STEM Education in Thai Universities under COVID-19 Pandemic

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Abstract

Thai universities respond to COVID-19 pandemic more readily and flexible than their school counterparts, normally guided by higher authority. Comparing with schools, universities, on one hand, have higher degrees of autonomy, better equipped, and generally reasonably endowed. On the other hand, universities are complex and large, having a typical student population of about 500 times more than those of most schools. Adding to complexity are diverse university operations ranging from teaching, research, and services to communities and industries, including hospital services. Resilience of the system are the key to meeting the COVID-19 challenges.

Addressing universities under COVID-19 pandemic since 2020 dwell mainly on two issues. First, how to deliver quality education without compromise and reduced rigorousness of depth and breadth. University education features (i) delivery of knowledge, normally via hundreds of lecture courses a semester, (ii) conducting laboratory experiments in science and technology, (iii) workshop or studio work, (iv) tutorials, and (v) on-site practices in cases of medicines, health science, engineering, and social field work etc. Senior projects and graduate study, in addition, requires access to university laboratories, no on-line possibility. Bearing in mind that tens of thousands students are involved. On quality assurance, on top of delivery knowledge, there are testing, examination and various assessments. Lastly and very important, cultivation of social and human skills, and maintaining contacts with students. The second issue is running a university of tens of thousands of students, few thousand staff during lock down or partial opening with social distancing measures. Internet facilities and digital literacy of students and staff are one deciding factors.

The paper covers these issues with practices from Thai universities, individually and some collective actions, with emphasis in the study in science, engineering, and technology. Preliminary assessment on effectiveness of measures and notes on learning losses will be highlighted.

Keywords: online learning, outcome based education

Introduction

Higher education institutions in Thailand first encountered disruptions in March 2020 when locally transmitted COVID-19 cases were recorded and lockdown in certain areas of the country were first introduced. Many universities in the affected provinces such as in Bangkok and surrounding areas were asked to turn students away from their premises. March is usually the end of the academic year when many students rush to complete their capstone projects, spend long hours in laboratories, and running computationally intensive simulations with on-campus computers. Most of these activities did not happen and the students and their professors had to seek new ways to complete their tasks with as little compromise to the education outcome as possible. This is only a fraction of the impacts of COVID-19 pandemic on higher education in Thailand. This paper collects information on how universities adapt their teaching and learning method in STEM education while the country is coping with the pandemic. A wide spectrum of higher education institutions and fields of STEM specialization participated in this study. The findings are of use to higher education management who can benefit from successful practices of other institutions at policy level and for instructors who can learn what other useful tools are available.

Prior to analyzing the practices of the STEM education in Thai universities, it is important to understand that higher education institutions in Thailand operate differently from basic education schools. Universities on average are far larger having a typical student population of about 500 times more than those of most schools. Large number of staff work in many units within the organization to perform diverse operations ranging from teaching, research and services to communities and industries. Therefore, the complexity of university management in this particular pandemic where minimising human contact is the most crucial factor can be a great challenge due to the wide-ranging constraints of each individual unit within the university.

On the other hand, universities enjoy higher degrees of autonomy and are generally better equipped to access more resources than schools. Hence, universities are able to adapt more quickly to the situations. Most, if not all, of university students are young adults whose digital literacy is almost second nature, and a large percentage of higher education instructors in STEM are also as digitally capable. This technical skill plays a big advantage in this nearly overnight digital transformation in education.

This study attempts to collect data from a range of higher education institutions in Thailand on how different STEM disciplines overcame the disruptions to traditional teaching and learning methods based on their strengths and constraints. The findings presented in the following sections are categorized into (a) substitutes to lectures, (b) ways to conduct practical classes, (c) ways to conduct examinations, (d) student soft skill development and (e) supports provided by the universities.

Methodology

This paper has been prepared by collecting data from a number of interviews with instructors and administrators in STEM education in Thai universities. Those in administrative roles range from research centre heads, associate deans, deans, and a university president. Fields of specialization include Engineering, Mathematics, Chemistry, Physics, Medicine, Veterinary, and Nursing. Both public and private universities from Bangkok, Kanchanaburi, Chiangmai, Chonburi and Mahasarakam provinces are represented in the study.

The researchers conducted interviews with representatives of faculty though Zoom meeting application. Most interviews are completed within 60 minutes. The researchers work in a team of 2-4 persons, with the main researcher doing the interviews and asking other relevant questions while the assistants concurrently record the discussions on a Google Sheet spreadsheet on screen share. This is to enable the interviewee to see and proof the recorded notes in real time. The Zoom meetings are recorded as a backup so that the researchers can revisit the data at a later date if needed. Details of all interview sessions are given in Table 1.

Table 1. List of university president, deans, associate deans, and lecturers who provided data presented in this work

	Institution	Faculty	Title	Interview Date
1	Rajamangala University of Technology Thanyaburi	-	President	26/8/21
2	University of the Thai Chamber of Commerce	-	Vice-President for Academic Affairs	31/8/21
3	Kasetsart University	Department of Companion Animals Clinical Sciences, Faculty of Veterinary Medicine	Dean	13/8/21
4	Mahasarakham University	Faculty of Nursing, Mahasarakham University	Dean	18/8/21
5	Chiang Mai University	Department of Mathematics, Faculty of Science, Chiang Mai University	Director of School of Lifelong Education	26/8/21
6	King Mongkut's University of Technology Thonburi	Faculty of Engineering,	Associate Dean for Student Affairs, Associate Dean for Academic Affairs and Research, Associate Dean for Planning and Development	26/7/21

|		Faculty of Industrial Education and Technology	Associate Dean for Academic Affairs and Educational System	27/7/21
		Faculty of Science	Associate Dean for Academic Affairs	29/7/21
7	Mahidol University	Faculty of Science (Agricultural Science), Kanchanaburi campus	Assistant to the Vice President for Kanchanaburi Campus	11/8/21
		Faculty of Engineering	Vice Dean for Administration and Finance	18/8/21
		Internal Medicine, Cardiology Faculty of Medicine, Ramathibodi Hospital	Lecturer	24/8/21
8	Burapha University	Department of Mechanical Engineering, Faculty of Engineering	Chairperson of B.Eng Programme in Mechanical Engineering	23/8/21
9	Thammasat University	Faculty of Architecture and Planning	Lecturer	21/8/21
10	Maejo University	Department of Chemistry, Faculty of Science	Lecturer	21/8/21
11	Siam University	Department of Physics, Faculty of Science	Lecturer	1/9/21
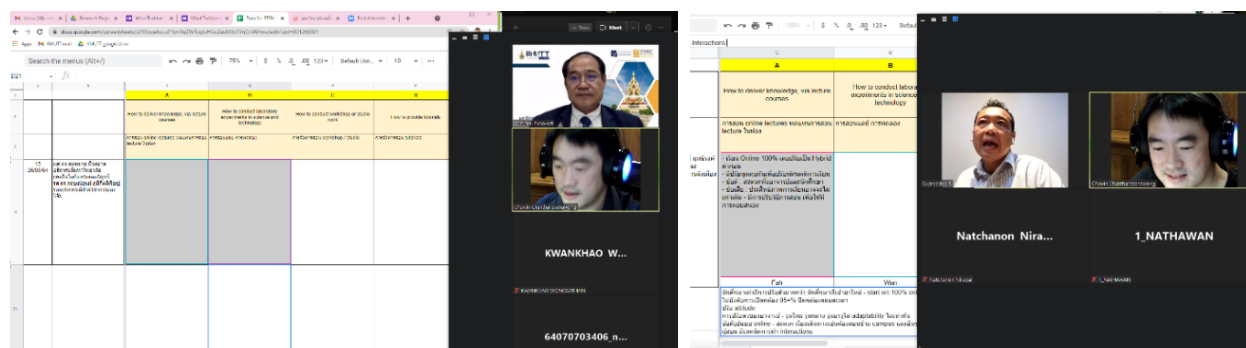
Fig.1 Researchers and co-researchers simultaneously take notes of the Zoom meeting interview on a shared Google Sheet spreadsheet

Results

The results are categorized into five sub-sections namely (a) substitutes to lectures, (b) ways to conduct practical classes, (c) ways to conduct examinations, (d) student soft skill development and (e) supports provided by the universities. Each sub-section contains all relevant information from each interview where the researchers pay particular attention to best practices which other higher education institutions can learn from.

(a) Substitutes to lectures

Traditional classroom lectures are reported the most disrupted activities because students are unable to attend classes in person. This is mainly due to the physical distance requirements imposed by the Center for COVID-19 Situation Administration (CCSA) which prohibits large number of students to gather inside a relatively confined space of a lecture theatre. Most, if not all, universities will need approximately 3-4 times existing physical spaces to accommodate the currently registered students.

Hence, the simplest alternative to replace classroom lecture is to make use of online VDO communication platforms. Two modes of lecture deliveries are observed namely, (1) synchronous online lecture delivery via the use of online meeting tools such as Zoom meeting, Microsoft Teams and (2) asynchronous lecture on pre-recorded VDOs which are delivered through Learning Management Systems (LMS) or popular social media platforms. Many universities had already implemented in-house or off-the-shelf Learning Management Systems (LMS) such as Moodle and Google Classroom even before the pandemic but these systems used to serve as supplementary systems.

Popular online learning platforms

Online meeting tools for synchronous online lectures have clearly gained huge popularity since the beginning of the COVID-19 pandemic in Thailand. Figure 2 shows the breakdown of platform choices of the universities the researchers have interviewed. Microsoft Teams and Zoom are by far the two most popular platforms.
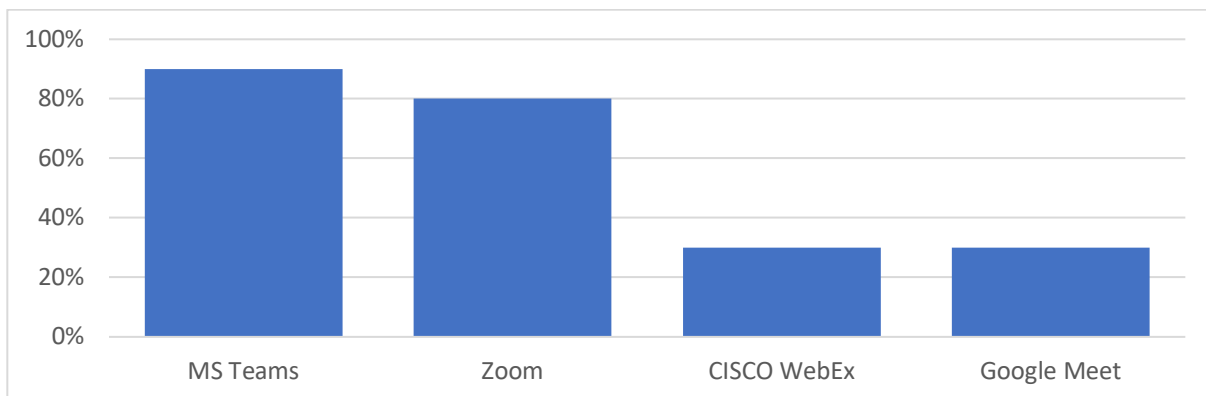

Fig.2 Percentage of interviewed universities that officially provide the online meeting platforms to its staff for synchronous online lectures

It may be worth noting that most universities already subscribe the Microsoft Office 365 software package which automatically covers the use of MS Teams at no extra cost, while Zoom is an additional software to be purchased separately. The main reason gathered from the interviews identifies the popularity of Zoom by its ease of use for both instructors and students.

Learning Management Systems

Moodle and its variants, followed by Google Classroom are the most popular platforms due to the simplicity. University of Thai Chamber of Commerce has explored the use of iTunes U by Apple Inc. but the platform is not performing well and will be shut down at the end of 2021. Many universities with a dedicated unit for online learning have chosen to develop their in-house LMS to securely host lecture materials, provide licensed services and conduct student assessment activities. Examples of in-house LMS are given in Figure 3.
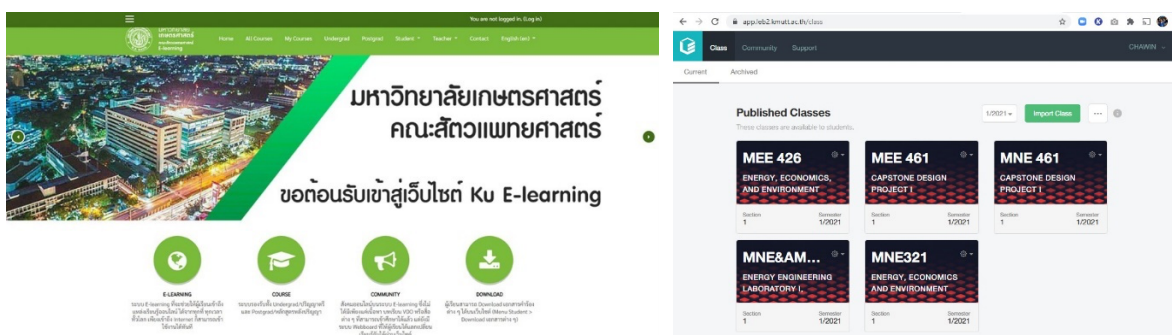

Fig.3 User interface of example LMS by Kasetsart University KU E-learning and King Mongkut's University of Technology Thonburi KMUTT LEB2

Students' and instructors' responses

The following student responses to online learning are gathered from observations by instructors and university management.

1. Students appreciate the convenience of not having to travel to campus, as well as the time and money saved on transportation.
2. Students do not have sufficient devices and peripherals for seamless online learning experiences. This common problem is observed even among medical school students who are typically perceived to be of higher socio-economic status than average population.
3. Students tend to turn off their VDOs during synchronous online lectures. Some instructors ask their students to turn the VDO on during online class so that they can observe the students' expressions to gauge their understanding. However, making the students turn on the VDO camera involuntarily may negatively affect their learning because it increases their anxiety and inadvertently stresses them out[1]. None of the universities the researchers interviewed mandated that students must turn on camera during class.

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[1] Gherhes, V.; Simon, S.; Para, I. Analysing Students' Reasons for Keeping Their Webcams on or off during Online Classes. Sustainability (2021), 13, 3203. https://doi.org/10.3390/su13063203

4. Instructors use interesting online activities to tackle lack of student engagement in class[2], such as KAHOOT, MIRO, MURAL, Quizlet web-applications or a simple virtual whiteboard. Although these are very powerful tools, they also require substantial amount of time to prepare and some instructors may find it difficult.
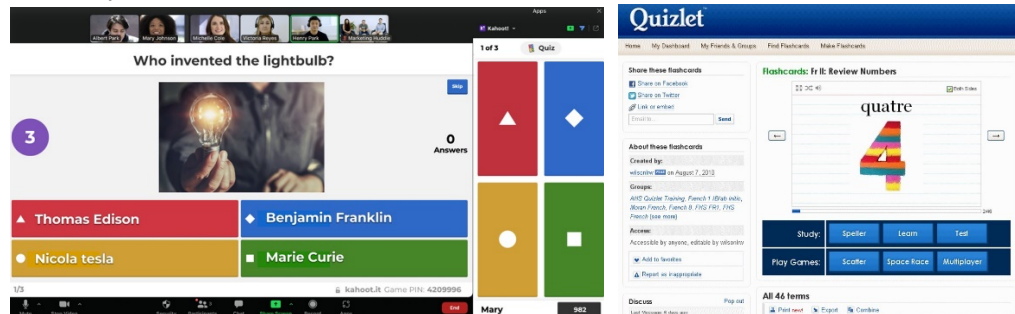

Fig. 4 Instructors use interactive online tools such as KAHOOT and Quizlet to engage students during online classes

5. Many instructors use different platforms to teach, for example Zoom, MS Teams, Facebook Live, etc. Students have to adapt and learn to use many different platforms to suit all the instructor teaching styles and platforms.

6. Faculty of Architecture and Planning, Thammasat University instructors have observed that new students (first year students in 2020) seem to have adapted to online learning faster than existing students. This may be because the new students perceive online learning as a norm whereas existing students need to adapt from previously in-person classes.

7. Instructors must learn new skills in order to conduct online lectures. Most universities can classify their teaching staff into three groups based on competency and, coincidentally by age groups. The young professors have little problem in using the online learning tools and they often introduce new tools to colleagues. The mid-career professors need some guidance in choice of tools and how-to. Once the mid-career professors are familiar with the tools they are able to operate normally without any need for assistance. Finally, the senior professors who are unfamiliar with online learning tools and require heavy assistance in conducting classes. They tend to favour pre-recorded online lectures with the help of laboratory technicians and release the VDOs to students on LMS.

Best practice

A common inconvenience during online learning is the first meeting point for students at the beginning of semester. Traditionally, universities publish the classroom assignments from each course and students will turn up at the classroom physically. With online learning, physical classrooms become an array of hyperlinks on various platforms. This information needs to be carefully managed and accurately communicated to students so that they can log on to correct online classes. This task used to be a responsibility of the department or faculty administrator. The method is largely manual and it continues into the era of online learning, which is very ineffective.

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[2] Castelli, F. R.; Sarvary, M. A. Why students do no turn on their video cameras during online classes and an equitable and inclusive plan to encourage them to do so. Ecology and Evolution (2021), 11:3565-3576. DOI: 10.1002/ece3.7123

Teaching and Learning Innovation Center of Chiang Mai University together with their Registration Office integrate the entire university student registration system with its MS Teams system. Therefore, once the student has completed the registration of courses for the upcoming semester, the system will create individual groups (Team) for every course and automatically put all the students and instructors into those Teams. This eliminates the confusion for the students while looking for the first meeting point for each course. The university allows its instructors to use online learning platform of their choice after the initial meeting on MS Teams.

(b) Ways to conduct practical classes

The most glaring weakness of online learning has to be the student learning loss in hands-on practices. It also proves to be the most difficult obstacle of online learning to overcome. This section reviews examples of various ways different fields of study employ specialized tools to deliver the best substitute to traditional practical classes to the students and strategies to deliver practical classes to students while maintaining the COVID-19 safety restrictions.

Pre-recorded VDOs

The most common strategy to conduct laboratory classes is to pre-record a VDO of instructor demonstrating the experiment and provide a set of raw data to students to analyse and write a report. An example here is a gyroscope laboratory in Mechanical Engineering, King Mongkut's University of Technology Thonburi. Two laboratory technicians set up a full HD VDO camera on a tripod on-site to record the instructor explain the laboratory objectives, the equipment and the demonstration.

A key factor in making a successful VDO is the digital and photography skill of the technicians. The VDO must be created from a student perspective in mind, so the technicians must understand the context of the experiment and insert close up VDO clips where appropriate. Figure 5 shows an instructor demonstrating the use of an optical tachometer and a close-up of the device with visible view of the readings.

Students only attend online classes, usually via Zoom or MS Teams, with the instructor who play the VDOs as experiment briefing. Then, students receive a set of raw data which the instructors prepare by conducting the experiment in real time, or a set of existing data from previous experiments. Some instructors prepare many sets of data and provide them to students at random so that they can analyse the data independently.

There are some positive comments from students on pre-recorded VDO. Mainly students find pre-recorded VDOs more concise than attending a live laboratory briefing.

Many pre-recorded laboratory demonstration VDOs made during the first COVID-19 wave in Thailand lacked in quality due to the short preparation time. Instructors and technicians have learned how to improve these VDOs over time based on students feedbacks.
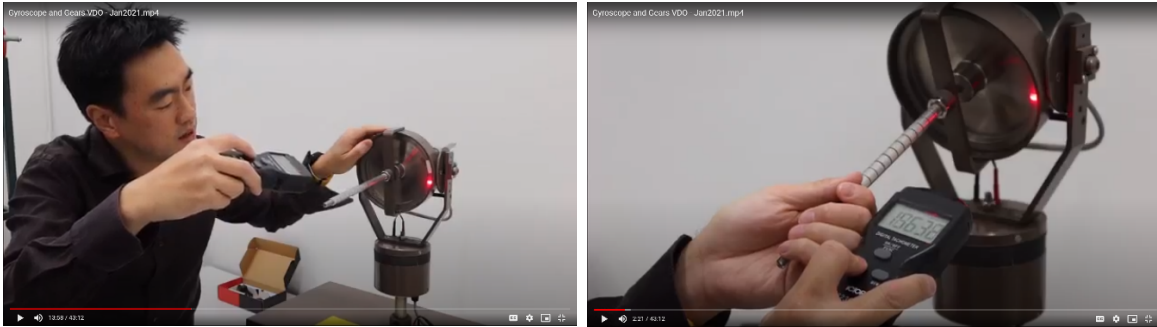
Fig.5 Example of pre-recorded VDO of a Mechanical Engineering laboratory

Computer simulations

Faculty of Medicine Ramathibodi Hospital, Mahidol University, has been using a clinical simulation with virtual patients on BodyInteract (www.bodyinteract.com) platform for many years. Previously, the medical students use a large touchscreen device at the university where the instructor would demonstrate in-person. Since academic year 2020, the faculty purchased additional licences for students to access the platform on personal devices so they can perform clinical simulations at home instead. Instructors have reported a good level of engagement by the students.

Research[3] has suggested that clinical simulation provides students with equivalent learning outcomes and may be used as a replacement learning tool. This view is shared by the instructor at Faculty of Medicine Ramathibodi Hospital but should be limited to non-critical diagnostic only.
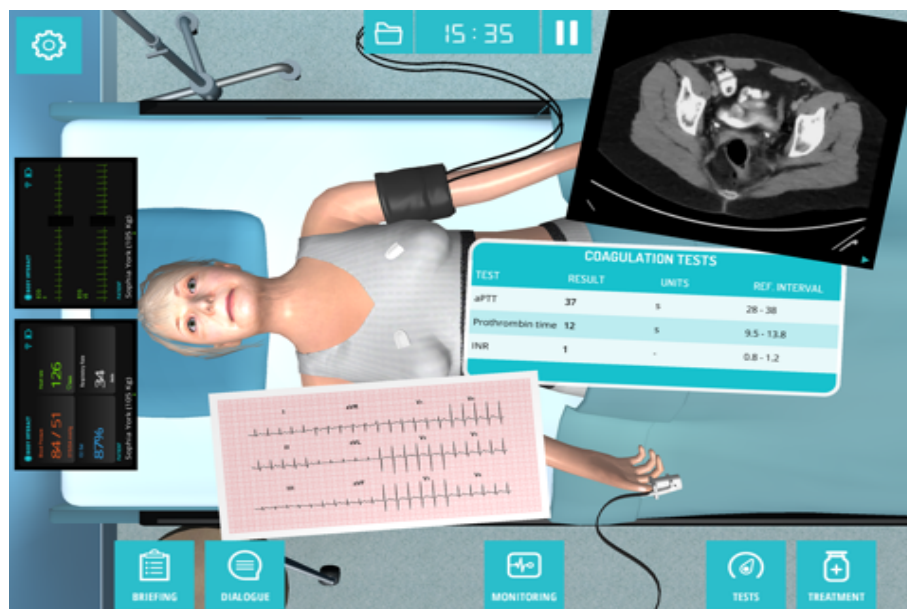

Fig.6 Screenshot example of BodyInteract clinical simulation where medical students can explore

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[3] Jaime Miguel Abreu, Bruno Guimarães, Miguel Castelo-Branco, The role of virtual interactive simulators in medical education: Exploring their integration as an assessment methodology in clinical years, Educación Médica, (2021), ISSN 1575-1813, https://doi.org/10.1016/j.edumed.2021.06.011.

There are a number of virtual laboratory services to cater for online scientific experiments, for example www.praxilabs.com is a service for biology, chemistry and physics. Students can conduct 3D interactive virtual experiments on the website by controlling the avatar and interact with virtual laboratory equipment as illustrated in Figure 7. The results are, however, simulated based on the pre-determined models. More immersive experience can be achieved with additional virtual reality goggles and input devices. Although none of the universities the researchers interviewed has already implemented it, many have expressed interests in using or even creating their own software.
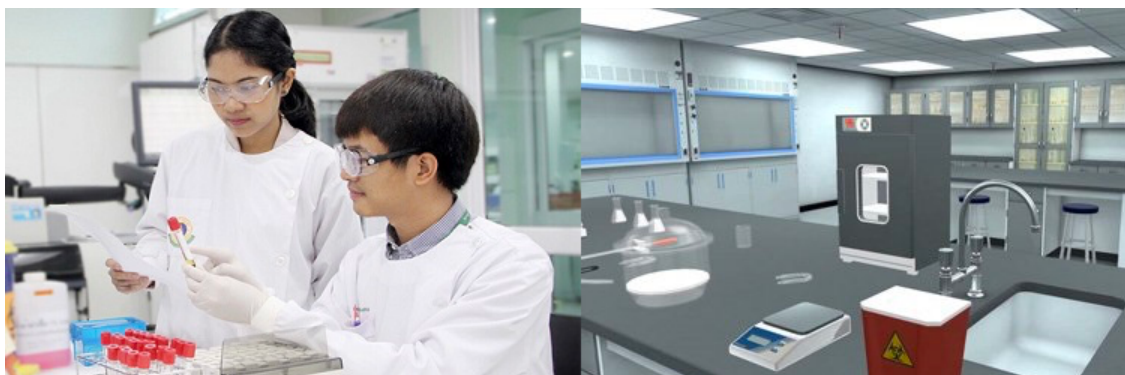

Fig.7 Many universities have expressed interests in providing virtual 3D interactive scientific laboratory to replace in-person experiments

Laboratory at home by post

Another popular practical class delivery method is to post some basic materials to students' homes and conduct online classes with students performing actual experiments at home. This method is limited to classes with low to moderate number of students and the experiments must not require specialized tools only available on university campus.

Fig.8 Materials for digital logic circuit course Department of Electrical Engineering, Mahidol University are packaged in A4-sized boxes and posted to students for their online practical classes

Department of Electrical Engineering, Mahidol University posted materials for Digital Logic Circuit course to students. The package consists of an MDX-02B digital logic circuit training board with additional digital logic IC chips, resistors, cables and a power supply. Instructors are able to complete the

entire practical classes of digital logic design course through online learning demonstration and the students the students work on their individual set.

Another discipline that has successfully completed laboratory at home approach is chemistry. Instructors post materials for inorganic chemistry laboratories to students' home at the beginning of semester and then conduct laboratory classes online. Veterinary medicine discipline also made this approach by posting a suture kit for animals to their students to practise at home.

Internship and externship

Internships in most STEM disciplines are compulsory and are an important part of the curriculum. Some disciplines require them as part of the licensure such as nursing and veterinary science. However, some disciplines can be more flexible as the internship is only designed to give the students a sense of professional career. Hence, the approaches towards internship vary widely depending on the course requirement.

Faculty of Nursing, Mahasarakham University allows students to work from home to complete their internship. The students have to perform practices with family members and broadcast the actions to the instructor on two simultaneous VDO cameras at different angles. Even though, the students receive technical instructions, they do not gain first hand human contact experience with actual patients which is critical in learning empathy.

Disciplines where internships are not critical, allow students to work on supervised projects with the advisors instead of an industrial internship. Maejo University allows students to replace internship with completion of two MOOC courses with equivalent learning outcomes.

Internships take place during the summer break which is between April to August. The summer period in 2020 coincided with an easing period of COVID-19 lockdown therefore some students were able to complete their internship on-site, especially those in provinces with low number of COVID-19 cases. For examples, students of Faculty of Veterinary Medicine, Kasetsart University were able to complete the entirety of their internships at agricultural farms in North East Thailand without any interruptions.

Other approaches to internships include postponing the internship to the following summer, breaking down internship into several short stints to be incorporated during term time whenever convenient, or cancelling the internship requirement altogether.

Medical School students must complete their extern in the final year. This is non-negotiable so the university has to fully vaccinate the students before they are allowed to begin the extern.

On campus classes during lockdown easing windows

There are periods in the latter half of 2020 and in early 2021 when Thailand handled COVID-19 infections very well and many activities were almost at a normal level. Restrictions of on-campus classes were partially lifted and practical classes were the first to be considered.

Another popular strategy by many faculties such as Faculty of Industrial Education and Technology, King Mongkut's University of Technology Thonburi is to reschedule the classes to concentrate as many practical classes as possible during the easing of lockdown period. Conversely, during the strict lockdown

period, instructors reschedule to concentrate their lectures at this time with the hope that practical classes can be given when the restrictions are lifted.

During the lockdown easing windows, Faculty of Science, King Mongkut's University of Technology Thonburi allows representatives of laboratory members to enter the university to conduct chemistry experiments and send the findings to remaining members who observe the experiments on live VDO feeds from home. The classes are carefully conducted as they still have to follow physical distancing guidelines, for example there must be a maximum of three students per experiment.

Students' and instructors' responses

The following student responses to online practical classes are gathered from observations by instructors and university management.

1. Students are stressed. Year 1-3 medical school students express their stress that they lack the opportunity to use hands-on tools and learn the necessary skills, while Year 4-5 medical students lack the opportunities gain valuable experience from the interaction with patients in person. Only Year 6 medical schools with full vaccination (2 doses) are allowed to extern at the university during the pandemic.
2. Practical classes require devices of higher specifications than regular online lectures. For example, students in Computer Aided Drawing classes need computers with moderately high-performance graphic cards and memory. Sometimes, students need to use multiple devices at the same time, such as practical assessment of Nursing School. This kind of requirement results in additional financial strain on the students and the parents, or the student will not be able to follow the course in its intended sequence.

(c) Ways to conduct examinations

This sub-section explores the ways in which examinations have been modified to accommodate flexibility during online learning. All universities the researchers have interviewed share a common focus that assessment methods may change, the learning outcomes must not be compromised. Two types of assessment activities are studied, namely written examinations and oral presentations or presentations.

Written examination

While instructors have little difficulties delivering online lectures, the examinations that follow can prove a difficult undertaking even for those with high technological expertise. End of term written examinations by nature are designed to be given in a controlled environment where students are allowed access to certain materials specified by the instructors. The situation is completely reversed during online learning where students are at home and instructors have very little control over them accessing information during the test. This part of the study describes in details three approaches the Thai universities have employed to conduct written examinations.

1. Usually fundamental courses for first year and second year students are less flexible and the assessments have to be in written examination. Online examinations typically involve students logging on to Zoom or MS Teams over the entire examination duration. Instructors often request specific VDO camera angles, such as the entire upper body of the students can be seen. This

method is easiest to implement for instructors as it is the closest format to traditional written examination but students often find it stressful because they have to be online continuously.

2. Changing written examinations into other types of assessments is the most common approach. Given sufficient preparation time, the instructors break down the midterm or final examinations into a series of tests. For advanced elective courses, written examinations are given as take-home examinations with open-ended questions or a series of mini projects. Sometimes, additional individual oral examinations are added to regular online written examinations to ensure that the students do the work on their own.

3. Use of examination technology. Some universities utilise LMS examination tools to randomize examination equations and multiple-choice answers. Examples of this approach include the CMU E-exam system by Chiang Mai University, while Thammasart University has purchased DUGGA (www.dugga.com) a digital assessment tool for its staff.

Oral examination and thesis examination

This sub-section focuses heavily on oral examination for both undergraduate final year projects and graduate student thesis examinations. The technicality of communication tool is certainly not an issue as all students and examiners are extremely familiar with the online meeting tools such as Zoom and MS Teams which serve the purpose very well.

The issue with thesis examination is the project scope modification. Physical distancing measures and university campus lockdowns heavily restrict research work, specifically those that need to use specialized tools on campus. Hence, it is very common that undergraduate final year projects and a number of graduate research work have to modify the methodology or scopes to put less dependency on experimental work and to focus more on computational work. Research work that are able to continue during this campus lockdown period are those that are completely computation or experimental work that can be done at students' homes.

An example of undergraduate work from Mechanical Engineering, King Mongkut's University of Technology Thonburi involves a study of aerodynamic forces on a radio-controlled racecar[4]. The students made a shift from wind tunnel experiment work to computational fluid dynamic work when the university made the campus off-limits to all students about 4 weeks before their project deadline day. The work was eventually completed with a successful analysis of its aerodynamic behaviour, fulfilling the project scopes and learning outcomes.

Architecture School students often create 3D models as their undergraduate thesis. Even though the online VDO meeting tools are convenient to use on smartphones such that students can point the camera at any angle during a presentation, instructors still find it difficult to fully understand the complete picture of the structure the students present over the VDO.

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[4] Kanthanasorn K., Sookkij T, Mansumitrchai T., and Chantharasenawong C., Installation of a rear fan on RC race car body to improve drag race performance (2021), B.Eng. Mechanical Engineering undergraduate thesis, King Mongkut's University of Technology Thonburi, Bangkok, Thailand
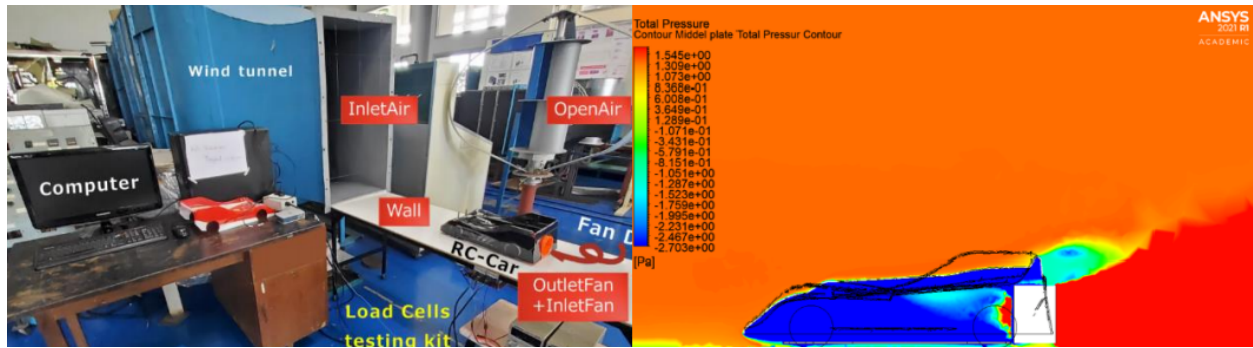
Fig.9 Engineering experiment is forced to switch to a computer simulation due to campus lockdown

However, there is one unexpected advantage of the conducting online thesis examination. With ongoing international travel restrictions and most faculty members being proficient in online meeting tools, inviting external examiners from overseas or from other universities has become extremely convenient and incur almost zero cost. Therefore, the opportunity to invite prominent professors to sit as an examiner during the pandemic has significantly increased.

(d) Student soft skill development

One of the university campus life highlights is participating at non-academic various activities by students' clubs and societies. This dimension of the campus life has effectively disappeared since the first wave of COVID-19 outbreak. Even though it is often perceived as a non-essential part of the higher education and are the first to be shelved when COVID-19 disruptions began, these activities certainly help build the students characters though experiences and human interaction.

Most universities suspend all student affairs activities as per the COVID-19 guideline on gatherings. Some student clubs may continue to operate through online channels but their impact has been minimal because these student activities are mostly based on enriching campus life with human contact.

Several new character-building activities for the online learning period have been initiated. Many involve online webinar style talks by famous personalities to broaden student perspectives. This point is similar to invitation of overseas professors to become external thesis examiner. It is relatively easy to invite famous social media influencers, prominent speakers, successful professionals or overseas professors to attend an online meeting session. Many English language proficiency improvement programs have also been initiated during this time due to the sudden availability of opportunities to host meetings with international participants. This view is shared by Faculty of Veterinary Medicine, Kasetsart University, Faculty of Science, Maejo University, Faculty of Industrial Education and Technology, King Mongkut's University of Technology Thonburi and Rajamangala University of Technology Thanyaburi.

Faculty of Engineering, Mahidol University conducted a fully online congratulatory meeting for its graduates in June 2021. The faculty posted a package to all its students which includes a class of 2021 t-shirt, masks and a congratulatory note prior to the event. While during the event, the Dean of Engineering Faculty symbolically handed the t-shirt out on VDO camera to the outstretched hands of the students on their CISCO WebEx meeting. This successful online event was followed by a new academic year online

orientation in August 2021, where the Faculty invited the President of Delta Electronics (Thailand) PCL to give a welcome speech to lift the spirits and give inspiration to the new students.
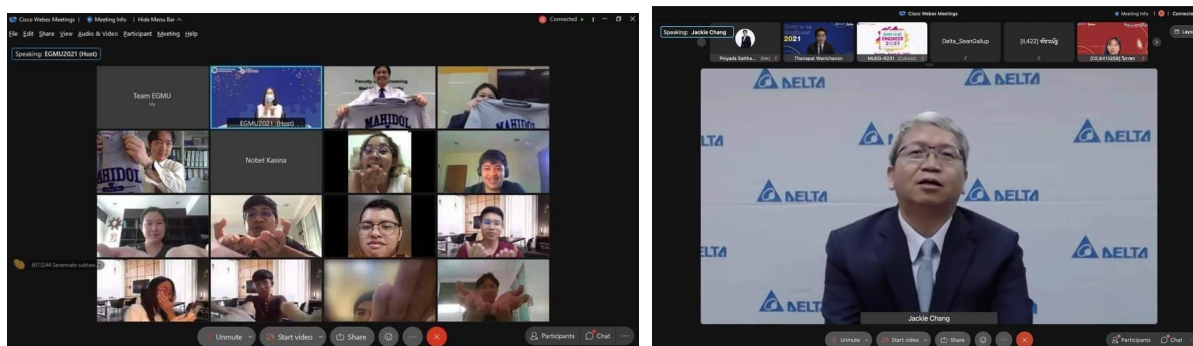

Fig.10 Online graduate send-off and new student orientation by Faculty of Engineering, Mahidol University with an invited guest speaker

Siam University has managed to continue with a limited number of traditional student activities such as making large candle donation to a local temple during the Buddhist Lent with a handful of student and staff representatives.

Other online soft skill building activities that can be held during the lockdown include career readiness workshop (Rajamangala University of Technology Thanyaburi), workshop for nursing license application (Faculty of Nursing Mahasarakham University), various student competition (University of the Thai Chamber of Commerce) and teamwork workshop (Burapha University).

(e) Supports provided by the universities

Finally, the researchers study the ways which universities provide support to its students and staff during this difficult time. The supports can be broadly catergorised into IT devices and services, financial support, and digital competency training.

Financial support

First and foremost, financial support is the most tangible help a student can receive. Prior to the higher education institution tuition fee reduction program[5] by the Ministry of Higher Education, Science, Research and Innovation (MHESI) in July, some universities already had a number of financial support programs for its students.

In addition to the tuition fee reduction programs, units within the universities also offer a number of short-term part-time work scholarships ranging from THB 2,000 – 4,000 per month. The students are asked to help faculty members prepare lessons, or become laboratory assistants.

Some faculties or departments have recently raised funds by asking for donations from its alumni, industrial partners and general public in order to offer more scholarship to its students. A 200% tax rebate for donations to registered higher education institution has made it an attractive option.

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[5] https://www.mhesi.go.th/index.php/all-media/infographic/4131-29764.html

Students are allowed additional time to pay their tuition fees. Usually these payments have to be made at the beginning of semester at the same time as student registration but most universities have voluntarily extended these payment deadlines to a much later date.

Fig.11 All Thai public and private universities offer tuition fee reduction programs to all their students

IT devices and services

Devices to access the online learning content an internet access have become essential to students and staff. All universities have notebook computer or tablet loan programs for its students but the demand can hardly be met. Chiang Mai University purchased over 2,000 new notebook computers for its students to borrow and entered into a partnership with a local IT store to provide its students and staff to purchase devices at corporate rate.

Apart from the computers and tablets, instructors need to set up a home studio in order to deliver online courses effectively. Thammasart University offers all its staff THB 1,500 per semester to spend on IT peripherals, while Chiang Mai University loans out over 2,000 Easy Studio kits (green screen, ring light, OBS-box) to its staff.

Most, if not all, universities also provide mobile phone sim cards for its student to access the internet with unlimited data plans. Other new services that the university or faculties offer to its members in response

to online learning are as follows. Veterinary Medicine, Kasetsart University hires a studio team to help its instructors record, post-production and broadcast online learning VDOs. Mahidol University upgraded its internet connection speed and server to accommodate a much higher traffic on its CISCO WebEx services. Burapha University began offering online library services to its students and staff. King Mongkut's University of Technology Thonburi introduced an online human resource management and digital signature program.

Fig.12 Universities collaborate with service providers to offer internet access for education to its students

Digital competency training

In 2020, there were a large number of online workshops for Zoom, MS Teams and other popular meeting platforms when online learning began. These workshops were offered at all universities. In mid-2021, there is hardly any workshop on how to use these platforms because most of the higher education personnel are already familiar with them.

The focus of workshops has turned to effective online learning, for example active learning, new online learning tools, and online examination tools such as DUGGA. Mahidol University has begun to offer these training on their own MOOC system.

Conclusions

Thai universities have demonstrated that they are able to rapidly and continually adapt their operations to deliver quality STEM education with all types of disruptions during the COVID-19 pandemic. The main strength of the universities in comparison with basic education counterparts is the higher degree of autonomy and access to wider resources and expertise.

Online learning has emerged as the main vehicle to deliver theoretical knowledge and essential practical skills to the students. The core strength of the university lies in the high level of technical skills of both its teaching and support staff. Majority of instructors can quickly adapt to the new online teaching platforms

such as VDO meeting tools (Zoom meeting) and LMS with integrated VDO meeting (Microsoft Teams, Google Classroom, Moodle). In order to deliver successful online learning, the university must provide supporting services too, including a reliable IT infrastructure and education media creation and distribution (VDO recording, editing and streaming).

Universities are large and complex organisations that comprise of large student and staff population. Supporting the entire population is the main challenge for many institutions due to its sheer size. For online learning to be successful, everybody must have access to sufficient devices and services. All universities have introduced large-scale device borrowing programs, purchased additional software, upgraded the existing IT infrastructure, on top of the extensive financial support programs. University has had to identify those students and staff who are in need of support at an early stage and provide them the resources to minimize the learning loss due to lack of access to online learning.

Under the circumstances, many teaching and assessment methods have had to change from its traditional format which has reduced rigorousness. These must be approached with the quality of education in mind. All universities have focused on learning outcomes of Outcome Based Education and the revised assessment methods must be designed to not compromise these outcomes. This research has mentioned a number of new innovative practices to support online learning. For example, clinical simulation with virtual patients for medical students, technical setup behind a successful pre-recorded laboratory demonstration VDOs, and invitation to high-profile guest speakers.

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