

Empowering Pre-Service Teachers for the Digital Transformation of Education from New Normal to Next Normal

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Abstract

The purposes of research were to comparison of digital technology used for the instructional management during the Covid-19 pandemic during the New Normal period and the endemic Covid-19 during Next Normal period adopted by pre-service teachers; and to develop the landscape of digital technology used for instructional management during the New Normal and the Next Normal periods adopted by pre-service teachers. The participants included 400 pre-service teachers. The research tool was an online questionnaire. The data were analyzed by mean and standard deviation. The results showed the comparison of digital technology for the instructional management in the New Normal and the Next Normal as follows. Regarding the New Normal, the finding were: (a) some websites and applications such as Google Meet, Line, YouTube, and Facebook Messenger were used to communication with students; (b) some websites and applications, namely Google classroom, MS Teams, Moodle, and Thaimooc were used to send and receive student's works; (c) some learning management systems, namely Google classroom, MS Teams, Moodle, and Thaimooc were used; (d) some digital media libraries such as YouTube, Trueplookpanya, DLTV, Satellite Distance Education Foundation, SciMath Knowledge Library, and IPST were used; (e) some online measurement and evaluation tools such as Google Forms, Kahoot, Quizizz, and Microsoft Forms were used and (f) some teaching guidelines and tools, like Video assignment, General Activities, and Attendance be used later. Regarding the Next Normal, the finding were: (a) some websites and applications were used to communicate with students, including Line, Facebook, Messenger, Youtube and Google classroom; (b) some websites and applications like Line, Facebook Messenger, YouTube, and Google classroom were used to send and receive student's assignments; (c) some learning management systems like Google classroom, MS Teams, Moodle, Edmodo, and Thaimooc were also used; (d) some digital media libraries like Google classroom, YouTube, Trueplookpanya, OBEC Content Center - NEDA, and DLTV (Satellite Distance Education Foundation) were also helpful; (e) some online measurement and evaluation tools like Google Forms, Kahoot, Quizizz, and Microsoft Forms were also used; and (f) some teaching guidelines and tools like Assignment, Announcements and Update, Student Support, and Grade Book will also be used later. The digital technology landscape consists of 6 parts: (1) the websites and applications used for communication with students; (2) the websites and applications provides for students to submit their assignments; (3) the learning management systems; (4) the digital media libraries; (5) the online measurement and evaluation tools; and (6) the teaching guidelines and tools to be used later.

Keywords: digital learning tools, applications for learning, new and next normal, digital transformation, digital landscape, pre-service teachers

1. Introduction

The outbreak of COVID-19 has caused an unprecedented crisis in education, thereby requiring all sectors worldwide, either in developed or developing countries, to seek ways to grapple with the impacts of the

pandemic on education. One of the measures launched to slow down and prevent the global spread is the massive closure of onsite activities in most educational institutions. In fact, the pandemic has posed severe impacts on countries around the world. There have been more than 620 million cases confirmed with over 6.55 million deaths. In Thailand, the number of infections, from 2020 to 2022, approximately totaled 4,680,000, with the death toll amounting to 32,771 (WHO, 2022). The rapid spread of COVID-19 caused universities and schools worldwide to shift to fully online education (Tafazoli & Meihami, 2022). Due to the pandemic, people have been forced to adjust themselves to the 'New Normal' whereby working and learning have been digitalized, and the emphasis has been placed on further developing educational technology. Nevertheless, most studies indicated that online learning demotivates and reduces students' participation (Alshwiah, 2022; El-Sayad et al., 2021; Keesookpun et al., 2023; Jitsupa et al., 2022).

As widely acknowledged, there has been an increasing rate of change in education, spanning from the conventional education and educational dynamics to the application of online and high-end technology with educational. Educational management is deemed challenging and thus it requires close cooperation from all parties (i.e., governments, institutions, teachers, students, and parents) to seek solutions and prepare for online education (Bozkurt & Sharma, 2020). Recent studies on technology application in education are mainly concerned with the teachers' preparedness and knowledge in using effective educational technology (Sepulveda-Escobar & Morrison, 2020; Tafazoli & Meihami, 2022), planning and adjusting policies to embrace online learning (Tafazoli & Atef Boroujeni, 2022; Stavridis & Papadopoulou, 2022), financial issues related to the preparation of teachers and students for online education (Aguilera-Hermida, 2020; Gillis & Krull, 2020).

Under the scheme of Thailand 4.0, the government stresses the importance of education, regarding it as one of the key development agendas for steering the country towards 4.0 and subsequently moving towards the "First World." In essence, the Thailand 4.0 model highlights educational reform, which needs to achieve three objectives: 1) adaptation to goals and systems of learning management; 2) adaptation to paradigms and teachers' skills; and 3) adaptation to curricula and teaching methods, placing an important on developing innovations, employing digital technology, and modifying teaching strategies to create the students' learning skills and enable them to develop themselves for the future (Strategy and Planning Division, 2016). A good educational system should be flexible and adaptable when it is faced with unexpected situations and contexts, locally and globally.

The learning management system for 21st century education is, therefore, needed to be adjusted and developed into the "Thailand Education Eco-System," which shifts its focus from a one-size-fits-all approach to a system that is more responsive to the students' learning and individual development. It should be viewed as the Thailand Education Eco-System (TE2S) rather than an educational system. The TE2S is intended for the development of human capital (Office of the Basic Education Commission, 2020). Online education plays a key role in supporting online teaching methods and providing schools with the online content that is free of charge. In other words, digital technology can be utilized in conjunction with traditional educational methods to improve learning management in emergency situations.

At the tertiary level, traditional learning has been increasingly replaced by online education. Several applications are utilized as a means of communication between teachers and students. Several pilot systems have been implemented, tested, and developed to replace traditional instruction (Mathuros, 2021). This is in consonance with the results of research study by Nilsook (2022), who stated that sudden changes in educational systems, caused by the coronavirus pandemic, have given rise to an increasing reliance on technology in the New Normal era. Two new learning styles were designed and developed into learning and instruction designs for the Next Normal era. The first involves learning strategies and teaching methods developed and used during the New Normal era while the second involves those particularly tailored strategies and methods for the classroom in the post-COVID-19 era. The latter places an emphasis on solving problems and adjusting to particular educational paradigms. Similarly, Santos and Castro (2021) indicated that there are eleven integral parts that constitute digital technology applications for learning management, including: 1) technological knowledge; 2) pedagogical knowledge; 3) content knowledge; 4) pedagogical content knowledge; 5) technology content knowledge; 6) technology and pedagogy knowledge; 7) technology, pedagogy, and content knowledge (TPACK); 8) educational technology tools; 9) relationship of the adequacy of EdTech tools to application of TPACK; 10) regression model; and 11) alternative approaches in the implementation of ICT in the classroom.

Furthermore, educational applications can be divided into several groups, e.g., social media applications, including WhatsApp, Facebook, and YouTube (El-Sayad et al., 2021; Sobaih et al., 2020). In Thailand, there has been an increasing interest in using social media applications. Top social media applications include Facebook, Line, Facebook Messenger, TikTok, Instagram, Twitter, and Pinterest respectively (Kemp, 2022). In the post-COVID-19 era, learning management is increasingly dependent on applications of digital technology.

Considering previous situations, it is obvious that teachers must be aware that several aspects of learning management systems need to be adjusted and changed. Regarding the preparation for education in the Next Normal era, teachers need to accustom themselves to new working lifestyles by changing the ways they think, learn, communicate, and conduct themselves according to the dynamic social context (Cahapay, 2020). Learning management should promote students' engagement in the design and development of classroom activities and assessments. Students can help develop online activities for both conventional and online classrooms by using digital technology, such as applications on websites, mobile applications, learning support systems, and the like (Manoharan et al., 2022). In the post-COVID-19 era, the main approach to education is still student-centered learning. Moreover, there must be various forms of learning resource provided for individual students. These resources are meant to help students learn effectively and develop their initiative and creativity, so they can learn from their own experiences and develop necessary skills within the learning environments available (Hong, 2022). The research objectives can be summarized as follows: 1) To Compare the digital technology used to manage learning during the pandemic Covid-19 (New Normal) period and the endemic Covid -19 (Next Normal) period adopted by pre-service teachers; and 2) To develop the landscape of the digital technology used for the instructional management during the New Normal and the Next Normal period adopted by pre-service teachers. The research questions are:

- 1) What are the digital technologies used for the instructional management adopted by pre-service teachers during the COVID-19 pandemic (New Normal) period and the COVID-19 endemic (Next Normal) period?
- 2) What elements constitute the landscape of educational digital technology used for the instructional management adopted by pre-service teachers during the COVID-19 pandemic (New Normal) period and the COVID-19 endemic (Next Normal) period?

2. Literature Review

2.1 Digital Learning Tools

The process in which learners use digital media for learning, included the Internet, corporate networks, computers, satellite broadcasting, audio cassettes, video cassettes, interactive televisions, and CDs. Applications include network-based learning. Computer-based learning in virtual classrooms and digital cooperation learning were the uses of digital tools for online or offline learning activities through wired or wireless networks (Lin, Chen & Liu, 2017; Anttila et al., 2012; Hockly, 2012). Digital tools for learning refers to software or teaching platforms used with computer devices or smart phones that supports the learning process using texts, images, and audio media (Sousa, Cruz, & Martins, 2017) for students can learn more efficiently, faster, more accurately and more clearly and takes less time. The learning style is the combination of learning using technology and students' learning behavior, to achieve the goals of learning and effective learning. There were 5 types of digital tools for learning, according to the nature of uses in teaching activities: teaching and learning management tools; content development tools; website resource tools; social tools; and personal and work development tools (Kongmanus, 2018; Francom et al., 2021). In addition to being tools for learning, they are also tools for developing communication for students to interact. So, students would be more enthusiastic and could take part in exchanging knowledge in both online and real classes. Santos, and Castro (2021) stated that the elements of the application of digital technology in knowledge management include: 1) technological knowledge; 2) pedagogical knowledge 3) content knowledge 4) pedagogical content knowledge 5) technology content knowledge 6) technology pedagogy knowledge 7) technology pedagogy and content knowledge 8) educational technology tools 9) relationship of the adequacy of EdTech tools to the application of TPACK; 10) regression model; and 11) alternative approaches in the implementation of information and communication technology in the classroom.

In the age of the digital economy and society, Thailand harnesses digital technology as a pivotal tool for steering the development of the country. As evidenced in the Thailand Digital Economy and Society Development Plan, B.E. 2559 (2016), one of the key missions is to develop human capital and drive the country towards the era of the digital economy and society (Ministry of Digital Economy and Society, 2016). In the same vein, the Office of the Education Council defined "digital technology" as the use of existing digital tools, devices, and technology, and maximizing the usage of them for bettering communication, operation, and collaboration, or for improving work processes and organizational operating systems. To accomplish the said mission, four steps need to be taken: 1) the usage of digital technology; 2) the understanding of digital technology; 3) the creation of digital technology; and 4) the access to digital technology. In addition, Santos and Castro (2021) stated that the application of digital technology for learning management comprised eleven components: 1) technological knowledge; 2) pedagogical knowledge; 3) content knowledge; 4) pedagogical content knowledge; 5) technology content knowledge; 6) technology and pedagogy knowledge; 7) technology, pedagogy, and content knowledge

(TPACK); 8) educational technology tools; 9) relationship of the adequacy of EdTech tools to the application of TPACK; 10) regression model; and 11) alternative approaches in the implementation of ICT in the classroom.

2.2 Applications for Learning

The application is a computer program for use and facilitation in various fields such as education, communication, entertainment. It is designed and developed to support use for computers, smartphones, tablets, and mobile devices of each system. Operations are called Native Applications. Nowadays, each operating system is more open, so applications that can work on every operating system have been developed, called Hybrid applications and Web applications, which were developed for use through a web browser but were customized on display. Only what is necessary to reduce the processing resources of the device. Makes it load through the web browser and use faster (Promsron et al., 2022). Learning applications, therefore, use the capabilities of technology as tools to help both learners inside and outside class to help them deal with their learning and check their assignments in various subjects. Besides, after learning, feedback can also be sent at once (Bikanga Ada, 2018). Currently, there is an automatic accuracy verification system, including reporting on student progress in learning. Data in the database can also be managed (Syaifudin et al., 2021). Most educational applications can be used on a variety of devices, such as computers, smartphones, and tablets. The applications have interactive capabilities and encourages student participation. With the appropriate design, even complex contents are also presented well. The application will emphasize its design principles and theoretical principles (Curum & Khedo, 2021). Learning applications can be divided into several categories, such as social media applications that are popular with teachers and students, including WhatsApp, Facebook, and YouTube (El-Sayad et al., 2021; Sobaih et al., 2020) found that social media applications, including Facebook, Line, Facebook Messenger, Tiktok, Instagram, Twitter and Pinterest were used in Thailand (Kemp, 2022). Apart from that, there are also other types of applications used for learning, such as applications used for communication, learning management, knowledge storage, content development, evaluation, and etc., which promote learning both inside and outside the classroom.

The application of digital technology in education refers to the harness of the positive potential of digital technology to maximize its usage both inside and outside the classroom. Recently, there have been developments of digital technology tools that can be utilized in the classroom, either for assisting teachers to deliver effective lessons or for reporting the students' progress. Most educational applications are compatible with smartphones and tablets, covering all subject matters—from mathematics to history. They can respond effectively to the users, thereby helping promote the students' engagement in the classroom. Also, learning materials are designed to properly fit mobile or tablet screens, thus enabling the students to break down complicated ideas. Through the application of educational technology, the principles of instructional design are balanced with theories (Curum & Khedo, 2021). Educational applications are divided into several categories. One of these includes social media applications that are popular among teachers and students, including WhatsApp, Facebook, and YouTube (El-Sayad et al., 2021; Sobaih et al., 2020). In Thailand, there has been widespread adoption of social media applications, e.g., Facebook, Line, Facebook Messenger, Tiktok, Instagram, Twitter, and Pinterest respectively (Kemp, 2022). Other types of digital applications that can bolster teaching and learning both inside and outside the classroom include applications for communication, learning management, knowledge bank development, content development, and evaluation.

2.3 New Normal Education

The outbreak of COVID-19 had detrimental effects on education at all levels, causing a switch from traditional to online learning (Tafazoli & Meihami, 2022; Sul-toni & Gunawan, 2023). The new wave of the pandemic gives rise to the "New Normal," an era in which working and learning styles are compelled to be digitalized and learning management is more dependent on technology. Many studies showed that online learning demotivates students and reduces their participation (Alshwiah, 2022; El-Sayad et al., 2021). The best teaching approach to managing online classes is to provide the students with appropriate online content and create a conducive learning environment. Even though the pandemic has had an impact on numerous parts of schools and universities and the interaction between teachers and students is made via mobile phones or computers, learning management still needs to yield benefits for both teachers and students (Nayak et al., 2022). As such, teachers need to be actively engaged in the instructional design that match students' needs. Moreover, recreational activities need to be held either in a traditional way or online. In this regard, teachers may adopt new technology to their classrooms, e.g., learning trough games, flipped classroom, seamless learning, or experience sharing between teachers and students (Peramunugamage et al., 2022; Utami et al., 2022).

2.4 Next Normal Education

In the post-COVID-19 era, learning management has become more and more reliant on the utilization of digital technology. Given previous situations, teachers need to be aware that several learning management system components need to be modified and updated. Teachers must adapt to new working lifestyles by adjusting the ways they think, study, communicate, and behave, according to the dynamic and changing social context, in order to accustom themselves to the education in the Next Normal age (Cahapay, 2020). Guidelines for instructional management are in urgent need of reform to allow students to study in a flexible environment and to increase student participation in the classroom. Flexibility in learning management entails responsiveness to diverse contexts and learning needs, e.g., social distancing and student's readiness to learn. Having taken these factors into consideration, teachers will be able to come up with appropriate teaching methods, such as one-to-one instruction, online learning, hybrid learning, and HyFlex. All these teaching methods are integral parts of a digital curriculum and are based heavily on the student-centered approach which enables students to have more interaction with lessons, teachers, and classmates (Bozkurt & Sharma, 2020). Learning management should focus on students' engagement in the design or development of classroom activities and assessments. Students can help develop online activities for both conventional and online classrooms by using digital technology, such as application websites, mobile applications, learning support systems, and so on (Manoharan et al., 2022). The main approach to learning management in the Next Normal era is still student-centered learning. Moreover, there must be various forms of learning support provided for individual students. These supports are intended to assist students to learn successfully and enhance their creativity and initiatives so that they can gain experiences and necessary skills on their own within the provided learning environments (Hong, 2022).

2.5 Digital Transformation in Education Framework

Regarding the idea for developing teachers' digital skills, the Office of the Basic Education Commission of Thailand (2020) discussed the importance of knowing how to use and understand digital technology and digital skills in a create way, as follows: 1) *Know how to use* is the ability to use the digital technology fluently, knowing the techniques for using computers and the internet basics well such as the ability to use various programs or the ability to use the internet; 2) *Understand* is the ability to understand the relevant context and evaluate digital media, realizing the importance of the content of evaluation; 3) *Creativity* is the ability to create content and be effective in communication. using a variety of tools, including the awareness of the necessity and importance of digital media to help learning. The Office of the Basic Education Commission (2020) defined digital skills as the skills in using tools, equipment, and digital technology that are available today such as computers, phones, tablets, computer programs and online media. Let's use it to get the most benefits in operational communication and collaboration or used to develop work processes or work systems in the organization to be modern and efficient (Office of the Civil Service Commission, 2019) consisting of 9 areas, as follows: 1) computer use; 2) internet use; 3) safety use basic skills for work; 4) using a word processing program; 5) using a spreadsheet program; 6) using a presentation program; 7) collaborating online; 8) using programs to create digital media; 9) using digital for security. Pre-service teachers can get ready and keep pace with the change in learning management in terms of digital technology, both in real and virtual classrooms, through the learning process with digital media for learning, including texts, images, sound, and interaction. According to the survey of tools that help in learning in 2022 (Manoharan et al., 2022), applications with digital media that can be used as native, Hybrid and web ones the can be classified, as follows: 1) websites and applications used for classroom communication; 2) websites and applications for assignment submission; 3) learning management systems; 4) digital media resources; 5) online assessment tools; and 6) teaching practices and tools to be further used, focusing on education as a guideline. On digital media for instructional management both in class and out of class.

A synthesis of the literature reviews regarding empowering practice teachers for the digital transformation of education from the New Normal period to the Next Normal period is presented in Table 1.

Table 1. Synthesis of the literature review

Literature Review	Meanings and References
Digital learning tools	Digital learning tools are critical for students in this era. They are characterized by software programs or applications, online cloud computing, Web 2.0, or other platforms that work with portable and wireless gadgets, such as tablets and smartphones. Digital Learning refers to the learning facilitated by digital technology (e.g., computer programs, educational apps, and online media) and digital devices and tools (e.g., smartphones, tablets, and computers) that support students' learning and enable them to learn faster and more effectively. (Al-Salman et al., 2022; Musa et al., 2020; Tüchler, 2021)
Applications for learning	Applications that enable students to maximize the usage of technology both inside and outside the classroom and assist teachers in tracking the data relevant to students' progress so that they can concentrate solely on their teaching. (Al-Mashhadani & Al-Rawe, 2018; Oliveira et al., 2021)
Technology-based learning	Laying the foundation of learning by utilizing information technology that corresponds to students' interests and abilities and promotes problem-solving skills, and self-directed learning skills. In the classroom, essential IT skills are emphasized, with an emphasis on the authentic learning approach. The instruction is aimed at producing students who can attain happiness in their lives, exploiting information technology, and keeping learning all the time. The knowledge acquired should be sufficient and relevant to every borderless society, IT society, and competitive society and should improve performance competency and the caliber of information collection and processing. (Anupan & Chimmalee, 2022; Bikanga Ada, 2018; Li et al., 2013; Qiao et al., 2021; Seta et al., 2022; Wang et al., 2021).
Pandemic COVID-19 (New Normal)	New lifestyles during the COVID-19 pandemic. (Al-Salman et al., 2022; Atlam et al., 2022; bin Naeem & Kamel Boulos, 2021; Chen et al., 2022; Chettri et al., 2020; Hanik, 2020; Hassell et al., 2021; Martín & Martín, 2021; Musa et al., 2020; Najwa et al., 2021; Nuanmeesri, 2021; Padmavathy et al., 2021; Qiao et al., 2021; Rahman, 2021; Shah et al., 2020; Subramanian et al., 2022; Zawacki-Richter, 2021)
Endemic COVID-19 (Next Normal)	Turning the pandemic into the endemic in the post-COVID-19 era. (Alawajee, 2021; Al-Salman et al., 2022; Atlam et al., 2022; bin Naeem & Kamel Boulos, 2021; Chen et al., 2022; Chettri et al., 2020; Haider & Al-Salman, 2020; Hanik, 2020; Hassell et al., 2021; König et al., 2020; Martín & Martín, 2021; Musa et al., 2020; Najwa et al., 2021; Nuanmeesri, 2021; Padmavathy et al., 2021; Qiao et al., 2021; Rahman, 2021; Shah et al., 2020; Sorkin et al., 2021; Subramanian et al., 2022; Tüchler, 2021; Vijayan, 2021; Zawacki-Richter, 2021)

3. Method

The study's background and related literature analysis led to the formulation of the following research questions: (a) what are the digital technologies used for the instructional management adopted by pre-service teachers during the COVID-19 pandemic (New Normal) period and the endemic COVID-19 (Next Normal) period?; and (b) what elements constitute the landscape of the educational digital technology used for the instructional management adopted by pre-service teachers during the COVID-19 pandemic (New Normal) period and the endemic COVID-19 (Next Normal) period?

A simple random sampling method was employed to select the sample from 164,231 undergraduate student teachers in semester 2 Academic Year 2022, at higher education institute in Thailand (Ministry of Higher Education, Science, Research and Innovation, 2022). The sample consisted of 400 participants who were student teachers from the Faculties of Education eight universities in all regions of Thailand. These student teachers were serving their teaching internship at primary and secondary schools as pre-service teachers. The university included (a) Naresuan University and Nakhon Sawan Rajabhat University in the North region; (b) Phuket Rajabhat University and Thaksin University in the South region; (c) Suan Dusit University and King Mongkut's University of Technology North Bangkok in the Central and Eastern regions; and (d) Khon Kaen University and Nakhon Phanom University in the Northeast region. The Krejcie and Morgan Table (1970) was used for the determination of the sample size. The independent variables included digital technology tools used for instructional management during the New Normal period and those used in the Next Normal period. The outcomes of using digital technology for instructional management during the specified time periods were the dependent variables.

The research tool used to collect the data was an online questionnaire. Initially, the online questionnaire requesting data collection was approved by an administrative member of the Faculty of Education of Nakhon Phanom University. Then the online questionnaire was distributed to the student teachers working at different educational institutions, taking approximately three weeks to complete the collection stage. Another research tool included a form for document synthesis. It was a form that was used to record the comparative information about the digital technology used by the student teachers during the New Normal and the Next Normal period.

With respect to the degree of agreement, the 5 Point Likert Scale was utilized, including: ‘strongly agree’ (average: 4.51–5.00), ‘agree’ (average: 3.51–4.50), ‘nether agree nor disagree’ (average: 2.51–3.50), ‘disagree’ (average: 1.51–2.50), and ‘strongly disagree’ (average: 1.00–1.50). The research tool passed the index of item-objective congruence (IOC) examination, and the verification of content was conducted by three experts. It was found that all IOC candidates achieved results of the rate of 0.85.

Regarding the quantitative data analysis, the collected data were analyzed statistically by using the mean, and standard deviation. The data obtained were then analyzed and concluded as the digital landscape.

4. Results

Among the 400 pre-service teachers 24% were male, 76% were female, with in average age of 21 years. 21%, 24%, 34% and 21% of the teachers were from the university of the North region, the South region, the Central and Eastern regions, and the Northeast region, respectively. All of them were studying in the fourth year, majoring in mathematics, science education, social studies, English, Thai, computer education, music education, primary education, and early childhood education.

The digital technology and its landscape that the pre-service teachers used for the instructional management during the Covid-19 pandemic (New Normal) period and the Covid-19 endemic (Next Normal) period were categorized into two sections according to the two major research questions.

4.1 Digital Technology Used for the Instructional Management by the Pre-Service Teachers During the New Normal and the Next Normal Period

The digital technology used for the instructional management during the New Normal and the Next Normal period and for the development of understanding of the adoption of the digital technology in education consists of: (a) websites and applications used to communicate with students; (b) websites and applications used to send and receive students' work; (c) learning management systems, (d) digital media libraries; (e) online measurement and evaluation tools; and (f) teaching guidelines and tools. The relevant findings are presented below.

1) Websites and applications used to communicate with students.

Figure 1 displays the use of the websites and applications that the pre-service teachers used to communicate with their students during the New Normal and the Next Normal eras. In the former era, it was found that most pre-service teachers used Google Meet and Line, followed by YouTube and Facebook Messenger. In the latter era, most of them used Line, Facebook Messenger, Facebook, and Google Classroom.

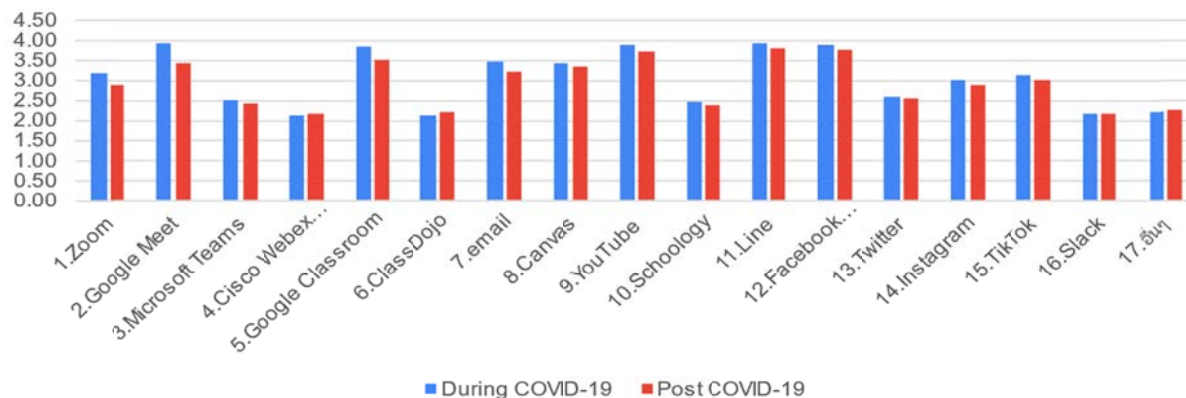


Figure 1. Websites and applications used for classroom communication

Table 2. Levels of agreement with websites and applications for classroom communication

Websites and Applications for Classroom Communication	Levels of Agreement			
	COVID-19 Pandemic (New Normal)		COVID-19 Endemic (Next Normal)	
	Mean	S.D.	Mean	S.D.
1. Zoom	3.19	1.29	2.89	1.29
2. Google Meet	3.91	1.19	3.40	1.26
3. Microsoft Teams	2.49	1.18	2.44	1.25
4. Cisco Webex Meetings	2.13	1.13	2.16	1.16
5. Google Classroom	3.82	1.26	3.49	1.32
6. ClassDojo	2.15	1.12	2.20	1.17
7. E-mail	3.45	1.31	3.21	1.33
8. Canvas	3.41	1.34	3.32	1.37
9. YouTube	3.89	1.24	3.71	1.30
10. Schoology	2.45	1.26	2.36	1.25
11. Line	3.91	1.19	3.81	1.24
12. Facebook Messenger	3.86	1.22	3.75	1.30
13. Twitter	2.59	1.36	2.54	1.37
14. Instagram	3.02	1.48	2.87	1.47
15. TikTok	3.15	1.48	3.02	1.48
16. Slack	2.18	1.19	2.16	1.24
17. Others	2.23	1.31	2.25	1.30

Table 2 illustrates the respondents’ agreement with the use of the websites and applications for communicating with their students. During the COVID-19 pandemic (New Normal), it was found that most of the respondents used Google Meet and Line (M = 3.91, S.D. = 1.19), followed by YouTube (M = 3.89, S.D. = 1.24), and Facebook Messenger (M = 3.86, S.D. = 1.22). However, in the COVID-19 endemic (Next Normal) most of them used Line (M = 3.81, S.D. = 1.24), followed by Facebook Messenger (M = 3.75, S.D. = 1.30), YouTube (M = 3.71, S.D. = 1.30) and Google classroom (M = 3.49, S.D. = 1.32).

2) Websites and applications used for students’ assignment submission.

Figure 2 shows websites and applications for assignment submission. During the New Normal period, most of the pre-service teachers used Google Classroom, followed by Line, Facebook, and electronic mails. Similarly, during the Next Normal period Line was used most frequently, followed by Google Classroom, Facebook, and electronic mails.

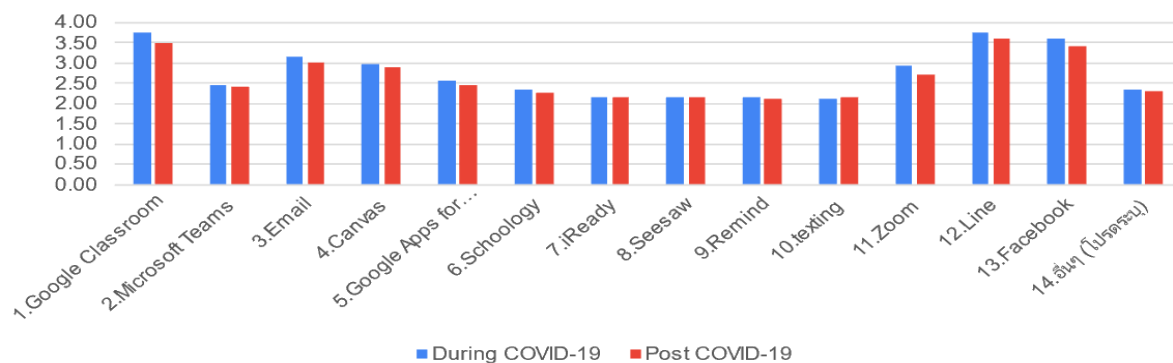


Figure 2. Websites and applications for assignment submission

Table 3. Levels of agreement with websites and applications for assignment submission

Websites and Applications for Assignment Submission	Levels of Agreement			
	COVID-19 Pandemic (New Normal)		COVID-19 Endemic (Next Normal)	
	Mean	S.D.	Mean	S.D.
1. Google Classroom	3.74	1.26	3.48	1.33
2. Microsoft Teams	2.44	1.25	2.42	1.26
3. E-mail	3.16	1.33	3.01	1.35
4. Canvas	2.95	1.40	2.90	1.39
5. Google Apps for Education	2.57	1.32	2.45	1.28
6. Schoology	2.35	1.25	2.28	1.23
7. iReady	2.16	1.17	2.17	1.19
8. Seesaw	2.14	1.16	2.15	1.18
9. Remind	2.15	1.16	2.13	1.17
10. texting	2.12	1.13	2.16	1.19
11. Zoom	2.93	1.31	2.72	1.34
12. Line	3.74	1.18	3.60	1.24
13. Facebook	3.58	1.27	3.42	1.37
14. Others (Please specify.)	2.32	1.32	2.31	1.35

Table 3 displays the respondents’ agreement with the use of the websites and applications for communicating with their students. During the COVID-19 pandemic (New Normal) period, it was found that the majority of the pre-service teachers utilized Google classroom and Line (M = 3.74, S.D. = 1.18), followed by Facebook Messenger (M = 3.86, S.D. = 1.22) and E-mail (M = 3.16, S.D. = 1.33). In the COVID-19 endemic (Next Normal) period, they used Line (M = 3.60, S.D. = 1.24), followed by Google classroom (M = 3.48, S.D. = 1.33), Facebook Messenger (M = 3.42, S.D. = 1.37), and YouTube (M = 3.01, S.D. = 1.35).

3) Learning management systems

Figure 3 illustrates the application of digital technology for learning management. During the COVID-19 pandemic (New Normal) period, it was found that most of the pre-service teachers used Google classroom, followed by MS Teams, Moodle, and ThaiMOOC. Likewise, in COVID-19 endemic (Next Normal) period, most of them used Google classroom, followed by MS Teams, Moodle, Edmodo, and ThaiMOOC.

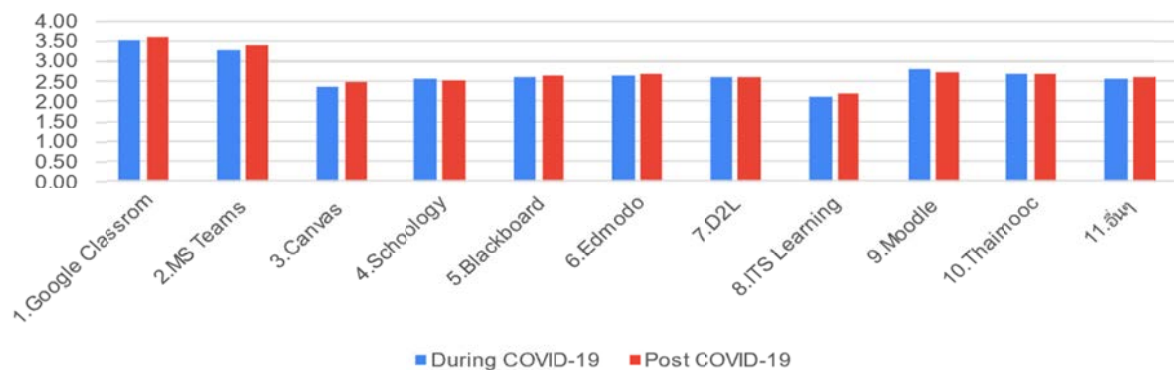


Figure 3. Learning management systems

Table 4. Levels of agreement with learning management systems

Learning Management Systems	Levels of Agreement			
	COVID-19 Pandemic (New Normal)		COVID-19 Endemic (Next Normal)	
	Mean	S.D.	Mean	S.D.
1. Google Classroom	3.52	1.48	3.59	1.50
2. MS Teams	3.28	1.52	3.40	1.45
3. Canvas	2.35	1.13	2.49	1.47
4. Schoology	2.58	1.37	2.53	1.54
5. Blackboard	2.62	1.48	2.65	1.49
6. Edmodo	2.65	1.44	2.71	1.57
7. D2L	2.61	1.26	2.61	1.52
8. ITS Learning	2.12	1.11	2.20	1.43
9. Moodle	2.82	1.55	2.73	1.52
10. Thaimooc	2.68	1.54	2.71	1.57
11. Others	2.58	1.47	2.60	1.53

Table 4 shows the details of the pre-service teachers’ agreement with the use of the learning management systems that employed digital technology. During the COVID-19 pandemic (New Normal) period, it was found that most of them used Google classroom (M = 3.52, S.D. = 1.48), followed by MS Teams (M = 3.28, S.D. = 1.52), Moodle (M = 3.82, S.D. = 1.55), and ThaiMOOC (M = 2.68, S.D. = 1.54). In the COVID-19 endemic (Next Normal) period, most of them used Google classroom (M = 3.59, S.D. = 1.50), followed by MS Teams (M = 3.40, S.D. = 1.45), Moodle (M = 2.73, S.D. = 1.52), Edmodo and ThaiMOOC (M = 2.71, S.D. = 1.57).

4) Digital media libraries

Figure 4 illustrates the use of the digital media resources for the instructional management. During the COVID-19 pandemic (New Normal) period, it was found that most of the pre-service teachers used YouTube, followed by Trueplookpanya, Distance Learning Television (DLTV), and SciMath Knowledge Bank by the Institute for the Promotion of Teaching Science and Technology (IPST). During the COVID-19 endemic (Next Normal) period, most of them used YouTube, followed by Trueplookpanya, OBEC Content Center, and DLTV.

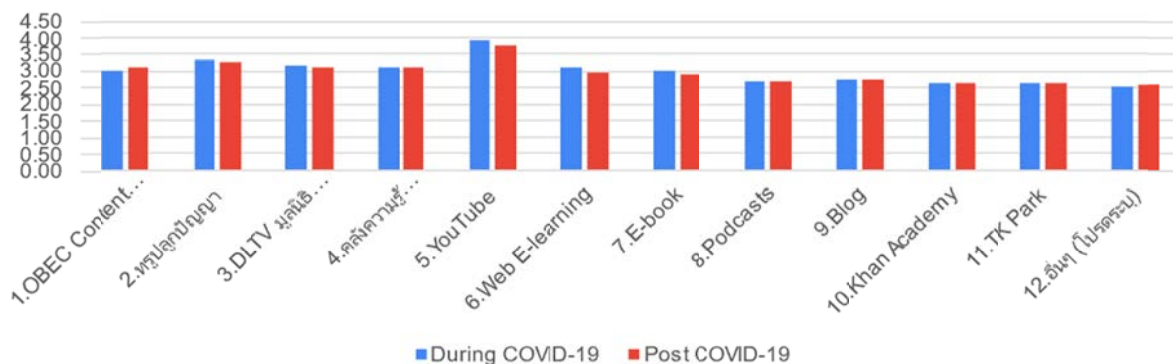


Figure 4. Digital media resources

Table 5. Levels of agreement with digital media resources

Digital Media Resources	Levels of Agreement			
	COVID-19 Pandemic (New Normal)		COVID-19 Endemic (Next Normal)	
	Mean	S.D.	Mean	S.D.
1.OBEC Content Center	3.03	1.25	3.12	1.20
2.Trueplookpanya	3.35	1.15	3.27	1.19
3.Distance Learning Television (DLTV)	3.19	1.24	3.11	1.29
4. SciMath Knowledge Bank by IPST	3.14	1.23	3.10	1.26
5.YouTube	3.92	1.17	3.76	1.21
6.Web E-learning	3.11	1.23	2.95	1.25
7.E-book	3.02	1.24	2.90	1.26
8.Podcasts	2.71	1.25	2.71	1.29
9.Blog	2.78	1.22	2.75	1.24
10.Khan Academy	2.66	1.26	2.66	1.26
11.TK Park	2.65	1.21	2.64	1.28
12.Others (Please specify.)	2.56	1.34	2.59	1.34

Table 5 provides the details of the pre-service teachers’ agreement with the use of the digital media resources. During the COVID-19 pandemic (New Normal) period, it was found that most of them used YouTube (M = 3.92, S.D. = 1.17), followed by Trueplookpanya (M = 3.35, S.D. = 1.15), DLTV (M = 3.19, S.D. = 1.24), and SciMath Knowledge Bank by IPST (M = 3.14, S.D. = 1.23). In the COVID-19 endemic (Next Normal) period, they used YouTube (M = 3.76, S.D. = 1.21), followed by Trueplookpanya (M = 3.27, S.D. = 1.19), OBEC Content Center (M = 3.12, S.D. = 1.20), and DLTV (M = 3.11, S.D. = 1.29).

5) Online measurement and evaluation tools

Figure 5 shows the use of the online assessment tools by the pre-service teachers during the New Normal and the Next Normal periods. During the COVID-19 pandemic (New Normal) period, it was found that most of them used Google Forms, followed by Kahoot, Quizizz, and Microsoft Forms respectively. In the COVID-19 endemic (Next Normal) period, the online assessment tools that were utilized most included Google Forms, Kahoot, Quizizz, Microsoft Forms.

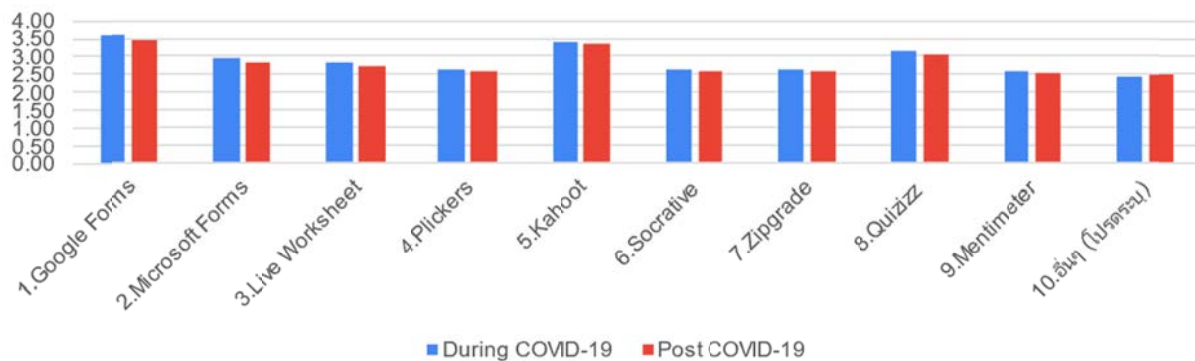


Figure 5. Online assessment tools

Table 6. Levels of agreement with online assessment tools

Online Assessment Tools	Levels of Agreement			
	COVID-19 Pandemic (New Normal)		COVID-19 Endemic (Next Normal)	
	Mean	S.D.	Mean	S.D.
1.Google Forms	3.62	1.18	3.46	1.24
2.Microsoft Forms	2.95	1.28	2.87	1.31
3.Live Worksheet	2.86	1.27	2.76	1.27
4.Plickers	2.65	1.20	2.61	1.25
5.Kahoot	3.39	1.27	3.33	1.34
6.Socrative	2.65	1.22	2.60	1.25
7.Zipgrade	2.67	1.26	2.62	1.27
8.Quizzz	3.17	1.28	3.05	1.29
9.Mentimeter	2.60	1.25	2.56	1.26
10.Others (Please specify.)	2.47	1.29	2.50	1.32

Table 6 illustrates the pre-service teachers’ agreement with the use of the online assessment tools during the New Normal and the Next Normal periods. During the COVID-19 pandemic (New Normal) period, it was found that most of them used Google Forms (M = 3.62, S.D. = 1.18), followed by Kahoot (M = 3.39, S.D. = 1.27), Quizizz (M = 3.17, S.D. = 1.28), and Microsoft Forms (M = 2.95, S.D. = 1.28).

6) Teaching guidelines and tools

Figure 6 displays the teaching practice and the tools that will be continually used in the future. During the COVID-19 pandemic (New Normal) period, it was found that many pre-service teachers used videos, followed by online general activities, and attendance check. In the COVID-19 endemic (Next Normal) period, most of the teaching practices and the tools used included online assignments, followed by online class announcements and updates, online student supports, and grade books.

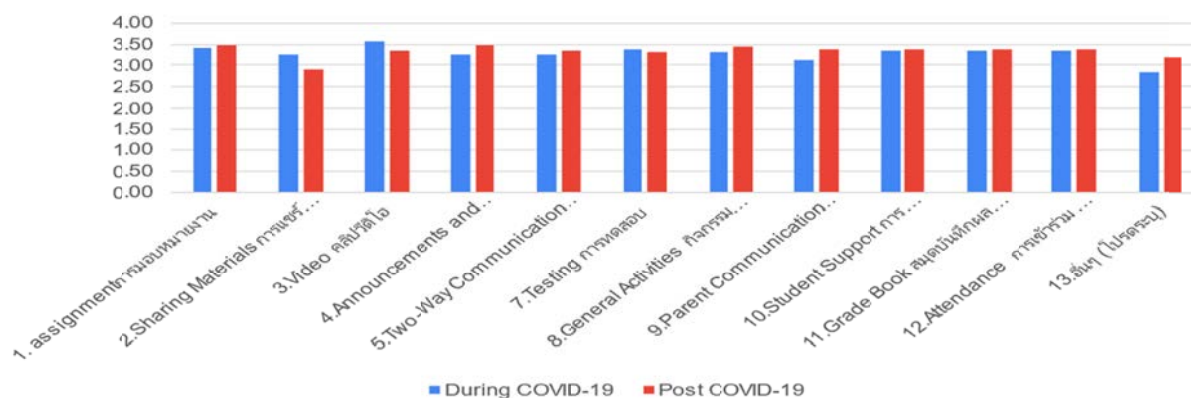


Figure 6. Teaching practices and tools to be further used

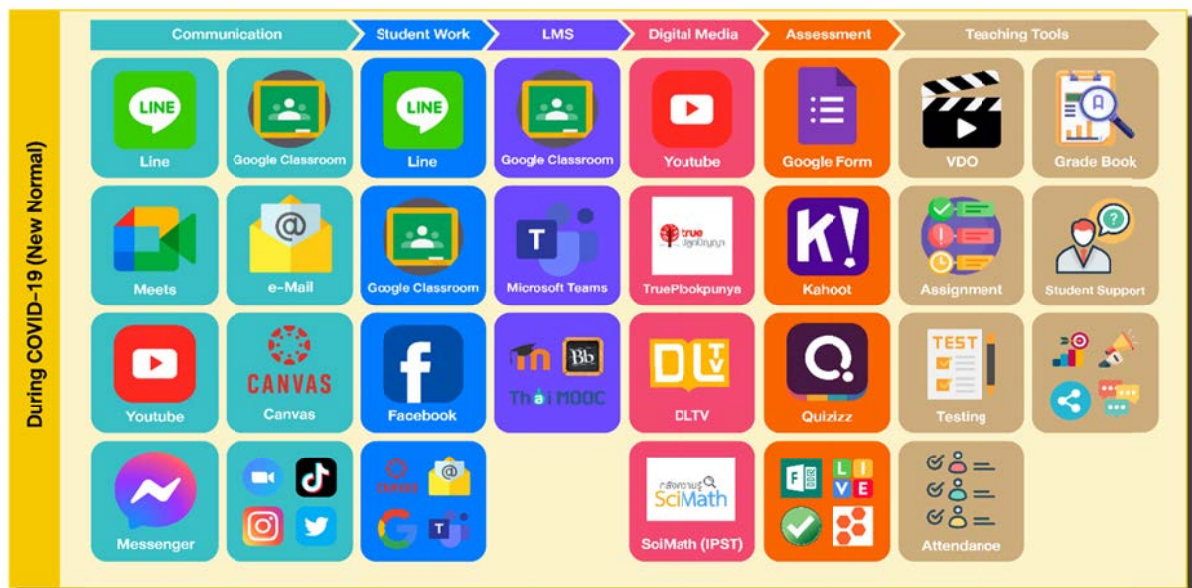
Table 7. Level of agreement with teaching practices and tools to be further used

Teaching Practices and Tools that Will Continue to Be Used	Levels of Agreement			
	COVID-19 Pandemic (New Normal)		COVID-19 Endemic (Next Normal)	
	Mean	S.D.	Mean	S.D.
1. Online Assignments	3.40	1.14	3.47	1.15
2. Sharing Materials	3.26	1.24	2.91	1.39
3. Videos	3.57	1.18	3.34	1.17
4. Online Announcements and Updates	3.26	1.13	3.46	1.18
5. Two-Way Communication	3.25	1.23	3.35	1.16
6. Online Testing	3.39	1.12	3.31	1.19
7. Online General Activities	3.31	1.14	3.43	1.13
8. Parent Communication	3.12	1.20	3.39	1.20
9. Online Student Supports	3.33	1.19	3.38	1.22
10. Online Grade Books	3.33	1.20	3.38	1.22
11. Online Attendance Check	3.34	1.20	3.37	1.23
12. Others (Please specify)	2.85	1.37	3.20	1.21

Table 7 gives the details of the pre-service teachers' agreement with the use of the teaching practice and tools that will be further used in the future. During the COVID-19 pandemic (New Normal) period, it was found that most of the pre-service teachers used videos (M=3.57, S.D.=1.18), followed by giving assignments (M = 3.40, S.D. = 1.14), using general activities (M = 3.39, S.D. = 1.12), and checking attendance (M = 3.34, S.D. = 1.20). The majority of them in the COVID-19 endemic (Next Normal) period used online assignments (M = 3.47, S.D. = 1.15), followed by online announcements and updates (M = 3.43, S.D. = 1.13), online student supports and grade books (M = 3.38, S.D. = 1.22).

4.2 Landscape of Educational Digital Technology Used to Manage Learning Adopted by Pre-Service Teachers During the New Normal and the Next Normal

From the information above, as shown in Tables 2–7, the digital technology landscape used for organizing the instruction during the Covid-19 pandemic and Covid-19 endemic period for pre-service teachers, consists of 6 parts: 1) websites and applications used to communicate with students; 2) websites and applications used for sending and receiving student work; 3) learning management systems; 4) digital media libraries; 5) online measurement and evaluation tools; and 6) teaching methods. The tools to be used in the future are shown in Figure 7 with compares the use of the digital technology in the New Normal and the Next Normal period.



(a) digital technology used for instruction management during the New Normal period



(b) digital technology used for instruction management during the Next Normal period

Figure 7. Comparison of digital technology used for instructional management in the New Normal Period (a) and in the Next Normal Period (b)

5. Discussion

Digital technology utilized by the pre-service teachers during the New Normal and the Next Normal periods can be divided into six categories: 1) websites and applications for classroom communication; 2) websites and applications for assignment submission; 3) learning management systems; 4) digital media resources; 5) online assessment tools; and 6) teaching practice and tools that will be continually used in the future. Regarding the study on pre-service teachers working in schools over a one-year period, the comparison between the New Normal and the Next Normal periods showed that there was a slight change in the application of digital technology, as illustrated in Figure 7. This might be attributed to the fact that during the Next Normal period, schools were able to adjust themselves to tackle the continuing spread of the Covid-19 pandemic. To illustrate, teaching methods and learning strategies were improved, including technological devices and infrastructures (e.g., mobile phone and internet signals). More classroom applications were developed to respond to the needs of teachers and students. It is worth noting that these applications played a key role in fostering students' motivation and collaboration, increasing their performance efficiency, and inspiring creativity (Malik et al., 2020). The findings also revealed that the pre-service teachers' learning and use of new websites and applications in their classrooms, which subsequently resulted in the adjustment of school policies, became more flexible.

Regarding the digital technology landscape for learning management in the New Normal and the Next Normal periods, as illustrated in Figure 7, the digital technology used during the New Normal period can be split into six categories: 1) websites and applications for classroom communication and digital technology used in learning management—Line, Meets, YouTube, Messenger, Google Classroom, Canvas, and electronic mails; 2) websites and applications for assignment submission—Line, Google Classroom, Facebook, Canvas, and electronic mails; 3) learning management systems—Google Classroom, Microsoft Teams, and Thai MOOC; 4) digital media resources—YouTube, True, DLTV, and SciMath by IPST; 5) online assessment tools—Google Form, Kahoot, and Quizizz; and 6) teaching practice and tools to be used in the future—videos, online assignment, online testing, and attendance check.

With respect to the Next Normal period, as shown in Figure 7, digital technology used in learning management can be divided into six categories, including: 1) websites and applications used for classroom communication, namely, Line, Google Classroom, Facebook, Tiktok, and electronic mails; 2) websites and applications for assignment submission, namely Line, Google Classroom, Facebook, Canvas, Microsoft Teams, and electronic mails; 3) learning management systems, namely Google Classroom, Microsoft Teams, and Thai MOOC; 4) digital

media resources, namely YouTube, True, OBEC, DLTV, and SciMath by IPST; 5) online assessment tools, namely online assignment, videos, online testing, and general activities; and 6) teaching practice and tools to be used in the future, namely videos, online assignments, tests, general activities, student supports, grade books, and attendance check.

To become digital citizens who are ready for the self-learning society and collaborative learning, which are part of the skills and competencies in the 21st century, students need to harness technology in order to enhance their own learning. Digital technology tools used in learning management during the New Normal and the Next Normal periods are regarded as guidelines for pre-service teachers. To reiterate, the purposes of the study were: 1) to compare digital technology used to conduct teaching during the COVID-19 pandemic (the “New Normal”) period and the endemic COVID-19 (the “Next Normal”) period by the pre-service teachers working at educational institutions; and 2) to develop the digital technology landscape for education in the New Normal and the Next Normal periods. The findings revealed six components of learning management in the aforesaid periods: 1) websites and applications for classroom communication; 2) websites and applications for assignment submission; 3) learning management systems; 4) digital media resources; 5) online assessment tools; and 6) teaching practice and tools to be used in the future.

In relation to the digital technology adopted in the New Normal period, the findings revealed six components as follows: 1) websites and applications for classroom communication (e.g., Line, Meets, YouTube, Messenger, Google Classroom, Canvas, and electronic mails); 2) websites and applications for assignment submission, including Line, Google Classroom, Facebook, e-mail, Canvas, and electronic mails; 3) learning management systems (for instance, Google Classroom, Microsoft Teams, and Thai MOOC); 4) digital media resources (e.g., YouTube, True, DLTV, and SciMath by IPST); 5) online assessment tools (e.g., Google Form, Kahoot); and 6) teaching practices and tools to be used in the future, including videos, online assignment, testing, and attendance check. With respect to the digital technology that were applied by the practice teachers during the Next Normal period, the findings revealed 6 components, including: 1) websites and applications for classroom communication (e.g., Line, Google Classroom, Facebook, Tiktok, and electronic mails); 2) websites and applications for assignment submission (e.g., Line, Google classroom, Facebook, Canvas, Microsoft Teams, and electronic mails); 3) learning management systems (e.g., Google Classroom, Microsoft Teams, and Thai MOOC); 4) digital media resources (e.g., YouTube, True, OBEC, DLTV, and SciMath by IPST); 5) online assessment tools (e.g., Google Form, Kahoot, Quizizz, and LiveWorksheet); and 6) teaching practices and tools to be used in the future (e.g., online assignment, videos, online tests, general activities, student supports, grade books, and attendance check).

6. Conclusion

Amidst the educational crisis that demanded the closure of schools and universities due to COVID-19, there was a dramatic movement toward the application of digital technology as a means for instruction. As a result, pre-service teachers have been confronted with two critical periods, the New Normal and the Next Normal ones. This led to differences in terms of the digital technology used for the instruction management. The digital tools adopted by pre-service teachers were grouped into the digital landscape, which comprises a wide array of categories. The findings of this study shed light on the significance and necessity of the digital tools that were used for the instructional management during and after the closure of educational institutions. Despite the reopening of most institutions early this year, schools and universities still need to be equipped with digital technology. In the worst-case scenario, if the pandemic is not completely over and schools and universities are ordered to be closed again, digital technology will assist in enabling students to never stop learning.

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Authors’ contributions

W.S., S.D., P.N., J.J., V.S., and N.T. contributed to the design and implementation of the research, Literature review, conceptualization, methodology, data analysis. W.S and J.J. review-editing and writing, original manuscript preparation. All authors have read and approved the published on the final version of the article.

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Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Obtained.

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The Publication Ethics Committee of the Canadian Center of Science and Education.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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