

## Beyond synchronous and asynchronous systems towards blended learning: perspective on medical education through covid-19 pandemic

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### ABSTRACT

Coronavirus Disease 2019 (COVID-19) pandemic affected various aspects, such as the health sector, education, economic, etc., being distracted. This transition requires technology acceleration to maintain the e-learning process across the world, including medical education. E-learning systems, such as synchronous and asynchronous learning, have their own advantages and limitations, especially in medical education that need theoretical and practical education. In this paper, new model of mixed synchronous and asynchronous systems towards blended learning were described as an idea for better medical education through COVID-19 pandemic. Learning systems can be divided into several type prior to previous researches, namely face-to-face learning, blended learning, flipped classroom, Information and Communication Technology (ICT) supported face-to-face learning, synchronous learning, and asynchronous learning. COVID-19 pandemic forced education system to full-online system learning, which are synchronous and asynchronous e-learning. In terms of theoretical learning, asynchronous systems may offer flexibility and convenience as well as the system can be used in conditions of time-zone difference, various internet connectivity, and different golden times for each student to learn factual information. However, asynchronous systems also may have a challenge in controlling the students to make sure they follow the class properly. To evaluate students' progress, educational stakeholders can hold a weekly reflection program as a synchronous distance learning. Besides, knowledge practice also can be conducted by focus group discussion (FGD) through synchronous distance learning. The synchronous and asynchronous systems provide the students to arrange their schedule more flexible thus can be utilized to learn practical skills in face-to-face education, such as clinical skills and laboratory practices, with strict health protocols. This system will lead to blended learning, which are online learning and shift-based traditional learning. This approach provides combination systems of asynchronous and synchronous distance learning to support blended learning in terms of lack of practice skills and laboratory competencies.



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## INTRODUCTION

At the end of 2019, People's Republic of China (PRC) reported about unknown pneumonia disease. Further identification and research had been done and showed that the etiology of the disease

is a new kind of pneumonia virus called 2019-Novel Coronavirus (2019-nCoV) and now we know it as Coronavirus Disease 2019 (COVID-19). In March 2020, the World Health Organization (WHO) declared COVID-19 as a global health pandemic which exposed many countries worldwide (Chowdhury & Oommen, 2020). The pandemic affected various aspects, such as the health sector, education, economic, etc., being distracted (Januraga & Harjana, 2020). At early pandemic situation, some countries decided to close all traditional (face-to-face) education, from elementary schools to colleges and universities because of COVID-19 pandemic situation. Face-to-face learning had been stopped and replaced by online or electronic-based learning (e-learning). This transition requires technology acceleration to maintain the e-learning process across the world. Sudden transition of conventional learning to e-learning caused by COVID-19 pandemic also led to some challenges and threats that were high internet costs, poor internet connectivity, limited technical skills learning, and challenges in accessing electricity (Olum et al., 2020).

Previous systematic review study showed that e-learning had several negative impacts on students. E-learning still confused the students because the students had to adapt to the online education system from face-to-face learning. The students also became passive, less creative, less productive, less useful for information accumulation in students, and also increased stress incidences (Argaheni, 2020). For medical and other healthcare students, technical and clinical skills are important to be basic competence as future healthcare practitioners. Current study showed that the e-learning system was considered to be less effective than the traditional learning model in terms of increasing skills ( $P < 0.001$ ) and social competencies ( $P < 0.001$ ) (Baćzek, Zaganczyk-Baćzek, Szpringer, Jaroszynski, & Wozakowska-Kapłon, 2021).

To face the educational problems during COVID-19, recent technology development can help people to communicate, especially as distance learning in the scope of education. E-learning systems can provide flexible learning that can be easily accessed as the students are connected to the internet system. COVID-19 pandemic forced education system to full-online system learning, which divided into synchronous and asynchronous e-learning. Synchronous distance learning is real-time interaction distance learning between student and teacher, while the asynchronous is not real-time based (Rowe, 2019). Both have their own advantages and limitations, especially in medical education that need theoretical and practical education. Theoretical education is a learning model to understand basic knowledge (theory), which can be done from textbooks, classes, etc. meanwhile, practical education is a learning model to gain information with sensible expertise or to know certain skill competences (Riyad & Pramana, 2020).

Both synchronous and asynchronous systems also have the same limitation, that is lack of direct practical learning. Skill competencies are very important for healthcare practitioners to treat their patients. A mistake of the practice can lead to further serious problems. In this paper, we would like to present a new model of mixed synchronous and asynchronous systems towards blended learning (traditional and online education) as an idea for better medical education through COVID-19 pandemic.

## **E-Learning Systems**

Recent technologies have been developed to help schools and the students doing their learning process. Various methods have been done to improve online learning that are suitable for the students and have effective management. Recently, there are many learning tools and media that are usually used in distance learning or video conferences, such as Zoom Meetings, Google Meet, Skype, Cisco Webex, and GoToMeeting. Based on Statqo Analytics (March 2020), these five video conferencing applications showed significant trends improvement (Angelina, 2020; Fajrin, Tiorida, & Kunci, 2020). In general, those video conferencing applications are often used in synchronous e-learning systems. Since modern technologies significantly develop, there are many types of e-learning systems prior to previous research. Table 1 shows learning systems definitions based on prior research.

**Table 1.** Definitions of Learning Systems

Learning System	Definition	Sources
Face-to-Face learning	Traditional or conventional learning system	(Alqahtani & Rajkhan, 2020; Tawafak, Alsideir, Alfarsi, Malik, & Jabbar, 2019)
Blended learning	Mixed system of traditional and online learning	(Graham, Woodfield, & Harrison, 2013; Mohammed, Kasim, & Shaharane, 2018; Thai, De Wever, & Valcke, 2017)
Flipped classroom	Learning system which provide online material to students prior to classes (Student-centered approach)	(Mohammed et al., 2018; Thai et al., 2017; Young, Bailey, Guptill, Thorp, & Thomas, 2014)
Information and Communication Technology (ICT) supported Face-to-Face Learning	Traditional learning that supported by information and communication technology	(Alhabeeb & Rowley, 2018; Muianga, Klopsri, Tedre, & Mutimucuo, 2018; Scholkmann, 2017)
Synchronous learning	Real-time interaction distance learning between student and teacher	(Mohammed et al., 2018; Rowe, 2019; Young et al., 2014)
Asynchronous learning	Non-real-time interaction distance learning	(Mohammed et al., 2018; Rowe, 2019; Young et al., 2014)

Source : (Alqahtani & Rajkhan, 2020) with few modifications

COVID-19 pandemic forced education system to full-online system learning, which divided into synchronous and asynchronous e-learnings. Both have their own advantages and limitations, especially in medical education that need theoretical and practical education. Theoretical education is a learning model to understand basic knowledge (theory), which can be done from textbooks, classes, etc. meanwhile, practical education is a learning model to gain information with sensible expertise or to know certain skill competences (Riyad & Pramana, 2020). The advantage and limitation of synchronous and asynchronous e-learning can be seen in Table 2.

**Table 2.** Synchronous VS Asynchronous

	Synchronous E-Learning	Asynchronous E-Learning
Advantages	Direct discussion between students and teacher	High quality dialogue can be achieved using a structured discussion and gives participants more time to think about the question or answer
	The liveness of the class can be examined or observed	Students can choose any time which is the best time for them to learn something.

	Communication between students and teacher can be better, clumsiness between them can be observed	There is no specific condition to access the learning material
Limitation	Students and teacher should have good internet connection	Lack of direct communication
	Real-time based learning leads to limited access at the other time (Prone to be rescheduled)	Prone to miscommunication of the learning material
	Do not give several times for the students to think about the learning material or question about it	

Source: (Narayana, 2016) with few modifications

### Synchronous and Asynchronous Systems towards Blended Learning

Both theoretical and clinical practice learning is important for healthcare students' education. In terms of theoretical learning, asynchronous systems may offer flexibility and convenience as well as the system can be used in conditions of time-zone difference, various internet connectivity, and different golden times for each student to learn factual information. Asynchronous systems can be accessed through various mediums and applications, such as YouTube, colleges' websites, Google Drive, etc. To abbreviate the systems, educational stakeholders can make a recording schedule for each learning subject thus can be re-watched by the students and the lecturers have more time to do the other academic activities. The records will be uploaded to the e-learning medium and can be accessed by the students. To avoid the leak of the video outside the college, the ICT team should restrict the access so the video only can be accessed by students and lecturers. This system can solve the rescheduled possibility in synchronous systems if there are mismatched schedules between lecturers and students. Therefore, the asynchronous e-learning system can provide a time-effective schedule for both lecturers and students.

However, asynchronous systems also may have a challenge in controlling the students to make sure they follow the class properly. To anticipate uncontrolled e-learning systems, educational stakeholders should provide scheduled reminders and assessments for the students' presence in the class. There are many methods and applications to provide scheduled reminders, such as google calendar, e-mail, etc. Integrated systems between educational stakeholders and students could ease the access of scheduled reminders of the class. Besides, the routine assessments after watching the lectures can provide good controlling systems and also the students can give feedback or questions to the lecturers. We also suggest that the students should be controlled by weekly targeted lectures so they can arrange their own schedule based on the target. Moreover, the educational stakeholders can arrange monthly assessments of the student to evaluate the effectiveness of the e-learning systems.

On the other hand, a previous study reported that interactive e-learning modules could enhance asynchronous distance learning (Suppan et al., 2021). Interactive e-learning modules can describe the lecture curriculum using a structure that is easy to understand. The modules materials can be obtained from power point presentations of the video that has been integrated with clinical competencies of the students. The module can help the students which like to learn by reading. The interactive e-learning module also can complement the lecture video. Nevertheless, those mechanisms of asynchronous distance learning also require to be combined with the synchronous systems. Direct or real-time communication is important for education in terms of evaluating the students, whether they understand with the lecture or not.

To evaluate students' progress, educational stakeholders can hold a weekly reflection program as a synchronous distance learning. This program provides real-time meetings between students and

lecturers at the end of the weekdays. The students will be divided into small groups within a tutor or lecturer and they have to present the learning materials that have been studied in a week. After a student presents their study results, the others should give feedback or additional knowledge prior to their studies. At the end of programs' session, the lecturer can re-explain the highlights of learning material and give a chance for the student to ask some questions. This synchronous program is required to provide the students in understanding the lecture in two-ways communication and ensure that the students have studied the learning materials. Another technical method that can be approached is weekly questions and answer (QnA) sessions. The question given by students will be accumulated in a week of learning materials then there will be synchronous class to answer and discuss the questions.

Besides, knowledge practice also can be conducted by focus group discussion (FGD) through synchronous distance learning. The students are divided into small groups and they will discuss or solve the case based on the targeted curriculum. Within FGD e-learning, the students are charged to be active in the discussion and solve the case using prior knowledge that they have studied in the lecture or other evidence. Both the synchronous distance learning, weekly reflection program and FGD, may provide a more effective approach as discussion and sharing knowledge between the students.

With the previous described synchronous and asynchronous e-learning, there will be times for students to learn practical skills in face-to-face education, such as clinical skills and laboratory practices. The synchronous and asynchronous systems provide the students to arrange their schedule more flexible thus the specified schedule from educational stakeholders will only be weekly reflection, FGD, and practical competencies. This opportunity can be utilized to make blended learning, which are online learning and shift-based traditional learning. Shift-based traditional learning is face-to-face learning which has been scheduled in several shifts. In a day, the stakeholder can limit this learning method up to 20-30% of total students to have a direct practical learning. The schedule must be published before early semester, thus the overseas students from other cities can prepare their travel plan to the college. The student will be divided into small groups and have several days to learn clinical skills and laboratory practices that have been scheduled. It may take 2-3 weeks to finish one generation.

To prevent COVID-19 transmission, the students and lecturers must be tested, either positively or negatively exposed by COVID-19, and apply the health protocol based on government policies. Before the students participate in the shift-based traditional learning, they have to learn the tutorial practice of learning materials video. It is necessary to limit time consumption in face-to-face practice, thus decrease the transmission potency of COVID-19. Also, when the students learn the skills competencies, they can directly start the practice and be guided by the lecturer. The SWOT analysis of present blended learning methods for healthcare students can be seen in Table 3.

**Table 3.** SWOT Analysis of the Present Blended Learning Concept

Strength	Weakness
<ul style="list-style-type: none"> <li>- Provide flexible lecture schedule for student</li> <li>- Student have an opportunity to review the learning material every week</li> <li>- No connectivity obstacle in learning process</li> <li>- No prone to be rescheduled</li> <li>- The learning video can be reused and updated in every generation</li> <li>- The students can practice skills and laboratory competencies directly using proper facilities of the college.</li> </ul>	<ul style="list-style-type: none"> <li>- Educational stakeholders should provide proper ICT facility and its human resources</li> <li>- Restricted controlling to the students during asynchronous distance learning</li> <li>- Systematic and structured schedule must be prepared in every early semester</li> </ul>
Opportunity	Threat
<ul style="list-style-type: none"> <li>- Proper skills and laboratory facilities</li> </ul>	<ul style="list-style-type: none"> <li>- Increase possibility of COVID-19</li> </ul>

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| <ul style="list-style-type: none"> <li>- Structured learning curriculum</li> <li>- Learning outcome can be reached during pandemic, especially practice skills and laboratory competencies</li> <li>- Appropriate academic instructor</li> </ul> | <ul style="list-style-type: none"> <li>transmission even with proper health protocol</li> <li>- Possibility of uncontrolled students or they can not comply with the blended learning system</li> </ul> |
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## CONCLUSION

COVID-19 pandemic has affected educational systems over the world. Sudden transition from traditional learning to online learning enforced governments and academic institutions to develop effective e-learning systems to maintain educational growth. In this paper, we evaluated distance e-learning and developed it in accordance with the recent situation of COVID-19 as well as giving a new approach in medical education. This approach provides combination systems of asynchronous and synchronous distance learning to support blended learning in terms of lack of practice skills and laboratory competencies.

Thus, we recommend healthcare academic institution, especially medical schools, to apply present blended learning to provide better practical learning of clinical skills and laboratory competencies. This e-learning system requires proper management, human resources, and technology. We also suggest further research to evaluate the present learning model in terms of communication effectiveness, knowledge growth, and practical competencies.

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