students learn through the usage of online system that might be difficult in setting up, especially in non-IT students and lecturers. It is probably too complex or based on poor network. Both lecturers and students must overcome all the problems that occur in online learning. This is to continue the learning process and achieves the learning goals.

2.3 Traditional Learning

Traditional learning is the learning under the scope of classroom. The learning is conducted with the whole class participating, taking place with in classroom and the school [6]. The components of traditional learning include blackboard, books, lecturer and students in a classroom. An experiment of a comparison of E-learning and traditional, conducted (2013) in a course of MSITM program, RSU. Its result was shown that there was no difference on learning in these treatments, but the mean scores of students under traditional learning seems to be higher comparing to the E-learning, even in many benefits of E-learning. Moreover, it was suggested by the researcher [6] that the blended learning-mixed of E-learning and traditional learning- would be an improvement of students' achievement.

2.4 Hybrid Learning and Blended Learning

Both hybrid and blended learning seems to be the same concept, and most of people use them interchangeably. Actually, they are not the same at all. itsLearning [2] pointed that "The hybrid learning approach greatly reduces 'seat time' in a traditional classroom and shifts more of the teaching and course delivery online. Meanwhile, in blended learning, online materials do not replace face-to-face class time."

This means that hybrid learning try to find a flexible balance of online and traditional. But blended learning focuses on a set ratio and a combination of online and traditional learning. However, both of them revolve around online interactions. For this study, hybrid learning is defined to switching between online and traditional learning during a term.

2.5 Online Learning System

Online learning system refers to software which features course management. It provides online learning courses with lectures, coursework, virtual events, communication channels, and evaluation. Students can join classes and do activities, self-learn with coursework at anywhere anytime. The example of a platform for providing online learning services are LMS, Moodle, Blackboard, M/S Teams, Google classroom, Coursesera, Udemy, Alison, and other platforms.

Traditional learning refers to classroom learning that helps lecturers and students know each other and this interaction will motivate students to achieve higher scores. Regular attendance in classes would help them be better disciplined, follow a regular schedule, improve their physical and mental health. In another way, in online classes, students are not directly interacting with the lecturer. Communication is impersonal-online forums, emails, and chat room. However, the best reason of online learning is that student can take a course from the comfort of their homes. Lectures, assignments, quiz, could be done through an online medium. Due to many benefits of online learning, it has become extremely popular, especially in the driving force of the COVID-19 outbreak. Consequently, there is a possibility that the educational paradigm will shift to a new form of online. More and more institutes will offer courses online after ending the outbreak of COVID-19. Based on the literature, an experiment [6] proved that there are no differences on learning in online and traditional treatments and traditional gave higher mean scores when compared to online. Moreover, the researcher [6] gave suggestion of the blended learning. It is expected to be a factor of its success.

III. METHODOLOGY

3.1 Design

This research was designed to examine three points, as follow:

(1) A Comparison of online, traditional, and hybrid learning

A course of "IT skills for professionals" in general education provided for all of undergraduate students in RSU, was chosen for this experiment. Many sections were offered in each semester. A class in semester 1/20 (before COVID-19) was chosen for a representative of traditional learning. Semester 2/20 was for hybrid learning. And semester S/21 (100% COVID-19 outbreak) was for online learning. All of traditional, online and hybrid classes were used of the same instructor and equivalent of all relevant features.

The learning achievement was defined as the students' level of understanding of the IT basic knowledge, was measured by total scores (means) as quantitative data. Total scores were collected from four tests. Each test was conducted after completing every 3-4 chapters. Each class used the same set of tests.

(2) Measuring knowledge with online exams

A course of "Programming Languages" for Computer Science students in RSU, was chosen for this experiment. This class in semester 2/20 was taught during three periods of times (see Fig. 2.). The first period of time started with the outbreak of COVID-19 (online) for a month. The second period was spent for traditional learning because COVID-19 was controllable (6 weeks). After then, the last period was forced to back to online learning because of the third wave of COVID-19 (5 weeks). This is a reason to choose it to be a representative of hybrid learning. Midterm was conducted by traditional exam (in classroom). But final exam was taken by online examination. To prevent fraud in the examination, a speed test or short time-limited exam was prepared. Therefore, the assessment was fair enough to describe the understanding of students. The exam plagiarism will not happen in time.

A comparison of traditional and online exams was measured by midterm (a representation of traditional examination) and final score (online examination) as a quantitative data.

(3) Satisfactions of IT and non-IT students on online learning and hybrid learning

IT students refer to students who study in ICT-related programs and non-IT students are students who study at other schools, except school of IT. Two classes of IT students and non-IT students offered their satisfactions via online survey in person. The questions are focused on their

satisfactions, opinion, advantages/disadvantages, software tools, and class assessments of online learning and hybrid learning. This survey was conducted at the end of courses. Computer Science students, as IT students in course of "Programming Languages" and non-IT students in course of "IT skills for professionals" were selected as target participants.

3.2 Procedures
There are two experiments conducted in two regular semesters and a summer, as follow:
(1) Experiment 1 - conducted in a course of "IT skills for professionals"
Semester 1/20, is as complete traditional learning.
Semester 2/20, is as hybrid learning (switching between traditional and online learning, during term).
Semester S/21, is as complete online learning.
All classes were used the same instructor, same tests, and equivalent of all relevant features. Total scores of four tests throughout the term, were collected and analyzed.
(2) Experiment 2: conducted in a course of "Programming languages"
Semester 2/20, is as hybrid learning. Midterm was taken by traditional examination, but final was taken by online examination.

In addition, the satisfactions of IT students and non-IT students were conducted by online survey at the end of course, as follow:
A course of "Programming languages" in 2/20–as hybrid learning and IT students
A course of "IT skills for professionals" in S/21– as online learning and non-IT students.

IV. RESULTS AND DISCUSSIONS
In this section, three research questions were examined by the above experiment, as follow:
Q1: Are there any differences in academic achievement between online learning, traditional learning, and hybrid learning?
Data from the experiment1 was analyzed by M/S Excel. Three pairs of online-traditional, online-hybrid, and traditional-hybrid learning were paired to analyze differences in learning achievement-whether there is a difference. The mean of total scores of students on each class was computed and mean scores of each pair of online-traditional, online-hybrid, tradition-hybrid, as well as p-value were computed by T-test, summarized in Table1, Table2, and Table3, respectively.

Table 1 Independent Sample T-test (online-traditional learning)

Statistics	Online Learning	Traditional Learning
Means	70.2	73.1
Observations	48	27
p-value	0.48	

Table 2 Independent Sample T-test (online-hybrid learning)

Statistics	Online Learning	Hybrid Learning
Means	70.2	58.1
Observations	48	13
p-value	0.022	

Table 3 Independent Sample T-test (traditional-hybrid learning)

Statistics	Traditional Learning	Hybrid Learning
Means	73.1	58.1
Observations	27	13
p-value	0.013	

A T-test comparison analysis (as shown in Table 1, 2, and 3) were computed to examine the differences between two groups of students

Mean scores of online and traditional experiments was not significant at 0.05 (95% confidence interval) (p-value = 0.48 is greater than 0.05). The hypothesis was accepted. There is no difference on learning in this treatment.

However, the effect of mean scores of online-hybrid and traditional-hybrid experiments were significant at 0.05 (p-value = 0.02, 0.01 are less than 0.05). The hypothesis was rejected. There are differences on learning in both pairs of online-hybrid and traditional-hybrid treatments. Moreover, the statistics revealed that the mean score of all experiments under traditional learning are highest comparing to online and hybrid. It is surprising that the mean score under hybrid learning is very low among them.

Using experimental methodology, the mean scores of each pair of students' classes who were registered in each semester, were compared. Three semesters were spent under the condition of having the class equivalent on all relevant features, except class size. Moreover, the researcher found that students in hybrid classrooms were often absent class or lately enter class. Most of them were used to be with the freedom of time under online learning. They were less enthusiastic and lack of self-regulation. This gave them a relatively low score.

In conclusion, using T-test comparison analysis, there is no difference in academic

achievement between online and traditional learning, but there are differences between hybrid and both online and traditional learning. However, small size of hybrid learning class in this experiment and students' depressed state of mind under the terrible circumstances of the epidemic should be made a note as important factors, effecting the lowest of hybrid mean score class. For this reason, it is suggested that blended learning, online materials do not replace face-to-face class time, should be examined.

Q2: Can online exams be used to measure knowledge and How?

Data from the experiment 2 was analyzed by M/S Excel. The mean of midterm (a representative of traditional examination) scores and the mean of final (a representative of online examination) scores of students on a Computer Science class were computed, as well as p-value were computed by T-test, summarized as Table 4.

Table 4 Two-tails Paired Sample T-test

Statistics	Midterm	Final
Means	37.1	41.9
Observations	16	16
p_value	0.22	

The effect of mean scores of the experiment is not significant at 0.05 (95% confidence interval) (p-value = 0.22 is greater than 0.05). The hypothesis was accepted. There is no difference on examination in the treatment of online and traditional exams. Furthermore, midterm scores and final scores of students were plotted in line graph, as shown in Fig. 3.
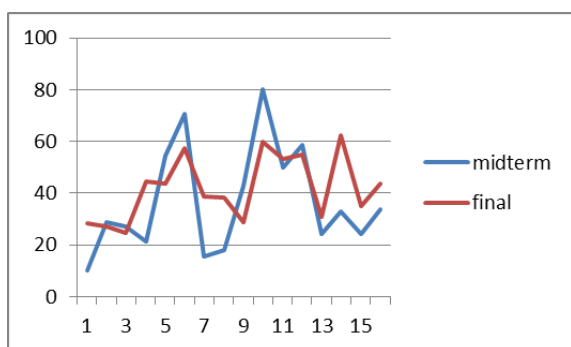

figure3. A Comparison of Midterm and Final Scores of Computer Science Class

Fig. 3 shows that both graph lines go in the same direction. If a student has a high midterm score, they tend to also have high final score, averaging there is no conflict between midterm and final scores. This is proved that online exam could be used to classify students in groups under their cognitive capability. Actually, it is difficult to assess

cognitive aspects in online examination, because of the intervention of knowledgeable persons outside the exam room or good students in the exam room to provide answers to their friends. Therefore, the assessment is not fair enough to represent the understanding of students [5]. This was a challenge for the researcher to find out a type of exam to reduce these problems in online examination. Finally, short time-limited exam was chosen by the researcher for this experiment. It was proved that students had not enough time to talk or search or share to other students with topics that are related to the exam matter being taking final examination. As a result, virtual examination room was silent and being in conducive environment. Therefore, short time-limited online exam could be used to measure students' knowledge.

Q3: What is the satisfaction of IT-related and non-IT related students about online learning?

In this section, some questions were answered by IT students (taking a course of programming languages) and non-IT students (taking a course of IT skills for professionals). After then, they were analyzed what's and how's students prefer?

Likert scales were used to rank quality from low to high or worst to best using five levels: 1 means strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 means strongly agree. The results were summarized in Table 5.

Table 5 Satisfactions about Online Learning

Satisfactions about online learning	IT Student	Non-IT student	Ave-rage	Re-mark
Lack of physical interaction	4.30	4.25	4.28	*max2
Lack of students' enthusiasm	3.25	3.08	3.17	
Difficulty of assessment in cognitive aspects	4.25	3.41	3.83	
Speed test is appropriate for online exam	4.10	3.57	3.84	
Interference from family members/home environment	3.95	3.67	3.81	
Technical barriers-computers / poor network	2.10	3.82	2.96	
Lack of IT skill and knowledge for online class	1.50	4.11	2.81	*min2
Availability of online instructional material	4.55	4.72	4.64	*max1
Positive response to online learning	2.36	2.08	2.22	*min1
Positive response to hybrid learning	2.73	-	2.73	
M/S Teams is easily use and has	3.45	4.34	3.90	

complete feature				
Demonstrative lab is useful	-	3.48	3.48	

From Table5, availability of online instructional material and lack of physical interaction were strongly agreed by students (4.64 and 4.28, respectively). In the opposite way, positive response to online learning and hybrid learning were disagreed (2.22 and 2.73, respectively), showing that students do not like to take online/hybrid classroom. Both of IT and non-IT students have strongly agreed with availability of online material but negative response to online and hybrid learning. This points to blended learning, which online materials do not replace face-to-face class time, should be examined. Moreover, IT students strongly agreed with the difficulty of assessment and speed test is useful for online examination (4.25 and 4.10, respectively). Non-IT students strongly agreed that M/S Teams is good in term of usability and powerful for online learning (4.34).

It was found that both of IT students and non-IT students have the same opinion, except in regards to lack of IT skill and knowledge for online class. Therefore, non-IT students are focusing on their IT skill and knowledge and they believed that understanding of IT have impacted the success of online learning. In addition, both of them have no problems of technical barriers such as computers, internet signals, etc.

V. CONCLUSION

The results from this study were shown that there is no difference in academic achievement between online and traditional learning, but there are differences between both pairs of online-hybrid and traditional-hybrid learning. Moreover, the mean score of traditional learning is the highest one, comparing to mean scores of both of online and hybrid learning. According to the experiment, small size of hybrid class and students' depressed state of mind under the terrible circumstances of the COVID-19's epidemic should be made a note. It was agreed that "at the beginning of online learning, students were enthusiastic about implementing learning, but after two months, students began to feel bored and less eager to learn [5]." It was also found that students in hybrid classroom were used to be with the comfortable at home and be often absent class or lately enter class when the class was switched to traditional classroom (COVID-19 was controllable). Switching between traditional and online learning as hybrid learning in this experiment was seen as an emergency treatments, conducted in the dire situation forced by the epidemic. Hybrid learning in this way was not suggested to conduct, but blended learning – online materials do not replace face-to-face class time – was suggested.

In addition, short time-limited online exam could be an effective tool for measuring students' knowledge. Online questionnaire was survey to students. Both of IT and non-IT students have a lot in common but they have different aspects as well. Most students have negative response to online learning and hybrid learning. They strongly agreed with online learning in the aspect of lack of physical interaction but they were very pleased in the benefit of availability of online instructional material. Traditional, online and hybrid design trade-offs. Nothing is all benefits and they all have gain and lose. According to COVID-19, people have learned and experienced that online learning is valuable and could be implemented to achieve the goals. However, non-IT students considered the need of IT skill and knowledge for online learning. IT students recommended that short time-limited exam is quite appropriate to conduct in online learning. Furthermore, students had no problems of technical barriers – computers/poor network.

In conclusion, online learning in HEI during COVID-19 pandemic was accepted to replace traditional learning without the difference of academic achievement. The assessment of learning was considered to use a short time-limited exam in virtual examination class. Non-IT students agreed with the need of IT skill and digital literacy. And the COVID-19 pandemic has disrupted the normal functioning of many activities across the world, including education. People are used to be, undeniably known and accepted towards online learning. It is an important factor, pushing HEI towards online learning, although less students and lecturers are ready for this transition. However, it was proved in this study that if an emergency online learning is well-planned-structured, performed under an appropriate online learning management system with well-IT skills lecturers and students, then it could result and equivalent learning to traditional learning. Therefore, universities should prepare their staffs to deliver this kind of quality online learning and provide an effective online study in virtual classroom. Today, social online networks as well as the behaviors of data sharing cause disruptive IT innovation. Therefore, a disruptive IT innovation is seen as an important key in adjusting the level of education. This means that everyone could easily own and use a computer, without necessarily being IT professionals. It is the shift towards online learning as personalization. It is forecasted by the researcher that digital education would really change all of educational models into digital university, such as courser, edx, Udacity and

Khan Academy. Those ones could accommodate a large number of students. Finally, disruptive IT innovation would cause or lead to open educational model, freedom learning in time and places.

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