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Research Article

Implementation of Practices and Issues Regarding Blended Learning in High School Education during the COVID-19 Pandemic

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Abstract: The present COVID-19 pandemic has brought extraordinary challenges and has affected the education sector, and no one knows when it will end. Every school has to adapt to the educational process called exclusively blended teaching and learning as the "new normal education policy". In this regard, this article was conducted to explore the constraints of blended education during the COVID-19 pandemic in Thailand. This present article was also desired to provide a baseline support structure that will assist teachers in an efficient transition to a blended learning approach. Since the concept of integrating co-teaching and blended learning is a new teaching model implemented during the pandemic crisis, it is important to review how a blended learning environment impacts the experience of teachers and students. A blended learning approach in fact is relatively new to the Thai educational system. It offers the opportunity for educators to develop new methods of communication with and among students, improve learning activities that are engaging to the digital native learner, and differentiate instruction to meet the needs of the diverse learners' styles presented in any classroom. In the blended based learning, it is necessary to build opportunities for interactions and communications between students and their instructors. Synchronous and asynchronous forms are also possible tools to reach the needed interactivity levels to enhance retention rate of students, support students in need, and replace individual face-to-face support and mentoring provided in conventional learning on-campus.

Keywords: Blended learning; COVID-19; student interaction; twenty-first century skills; new normal education

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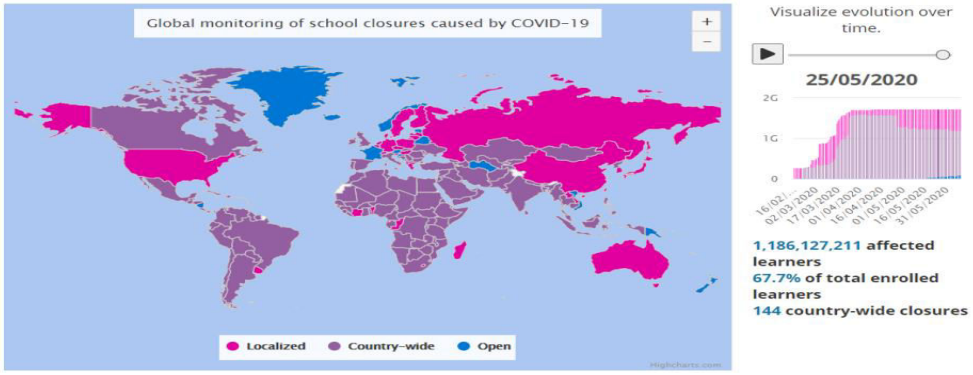
1. Introduction

After the spread of COVID-19 in China, the World Health Organization (2020) officially declared the COVID-19 epidemic as a public health emergency of international concern. The global outbreak of the COVID-19 pandemic has spread worldwide, affecting almost all countries and territories. Lockdowns and stay-at-home strategies have been put in place as the needed action to flatten the curve and control the transmission of the disease (Sintema, 2020). Lockdown and social distancing measures have led to closures of schools, training institutes and higher education facilities in most countries. In the time of this pandemic, however, there is a paradigm shift in the way of delivering education system through various distance learning platforms. E-learning tools, for example, have played an important role as a useful platform, helping schools and universities facilitate student learning during the closure of universities and schools (Subedi et al., 2020).

On March 18, 2020, the UN Educational, Scientific and Cultural Organization (2020) estimated that 107 countries had implemented national school closures related to COVID-19, affecting 862 million children and young people, roughly half the global student population. UNESCO monitoring the policy responses that are deployed to combat COVID-19 and their impacts, such as school closures is shown in figure 1.

Figure 1: **Screenshot of interactive dashboard created by UNESCO.**



In response to the spread of COVID-19, many countries decided to temporarily suspend in-person instruction and move to a remote learning model. As a report from UNESCO (2020) provides the facts that more than half a billion children have been forced to become virtual-school learners for this sudden shift.For students without internet, lessons are being broadcasted on TV or printed work sheets distributed to enable continued learning (World Bank, 2020). For example, China, as the first country to be affected by the epidemic, has imposed strict measures to contain the spread of the Covid-19 pandemic. Most face-to-face activities, including teaching, have been banned. Chinese universities and colleges have postponed the beginning of spring semester. Students are not allowed to return to campuses without approval. The Ministry of Education has launched an initiative entitled 'Disrupted classes, undisrupted learning' (Xudong Zhu and Jing Liu, 2020). The second example is from the UK evidence, the COVID-19 pandemic's impact on education, the switch from offline to online learning is likely to affect negatively those children, in primary and lower secondary schools, who have higher difficulties in adapting to the new learning environment OECD (2020). Furthermore, the Taiwanese government has minimized the spread of COVID-19 with national policies that avoided widespread planned school closures, applying the same strategies as used in H1N1 influenza pandemic during the 2009. Instead of a national shutdown, Taiwan mandated temporary, local class or school closures based on local infection rates in conjunction with in-school health and safety measures, Taiwan Ministry of Education. (2020). Like other countries, the Thai government also announced a state of emergency in Thailand. A curfew between 10pm and 4am, starting the following day, was imposed to control the spread of the virus, Prime Minister's Office. (2020b). Both mandatory and voluntary measures were implemented to contain the outbreak, including the cancellation of public activities such as the closure of schools and universities, entertainment places and sport venues. In addition, social campaigns like "stay home, stop the virus, save the nation" are considered as the efficient means to fight against the virus. To put it briefly, the pandemic has fostered to adapt online learning, distance education and blended learning.

Due to the uncertainty of reopening the educational institutions for students resulting from the increase of the COVID-19 outbreak, Kasetsart University Laboratory School Center for Educational Research and Development, Thailand has adopted a blended learning system to replace a traditional face to face approach as one of the best-fit pedagogies which was recommended by Graham et al., (2013). Over a period of time, there has been a high growth in the adoption of blended learning in the field of education, but just a few research studies emphasized on adoption problems associated with learners, academic staff, and management in Thailand. From these reasons, this article tries to explore the impacts of the COVID-19 outbreak on the teaching and learning system in Thailand, especially with the implementation of blended education in the current pandemic. It is noted that Blended learning or BL is also carried out in this article as one of the models that will be best implemented in the field of education during the COVID-19 pandemic.

2. Blended Learning "New Models for the New Normal"

UNESCO (2020) and World Health Organization (2020) reported that the pandemic of COVID-19 has accelerated the uptake of distance learning approaches all over the world. The need to restrict human interaction in order to reduce the possibility of infection has led to a full lockdown of all educational institutions. However, as schools reopen, teachers face the difficult task of teaching with an out-of-date syllabus and operating in a new and ever-changing environment in which they have yet to receive full training. A major challenge is how to best support teachers in adapting to the new normal education. The resulting situation posed great challenges for all actors in an educational context. One promising strategy for promoting online active learning is the integration of a face-to-face and online instructionapproach, hereafter referred to as the blended classroom approach.

Blended Learning (BL) has been widely adopted across higher education. Some scholars refer to it as the "new traditional model" (Ross and Gage 2006). It is generally viewed as a combination of face-to-face learning with computer-mediated instruction, a concept which is quite synonymous to hybrid teaching (Bryan and Volchenkova, 2016). According to Mantyla (2001), blended learning is the use of two or more presentation and distribution procedures for improving both the content and the learners' experience. Similarly, Fallery (2004) proposes that blended learning should be analyzed in detail to recognize to what extent it is able to encounter the amplified socialization requirements that seemed to be essential when e-learning was used. However, there are several challenges associated with the understanding of blended learning models and their implementation in an educational institution.

Also, Rovai and Jordan (2004) found that students in a blended course measured highest in a sense of community, similar to those students in a face-to-face session, but higher than those in a fully online session. They stated that, "since students in the blended course exhibited a similar sense of community and variability as students in the traditional course, offering the convenience of fully online courses without the complete loss of face-to-face contact may be adequate to nurture a strong sense of community in students who would feel isolated in a fully online course".

Graham (2006) provides that these two archetypal learning environments have remained largely separate in the past because they have used different media/method combinations and have addressed the needs of different audiences (see Figure 2). For example, traditional F2F learning typically occurred in a teacher-

directed environment with peer-to-peer interaction in a live synchronous environment. On the other hand, distance learning systems emphasized self-paced learning and learning-materials interactions that typically occurred in an asynchronous environment. The widespread adoption and availability of digital learning technologies has led to increased levels of integration of computer-mediated instructional elements into the traditional F2F learning experience.

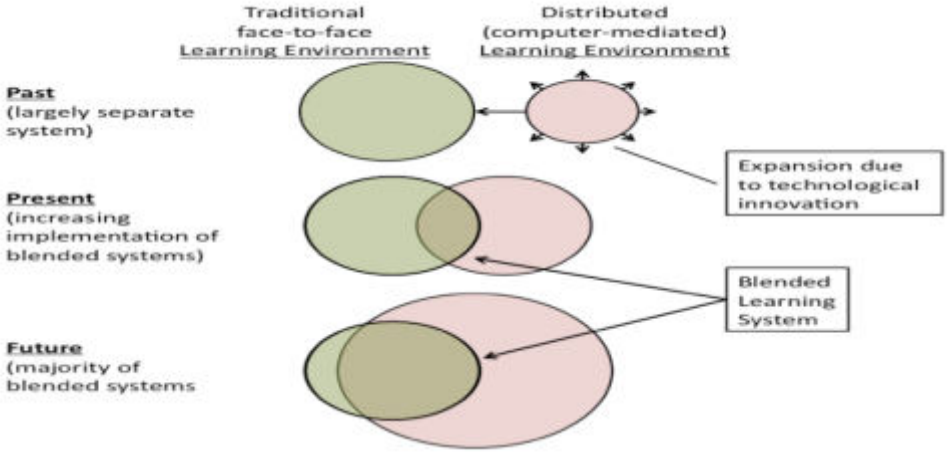


Figure 2: The Trends of Blended Learning (Graham, 2006, p. 5)

3. Discussion

As of July 2020, 98.6% of learners worldwide were affected by the pandemic, representing 1.725 billion children and youth, from pre-primary to higher education, in 200 countries (United Nations, 2020). Therefore, the online learning, distance and continuing education have become an "Education in Emergency" in unprecedented global pandemic. Hodges, Moore, Lockee, Trust and Bond (2020) argued that the transitioning from traditional face-to-face learning to online learning can be an entirely different experience for the learners and the educators, which they must adapt to with little or no other alternatives available. The education system and the educators have adopted through various online platforms and are compelled to adopt a system that they are not prepared for. From the study by Bordoloi, R and Das, P. and Das, K. (2021), they found that students from the conventional modes of learning preferred blended learning. The previous studies such as Mezirow (1991), Styslinger, Walker, Lenker, and Fink, (2014) Styslinger et al. (2014), Longo (2016), Wilhelm (2014) and Strayer (2012) have been also conducted in interruption of traditional education and blended learning education. According to Mezirow (1991) discussed learning is a process using a prior interpretation to devise a new interpretation of experience to guide future decisions. In the case of blended learning, transformation cannot occur by the process of collection and dissemination of information alone (Styslinger, Walker, Lenker, and Fink, 2014). In view of Styslinger et al. (2014), they discussed the importance of challenging students through blended learning strategies. The challenges that existed for middle school teachers, as they worked to change the instructional model through blended learning, were varied based on the learning style of the student (Longo, 2016). Longo (2016) also discussed the middle school educator's quest to infuse technology into lessons for delivery of instruction and assessment. Wilhelm (2014) argued, in order "to achieve transformative possibilities, technology must be used as a research resource and as a design tool for making usable knowledge artifacts". While Strayer (2012) mentioned, educators have known the persistent challenge of how best to use technology when helping students learn. Once the blended learning environment was developed, modifications were made easily to adapt lessons (Strayer, 2012).

The recent studies, for example, Cortez (2020) and Saboowala and Manghirmalani-Mishra (2020), Samson (2020) and Lemay Doleck and Bazelais (2021) have proved that learning is enhanced through a blended modebut these studies have been conducted on blended learning providing impact to educators only. Drawing from the description mentioned above, this article, therefore, tries to explore the impact of the COVID-19 pandemic on teaching and learning system in Thailandand Kasetsart University Laboratory School Center for Educational Research and Development, especially with the implementation of blended education in the current pandemic. Along with the mentioned scope of interest, this article attempts to find out managerial contribution in the field of education during the COVID-19 pandemic as well.

3.1 The impact of COVID-19 on the Education Sector in Thailand

In April 2020, in response to the Covid-19 crisis, the Ministry of Education announced a timeline plan for delaying education activities to respond to Covid-19 for the 2020/21 academic year. In the preparation for remote

learning, schools and teachers prepared remote learning material with training how to implement it. The next step was to experience the trial for remote leaning, some schools and students implemented online teaching and learning and retrieving the experiences' feedback from students and schools. Finally, all schools with all teachers and students started using distance learning, online education system or blended approach depending upon the school readiness. The Ministry of Education has developed plans for the distance learning approach via satellite or DLTV (Distance Learning Television).Apart from the DLTV method, teachers are expected to be more active in providing support to learners via different online platforms. By doing so, teachers have to respond to the different needs of learners, provide them with feedback and generate an exchange of ideas. Learning materials should be conscious of accessible media and the needs of all students. This may include developing more materials for TV, mobile phones, and print options, available in minority languages and for assistive devices. This will depend on the varying ability of students to access remote education, the quality of remote instruction, and the conduciveness of the home environment.

Many researchers, such as, Akinbadewa and Sofowora (2020), Alharthi (2020), Al-Husban (2020), Weinhandl, Lavicza, and Hohenwarter (2020) and Hebebci, Bertiz, and Alan (2020) have extensively studied the impact of distance learning on education. They found that distance education has a number of benefits such as ensuring the continuity of education (Akinbadewa and Sofowora, 2020), ensuring a lifelong learning (Alharthi, 2020), and reducing the high costs associated with traditional education (Al-Husban, 2020). Limitations such as teaching methods, scheduling, and time have existed since the teacher and the learner were located in different conditions (Weinhandl, Lavicza, and Hohenwarter, 2020) Hebebci, Bertiz, and Alan, (2020) pointed out that for children whose parents with low levels of education, or who do not live with their parents and lack adult guidance, remote education is additionally challenging. To solve this problem, some schools will have to implement a blended approach of onsite and remote learning to allow for schools to adequately implement the necessary social distancing measures.

The impact of online learning was not limited only within the educational system, it also extended to the student's learning experience when it comes to accessing research and study materials; for example, students' ability to access textbooks and resources they need to review can be hampered by a lack of copyright limitations and exceptions. In a survey conducted by the National Statistical Office of Thailand (2020), it showed that many students do not have computers, notebooks, or tablets at home, moreover, they do not have adequate or any internet at home. In addition, extensive time in front of the television may not be appropriate for such young children (Supanitayanon et al., 2020). Students have reportedly not been able to log on to the online system at all, making it difficult to access these resources (BBC Thai, 2020). However, it does have some advantages such as learning through the internet. O'Malley and McCraw (1999) mentioned that students can now obtain instruction and learn with ease at home by simply clicking a few buttons on the computer, smartphone and smart tablet to listen live or asynchronously to a professor thousands of miles away, interact with the professor, and solve problems without having to physically be in a classroom. While a more expensive option for education in terms of set up, distance education has progressed in learning practice from an "anywhere" to an "anytime" education delivery method (Shachar M, Neumann, 2003). To summarize the potential move to remote education has highlighted the importance of the digital divide, teaching and student's learning experience, the varying ability of students and families to access remote education, and the ability of schools to offer remote education. It is important to understand the impact of distance learning on education and the social consequences.

3.2 Development of Blended Education in Thailand

Most scholars in Thailand defined blended learning as a combination of online and face-to-face instructions, as found in the studies conducted by Nilsook and Wannapirun (2012), Simasathiansophon (2014), Chomchaiya (2014). The Face-to-Face Driver model has been mostly applied to Thai schools and universities, as addressed in the curriculum that the instruction should be done in the classroom. In this article, the term, 'blended learning' is defined as "the combination of previous instruction and online instruction in different models" (Horn and Staker, 2011). This definition encompasses the idea that Blended learning or BL is not merely limited to a combination of face-to-face instruction and online learning. But learning only through online without face-to-face instruction can be defined as Blended learning or BL models too. Hence, the phrase, "previous instruction" is used to avoid such limitation of face to-face instruction. In addition, it should be noted that the combination between two modes of learning can be varied, depending on individual learning subjects, contexts, objectives, as well as needs and readiness of a particular educational institution.

Khaopa (2012) reported that several universities have used blended learning along with traditional teaching in classroom to promote students' learning rather than online education. The report aligns with others' claims (Simasathiansophon 2014). The common use of blended e-learning perhaps is because it has proved to be a teaching tool rather than an educating tool (Pagram and Pagram 2006), which requires a teacher to deliver knowledge to learners. Past studies into the use of blended e-learning revealed positive results, which suggested that Thai teachers should employ e-learning in the classroom as additional learning support or blended learning

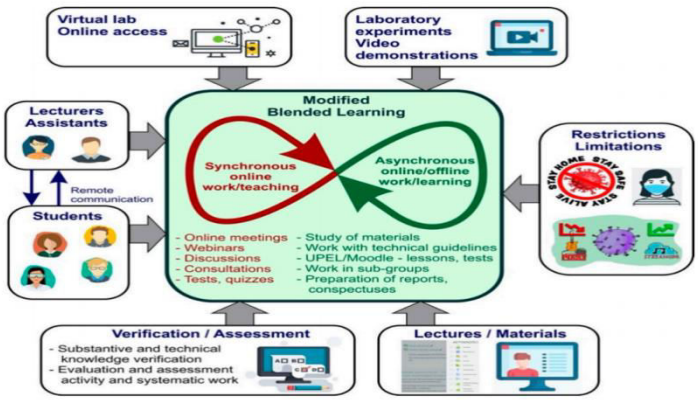
only (Simasathiansophon 2014). It also has positively affected Thai undergraduate students' attitudes towards the roles of the teacher as a provider of feedback, encouragement and learning guidelines in a business statistics class (Suanpang and Petocz 2006), and graduate students' satisfaction with blended e-learning exercises, homework, research and organizational analysis on information management (Nilsook and Wannapirun 2012). Both studies additionally indicated similar outcomes that students concurrently seemed motivated to learn better because they were allowed to access the e-learning materials at their convenience. Nevertheless, Pagram and Pagram (2006) argued that Thai students tended to need much guidance and encouragement from teachers at all levels, even in tertiary education. They would read or study only when their teachers assigned them to do some work or when they had to take an exam. This aspect implies that Thai students in general need extrinsic motivation to learn which is driven by their authoritative teachers. This type of motivation arises from outside the learners, and it can be beneficial for them (Plotnik and Kouyoumjian 2011). These reviews suggested that mixed methods can help students achieve their study if instructors are trying to improve the learning outcomes of their courses and allow students to receive instruction both inside and outside of class. Moreover, by better understanding the potential of mixed method courses, instructors can better employ these methods to fulfill the needs of their students.

3.3 Challenges to Transitioning to Blended Learning in the Classroom

As already mentioned earlier, the COVID-19 lockdown was introduced in the beginning of 2020. Limitations in the field of traditional face-to face (f2f) contacts resulted in the need of a transition to fully remote work with students in the learning process. Blended learning has also been found to develop learning skills among Thai students. Some of the skills provided by blended learning has been known to improve self-directed learning and communication skills (Sriarunrasmee, Techataweewan, and Mebusaya, 2015). Blended learning has also been found to support students in comprehension of content as well (Banyen et al., 2016). In spite of this, the role of attendance has not been looked at closely in Thailand.

In response to the rising concerns about the current COVID-19 pandemic in Bangkok and to minimize the disadvantage of the distance learning approach, Kasetsart University Laboratory School Center for Educational Research and Development has adopted the blended learning approach recommended by Andrzej O˙zadowicz (2020) as shown in Figure 3. From a practical and an operational point of view, Kasetsart University Laboratory School Center for Educational Research and Development has adapted different online platforms such as Google Classroom, Microsoft teams and the Line application platform. These platforms allow the providing and sharing of study materials as well as presentations from lectures in the form of PDF files and graphics shared with students. All of the work from students have been processed continuously. And the students are becoming more active, with the possibility of tracking and even assessing students' activities by the teacher. The students proceed through the stages only by answering the questions correctly, working individually or in groups with asynchronous discussion. Moreover, the lessons are available for students according to the course schedule, correlated as much as possible with the topics carried out as part of the laboratory exercises. Laboratory classes are also a specific element of English and science teaching considering implementation of the e-learning. After a virtual Laboratory classes, the students may need to prepare short reports with results of their work and with short technical discussion according to guidelines provided by the teachers. Synchronous F2F in a live virtual classroom implies that the students and the teacher work together simultaneously but in different places. Synchronous delivery online creates a sense of a virtual community. It means that everyone has to be at the computer at a certain time. It requires that students should coordinate with the instructor and classmates to plan a schedule to be available at a prescribed time.

Figure 3. A general framework of the modified blended learning approach.



Source: Andrzej O˙zadowicz (2020)

3.4 Students' and Teachers' views on the impact of Coronavirus on their education experience

In response to school closures caused by COVID-19, Kasetsart University Laboratory School Center for Educational Research and Development has adapted the use of distance learning programs and open educational applications and platforms that schools and teachers can use to reach learners remotely and limit the disruption of education. A blended learning environment is relatively new to the Thai educational system. Since the concept of integrating co-teaching and blended learning is a new teaching model implemented during the pandemic crisis, it is important to review how a blended learning environment impacts the experience of teachers and students. In such a critical time, there has been a drastic change in how teaching and learning happen while learners are physically out of school and separated from their teachers and their classmates. Teachers have agreed that the transition from conventional learning systems to blended systems occurred suddenly because the Covid-19 pandemic was not preceded by mature preparation. Because of the reduced face-to-face class time and the increased use of online systems, teachers have expressed that it is common to expect that students need to take more effort in getting familiar with and make effective use of the blended learning environment. To help them keep concentrating in learning, educators should put more effort in checking and making sure that students enjoy the learning environment.

The fact that blended learning becomes more established, it offers the opportunity for educators to develop new methods of communication with and among students, improve learning activities that are engaging to the digital native learner, and differentiate instruction to meet the needs of the diverse learners' styles presented in any classroom. Students accepted that "learning, downloading materials, and submitting assignments online were convenient because they could access the materials and submit assignments from anywhere at any time. However, lack of access to technology or absence of fast and reliable internet access can deprive students in rural areas and disadvantaged families from education. It is widely understood that lack of access to technology or absence of good internet connection is an obstacle for students to continued learning, especially for students from disadvantaged families. Further, careful consideration of many elements in the instruction design that creates a setting indicates the greater understanding of the students receiving from blended learning during transformation period. Online learning and technology are appropriate for students' learning because mobile phones are part of their lives. They are addicted to using mobile phones. When using online learning, students are more motivated to learn because they are required to use mobile phones to do class activities, and class materials appear on their mobile phone screens, so they have to pay attention to them". When looking at how the use of a blended learning environment affected what went on in the classroom, the issue of classroom dynamics stands out. Teachers mentioned that "One of the most difficult aspects of teaching online is integrating students with virtue interaction in the classroom because the multisensory, multimodal, and multitasking interactions that are commonplace in a face-to-face course are difficult to capture or emulate in an online course". It is necessary for teachers to design these interactions effectively so that students are motivated to participate and learn the course materials, and the instructor has ample opportunities to interact with students, stimulate their critical thinking, facilitate their learning, and meet course objectives".

Effective teaching styles are very important for enhancing online lessons and motivating students to participate in online discussions. Despite realizing the facts, teachers did not have the necessary technical skills and they did not manage in such a short time to adapt their teaching style or to properly interact with students in the online environment to assure high standards of the teaching process. The technical skills of teachers can be presented by their ability to use different functions offered by the E-learning platform to adapt their teaching style to the online environment, for example, using the video conference function where students can actively participate because teachers have the possibility to make them moderators. The quality of an online session depends on the participant's spirit. When it comes to this matter, teachers suggested that "student – teacher interactions in an online course include (1) asynchronous or synchronous discussions between students and the instructor, (2) collaborative activities among students for completing course assignments, (3) students interacting one-on-one with the instructor on course materials such as course notes, homework assignments, announcements, etc.

4. Conclusion and Recommendations

In conclusion, the COVID-19 pandemic has affected learners and instructors both positively and negatively. Most of the opinions disclosed the disadvantages of education in pandemic period for students. During the COVID-19 pandemic, all schools in Thailand have intensified their efforts to enhance online interactions and motivate students to participate in online learning. Transitioning from classroom teaching to blended instruction is a challenge even under the best possible circumstances to adjust to the "new normal." To implement blended learning,the transformation of learning that can be pursued includes the transformation of technology andlearning media, transformation of learning designs, transformation of learning models andtransformation of assessment processes and learning outcomes.

In blended based learning, it is necessary to build opportunities for interactions and communication between students and their instructors. This finding is supported by the studies of O'Lawrence (2005) and Yoon, Seo

Young and Lee, Chung-Hyun. (2010), they specified the lack of interaction to be the issue from the perspectives of teachers. Teachers are also possibly the most important element in the whole process, especially in the relationship with disadvantaged students, for whom the family can often offer only limited support (in fact, in many cases teachers have a mediating role between students and their family). Moreover, schools are advised to remind students' parents of their important role to strengthen school-parent engagement in order to provide appropriate information and guidance to parents on effective practices for supporting their children learning (Garbe, Ogurlu, Logan, and Cook, 2020).

To be precise, blended learning has the potential to overcome several of the disadvantages of both traditional methods and online learning. Synchronous and asynchronous forms are possible tools to reach the needed interactivity levels, enhance retention rate of students, support students in need, replace individual face-to-face and mentor conventional learning on-campus. Integration of virtual and physical landscapes enables both instructors and students to become learners, but this is most effective when there is institutional support through the provision of professional learning and the opportunity for redesigning courses to the most appropriate blend (Bliuc, 2007). This finding is supported by the studies ofKintu, C. Zhu, and E. Kagambe (2017) and Kudryashova, Gorbatova, and Rozhkova (2016) claimed that if the blended learning model was applied to the learning process it would be more effective with the transition of students to higher levels in gaining knowledge and developing skills.

References

Alharthi, M. (2020). Students' attitudes toward the use of technology in online courses. Int. J. Technol. Educ., 3, 14–23.

Al-Husban, N.A. (2020). Critical thinking skills in asynchronous discussion forums: A case study. Int. J. Technol. Educ., 3, 82–91.

Akinbadewa, B.O.; Sofowora, O.A. (2020). The effectiveness of multimedia instructional learning packages in enhancing secondary school students' attitudes toward Biology. Int. J. Stud. Educ., 2, 119–133.

Andrzej O ˙zadowicz. (2020). Modified Blended Learning in Engineering Higher Education during the COVID-19 Lockdown—Building Automation Courses Case Study Educ. Sci. 10, 292; pp. 2-20 doi:10.3390/educsci10100292

Banyen, W., Viriyavejakul, C., andRatanaolarn, T. (2016). A blended learning model for learning achievement enhancement of Thai undergraduate students. International Journal of Emerging Technologies in Learning (IJET), 11(04), 48–55. Retrieved from http://online-journals.org/index.php/i-jet/article/view/5325

BBC Thai (2020) 'First day of online learning in Thailand: From kindergarten to vocational college students' [original in Thai], BBC Thai 18 May 2020, retrieved from: www.bbc.com/thai/thailand-52703005.

Bliuc, A. M., Goodyear, P., and Ellis, R. A. (2007). Research focus and methodological choices in studies into students' experiences of blended learning in higher education. *The Internet and Higher Education*, *10*(4), pp.231–244.

Bordoloi, R and Das, P. and Das, K. (2021). Perception towards online/blended learning at the time of Covid-19 pandemic: an academic analytics in the Indian context, Asian Association of Open Universities Journal Vol. 16 No. 1, 2021 pp. 41-60.

Bryan, A., andVolchenkova, K. N. (2016). Blended learning: Definition, models, implications for higher education. Bulletin of the South Ural State University, 8(2), 24-30. https://doi.org/10.14529/ped160204

Chomchaiya, C. (2014). An investigation into the development of English language reading comprehension among Thai undergraduate students using an online blended learning approach. [Doctoral dissertation, Curtin University]. Curtin University databased.

Cortez, C. P. (2020). Blended, Distance, Electronic and Virtual-Learning for the New Normal of Mathematics Education: A Senior High School Student's Perception. European Journal of Interactive Multimedia and Education, 1(1), e02001. https://doi.org/10.30935/ejimed/8276

Fallery, B., (2004). The three visions of open training and their norms propositions: Standardizing contents, activities or interfaces? Informational systems and management. 9(4) pp. 2-24.

Garbe, A., Ogurlu, U., Logan, N., and Cook, P. (2020). COVID-19 and Remote Learning: Experiences of Parents with Children during the Pandemic *American Journal of Qualitative Research, Vol. 4 No. 3, pp. 45-65, https://doi.org/10.29333/ajqr/8471*

Graham, C. R. (2006). Blended learning systems: Definition, current trends, and future directions. In C. J. Bonk and C. R. Graham (Eds.), The handbook of blended learning: Global perspectives, local designs (pp. 3-21). John Wiley and Son.

Graham, C. R. (2013). Emerging practice and research in blended learning. In M. G. Moore (Ed.), Handbook of distance education, (3rd ed., pp. 333–350). New York: Routledge.

Hebebci, M.T.; Bertiz, Y.; Alan, S. (2020). Investigation of views of students and teachers on distance education practices during the Coronavirus (COVID-19) Pandemic. Int. J. Technol. Educ. Sci., 4, 267–282.

Hodges, C.; Moore, S.; Lockee, B.; Trust, T.; Bond, A. (2020). The Difference between Emergency Remote Teaching and Online Learning, Why IT Matters to Higher Education. Available online: https://er.educause.edu/articles/2020/3/the-difference-betweenemergency-remote-teaching-and-online-learning.

Horn, M. B., andStaker, H. (2011). The rise of K-12 blended learning (Innosight Institute white paper). Retrieved 2012, October 12, from http://www.inno-sightinstitute. org/media-room/publications/education-publications/the-rise-of-k-12-blended-learning/

Khaopa, W. (2012). Thailand could be major e-learning hub in region. The Nation. Retrieved February 3, 2015, from http://www.nationmultimedia.com/national/Thailand-could-be-major-e-learning-hub-in-region30195003.html

Kintu, M,. Zhu, C,.andKagambe, E. (2017). Blended learning effectiveness: the relationship between student characteristics, design features and outcomes. Int. J. Educ. Technol. High. Educ. 14(1). pp. 7. Retrieved from https://10.1186/s41239-017-0043-4.

Kudryashova, A,.Gorbatova, T,.andRozhkova, N. (2016). Developing a blended learning based model for teaching foreign languages in engineering institutions', SHS Web Conf. vol. 28, p. 01128, Retrieved from https://doi.org/10.1016/j.ijedro.2020.1000 12.

Lemay DJ, Doleck T, Bazelais P. (2021). Transition to online teaching during the COVID-19 pandemic. Interact Learn Environ (in press; https://doi.org/10.1080/10494820.2021.1871633).

Longo, C. M. (2016). Changing the instructional model: Utilizing blended learning as a tool of inquiry instruction in middle school science. Middle School Journal, 47(3), 33–40.

Mantyla, K. (2001). Blending E-Learning: The Power is in the Mix, Alexandria, VA: American Society for Training and Development, ISBN 1562863010

Mezirow, J. (1991). Transformative dimensions of adult learning. San Francisco, CA: Jossey-Bass.

National Statistical Office of Thailand (2020). Statistical Yearbook Thailand 2020, *National Statistical Office, Ministry of Digital Economy and Society*, Retrieved from http://service.nso.go.th

Nilsook, P. andWannapirun, P. (2012). Blended e-learning activities for the Information and Innovation Management course: Its outcomes of graduate students at Bangkok-Thonburi University. The Proceedings of International e-Learning Conference 2012 (IEC2012) "Smart Innovations in Education and Lifelong Learning", June 14-15, IMPACT, Muang Thong Thani, Thailand. Retrieved January 10, 2016, from http://support.thaicyberu.go.th/proceeding/proceedingIEC2012.pdf

OECD (2020), Country Note: *School Education* During *Covid -19,* OECD Publishing, England, https://www.oecd.org/education/United-Kingdom-coronavirus-education-country-note.pdf

Office of the National Council (2020) 'Educational Statistics of Thailand 2014 to Educational Statistics of Thailand 2018', Ministry of Education, Kingdom of Thailand.

O'Lawrence, H. (2005). A review of distance learning ınfluences on adult learners: Advantages and disadvantages. Informing Science and IT Education Joint Conference, 2005 (pp.125-135). Arizona, USA, 16-19 June.

O'Malley J, McCraw H. (1999). Students' perceptions of distance learning, online learning, and the traditional classroom. *Online J Dist Learn Admin*. 2:1–10.

Pagram, P. andPagram, J. (2006). Issues in e-learning: A Thai case study. The Electronic Journal of Information Systems in Developing Countries, 26(6), 1-8. Retrieved December 10, 2015, from http://www.ejisdc.org/ojs2/index.php/ejisdc/article/view/276/175

Prime Minister's Office. (2020b). The Declaration of the Emergency Decree on Public Administration in Emergency Situations, Prime Minister's Order. Bangkok: Prime Minister's Office.

Plotnik, R. andKouyoumjian. H. (2011). Introduction to Psychology. Belmont, CA: Wadsworth.

Rovai, A., and Jordan, H. (2004). Blended learning and sense of community: A comparative analysis with traditional and fully online graduate courses. International Review of Research in Open and Distance Learning, 5. Retrieved from http://www.irrodl.org/index.php./irrodl/article/view/192/274

Ross, B., and Gage, K. (2006). Global perspectives on blended learning: Insight from WebCT and our customers in higher education. In C. J. Bonk and C. R. Graham (Eds.), Handbook of blended learning: Global perspectives, local designs (pp. 155-168). San Francisco, CA: Pfeiffer Publishing.

Saboowala, R., andManghirmalani-Mishra, P. (2020). Perception of In-Service Teachers Towards Blended Learning as the New Normal in Teaching-Learning Process Post COVID-19 Pandemic.

Seage, S.J.; Türegün, M. (2020). The effects of blended learning on STEM achievement of elementary school students. Int. J. Res. in Educ. Sci., 6, 133–140.

Serhan, D. (2019). Web-Based Homework Systems: Students' Perceptions of Course Interaction and Learning in Mathematics. Int. J. Soc. Educ. Sci., 1, 57–62.

Simasathiansophon, N. (2014). A perspective on blended-learning approach through Course Management System: Thailand's case study. International Journal of Information and Education Technology, 4(2), 172-175. Retrieved January 10, 2016, from http://www.ijiet.org/papers/392-IT064.pdf

Shachar M, Neumann Y. (2003). Differences between traditional and distance education academic performances: a meta-analytic approach. *Int Rev Res Open Dist Learn*. 4:1–20. doi: 10.19173/irrodl.v4i2.153

Sriarunrasmee, J., Techataweewan, W., andMebusaya, R. P. (2015). Blended learning supporting self-directed learning and communication skills of Srinakharinwirot University's first year students. Procedia - Social and Behavioral Sciences, 197, 1564– 1569.

Strayer, J. F. (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation. Learning Environments Research, 15(2), 171–193.

Styslinger, M. E., Walker, N. L., Lenker, T. K., and Fink, L. (2014). Beyond the sticky note and venn diagram: Comprehension strategies for 21st-century schools. Voices from the Middle, 22(2), 13–20. Retrieved from http://cupdx.idm.oclc.org/login?url=http://search.proquest.com.cupdx.idm.oclc.org/docview/1635286410?accountid=10248

Suanpang, P., andPetocz, P. (2006). E-learning in Thailand: An analysis and case study. International Journal on E-Learning, 5(3), 415-438. Retrieved December 10, 201, from https://www.learntechlib.org/p/5708

Supanitayanon, S., Trairatvorakul, P. and Chonchaiya, W. (2020) 'Screen media exposure in the first 2 years of life and preschool cognitive development: a longitudinal study', Pediatric Research

Taiwan Ministry of Education. (2020). [Standards for suspending schools].Taipei, Taiwan: Ministry of Education School Health Information. https://cpd.moe.gov.tw/index.php?guid=BD28807E-9D44-A1D4-D795-3408DA587793 (accessed 05/05/20)

UNESCO (2020b). UNESCO Rallies International Organizations, Civil Society and Private Sector Partners in a Broad Coalition to Ensure #LearningNeverStops. UNESCO.https://en.unesco.org/news/unesco-rallies-international-organizations-civil-society-and-private-sector-partners-broad

United Nations. (2020). Policy brief: Education during COVID-19 and beyond. United Nations. https://www.un.org/development/desa/dspd/wp-content/uploads/ sites/22/2020/08/sg_policy_brief_covid-19_and_education_august_2020.pdf

Weinhandl, R.; Lavicza, Z.; Hohenwarter, M.; Schallert, S. (2020). Enhancing flipped mathematics education by utilising GeoGebra. Int. J. Educ. Math. Sci. Technol., 8, 1–15.

WHO. (2020). Novel coronavirus (COVID-19) situation. Retrieved from https://experience.arcgis.com/experience/685d0ace521648f8a5beeeee1b9 125cd.

Wilhelm, J. (2014). You gotta BE the book: Teaching engaged and reflective reading with adolescents (3rd ed.). New York, NY: Teachers College WHO. (2020). Novel coronavirus (COVID-19) situation. Retrieved from https://experience.arcgis.com/experience/685d0ace521648f8a5beeeee1b9 125cd.

World Bank (2020), "How countries are using edtech (including online learning, radio, television, texting) to support access to remote learning during the COVID-19 pandemic", www.worldbank.org/en/topic/edutech.

Xudong Zhu and Jing Liu, (2020). Education in and After Covid-19: Immediate Responses and Long-Term Visions, Postdigital Science and Education, 2, pp. 695–699Samson, P. J. (2020). "Student behaviors in a blended synchronous course Student behaviors in a blended synchronous course," Journal of Geoscience Education, vol. 0, no. 0, pp. 1–10, https://doi.org/10.1080/10899995.2020.1768002

Yoon, Seo Young and Lee, Chung-Hyun. (2010). The perspectives and effectiveness of blended learning in L2 writing of Korean university students. Multimedia-Assisted Language Learning, 13(2), 177-204.