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Competency levels and influential factors of college students' mobile learning readiness in Thailand

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Abstract

One of the key successes of learning through mobile technology comes from the competencies of learners. This study aimed to investigate the overall competency levels of mobile learning readiness and four influential factors (connectivist learners, technology readiness, self-directed learning, and netiquette) that may impact college students' mobile learning readiness in Thailand. The surveys were given to 583 Thai college students who came from various fields such as Social Science, Agriculture, Engineering and Computer Science, and Science. Descriptive statistical procedures were used to generate overall mobile learning readiness and the confirmatory factor analysis was used to determine whether the competencies of connectivist learners, technology readiness, self-directed learning, and netiquette influence the mobile learning readiness of college students in Thailand. The results showed that overall mobile learning readiness among Thai college students was at a high level in which learners' competency in technology readiness was the most influential factor related to their mobile learning readiness, followed by the competencies of self-directed learning, netiquette, and connectivist learners. The results of this study could provide useful guidance for instructors in designing effective instruction, activities, and learning materials that encourage learners to be successful in the mobile learning environment. The future study may explore other related factors such as learners' cultural backgrounds, educational systems, or government supports that may influence mobile learning readiness among learners in higher education in different countries.

Keywords: Connectivism, Mobile learning, Netiquette self-directed learning, Technology readiness

Introduction

Advancements in technologies have changed the process of learning. The popular use of mobile technologies, especially for learning within an online environment becomes an approach for encouraging students from various backgrounds, learning styles, and interests to have further access to an education setting. Iraki (2015) stated that mobile technology is the appropriate tool for facilitating individual access to learning anytime and anywhere, which is the way to promote equity and equality among learners.

The popular use of mobile technology for supporting learning creates a new concept of learning, which is called "mobile learning." It refers to approaches where teaching and learning content is communicated and transferred through mobile technologies (Mehdipour & Zerehkafi, 2013). It is a learning way that allows learners to perceive flexibility in terms of their learning time and location using mobile devices (Zhang & Zhang, 2023). It is the learning that takes place in a multifaceted context through social and content interactions by implementing personal electronic devices (Berge & Muilenburg, 2013). In addition, Ismail et al. (2016) indicated that mobile learning is suitable for learning within higher education because learners can access the tools and have abilities to control their learning. The most important advantage of learning through mobile technology is providing time and location-independent learning opportunities (Rysbayeva et al., 2022). It increases learning accessibility, reduces learning costs, and promotes lifelong learning (Ahmad et al., 2021) because learners can access and exchange new information without limitations of time and location (Brown, 2005) and they do not need to travel to institutions for learning (Elias, 2011).

Besides the quality of mobile technology, learning competence is also the key to successful mobile learning (Yu et al., 2015). Keskin and Metcalf (2011) supported the idea that connectivism is one of the significant theories in mobile education and that connectivist learners are suitable for learning through mobile technology. According to Siemens (2005), connectivist learners view learning as a network phenomenon influenced by technology and socialization. Connectivist learners believe that learning is a process of connecting diverse information, sources, and opinions in which their important tasks are to find those connections through the use of various technologies and apply skills for learning. In addition, Barnes (2014) supported that most of the learners in the digital age have knowledge and abilities as connectivist learners in which fast communications and information access are important aspects of being successful learners.

Technology has become the main learning tool for learners in this century, especially for learners who are digital natives and use technology in all aspects of their lives (Prensky, 2001). Therefore, mobile learners must have competencies of technologies that include sufficient skills, knowledge, and attitudes in using those technology tools to support their learning within a mobile learning environment. Geng et al. (2019) also supported that technology readiness is a critical dimension that is connected with students' learning within the online environment. Technology readiness refers to the learner's propensity to embrace new technologies for accomplishing goals in learning (Parasuraman, 2000).

Self-directed learning is another important skill for online learners. It refers to learners' abilities to control their own learning which would lead them to achieve learning goals. Lin et al. (2016) explained that high responsibility and learning awareness are important abilities of self-directed learning that encourage learners to be successful in mobile learning. Besides those abilities, competencies of netiquette are necessary for encouraging learners to be successful digital learners (Al-Khatib, 2023).

Netiquette refers to recommended online practices that include individuals' knowledge, attitudes, and abilities in recognizing appropriate ways and using the proper tools for successful online communication (DeJong, 2014). In terms of learning, netiquette has become part of digital literacy, and it is in training demanded for learners nowadays

(Reis et al., 2019; Soler-Costa et al., 2021). Arouri and Hamaidi (2017) supported that netiquette increases the quality of online education because it encourages learners to create effective communication that keeps problems or negative learning issues away, such as avoiding using rude words, asking questions that can create conflicts, sharing others' personal information, or engaging in cyberbullying (Kumazaki et al., 2011). Gupta et al. (2022) stated that online learning problems are mostly caused by the unethical use of informational technology resources for communication. Therefore, knowledge regarding technology ethics, plagiarism, and privacy is needed for learning in digital education, including mobile learning (Iraki, 2015).

Termirkulova (2023) stated that the COVID-19 pandemic has dramatically transformed traditional education into distance learning and its impact created a high demand for teachers and students to integrate and use information communication technology for teaching and learning content, access materials, and participate in learning activities, especially mobile devices. In addition, Rysbayeva et al. (2022) supported that mobile devices facilitate the use of technology that provides further learning opportunities beyond traditional education approaches, and it made the use of mobile tools an important requirement for all learners nowadays. Therefore, during the COVID-19 pandemic. mobile learning is highly recommended as a substitute for face-to-face learning because of its flexibility meets the various needs of learners (Kashive & Phanshikar, 2023) and provides a convenient and personalized approach to learners (Wijayanto et al., 2023),

The use of mobile devices by higher education students has grown in the last few years (Global Market Insight, 2019). Mobile learning has become one of the common online learning approaches during the pandemic. Pham and Truong (2023) supported many research studies that confirmed the dominance of higher education as the most usual setting in mobile learning research because learners in higher education have their own mobile technologies and have sufficient skills and knowledge to use those technologies to support learning. Corbeil and Valdes-Corbeil (2007) stated that mobile learning readiness among learners is essential prior to the adoption of mobile learning which includes abilities, skills, and attitudes that encourage learners to achieve the goals of mobile learning courses. It has a significant impact on the adoption and implementation of mobile learning (Bakhsh et al., 2015). Furthermore, Alsharida et al. (2021) explained that there are many studies paid attention to exploring mobile learning readiness through the Technology Acceptance Model in which those results showed that positive attitudes, perceived ease of use, and perceived usefulness impact mobile learning acceptance (Abu-AlSondos, et al., 2023; Ebadi & Raygan, 2023) and mobile learning intention among individuals (Khlaif et al., 2023).

Research gap
Although those previous studies presented factors that impacted the success of mobile learning, they did not examine how those factors impacted learners, especially their mobile learning readiness. Also, among those studies, there are no research studies aimed at finding other influential factors (connectivist learners, technology readiness, self-directed learning, and netiquette) that may impact mobile learning readiness among Thai college students.

Purpose and research questions

The purpose of the study was to investigate the overall competency levels of mobile learning readiness and four influential factors (connectivist learners, technology readiness, self-directed learning, and netiquette) that may impact college students' mobile learning readiness in Thailand. The results of this study could be beneficial for instructors and institution administrators in preparing supports or designing appropriate instruction, activities, and learning materials that encourage their learners to have essential digital competencies that would enhance them to able to learn within a mobile learning environment efficiently. The study asks the following research questions:

1. What are the overall competency levels of mobile learning readiness among college students in Thailand?
2. To what extent do competencies of connectivist learners, technology readiness, self-directed learning, and netiquette affect mobile learning readiness among college students in Thailand?

Literature review

Connectivist learner

Al-Shehri (2011) explained that mobile learning occurs from the urgent needs of digital learners and connectivism seems to be the effective learning theory that is related to principles of learning and teaching within the mobile learning environment. The advancement of technology nowadays, especially mobile technology, allows all individuals to access various information through network connections. Keskin and Metcalf (2011) stated that connectivism is one of the related theories of mobile education that focuses on the connection of various information that creates learning among learners. It views learning as a process of connecting specialized information sources (Siemens, 2018) and it occurs when knowledge is actuated through the process of a learner connecting to and feeding information into a learning community (Kop & Hill, 2008). In addition, Jinot (2019) explained that mobile learning encourages learners to access diverse information resources and creates opportunities for learning new knowledge through digital mobile applications.

Connectivist learners believe that recognition of updated and various information is the most important aspect of creating successful learning. Therefore, advanced communication technologies, such as high-performance computers, tablets, and smartphones that allow learners to connect and access various information become important learning tools for connectivist learners. As Boyraz and Ocak (2021) explained, the principle of connectivism highlights that learning occurs when learners are able to form networks with other learners and digital learning sources.

Besides the connection of information that creates learning, connectivism also emphasizes facilitating a continual learning environment where learners have the freedom to access resources and exploit knowledge networks through mobile technology to support their learning goals (Mundie & Hooper, 2014). Thus, knowledge

management and decision-making are essential abilities of connectivist learners. In addition, Tschofen and Mackness (2012) indicated four key principles of learning within connectivist environments and those principles represent the essential learning capability of connectivist learners. Those principles are (a) autonomy, (b) connectedness, (c) diversity, and (d) openness (Downes, 2012).

Autonomy   Gagne and Deci (2005) explained that autonomy concerns acting from interest and integrated values. It refers to learner self-expression that includes their understanding and motivation in making choices of learning and information (Tschofen & Mackness, 2012). Autonomy is a concept of choices, controls, and independence in which connectivist learners should recognize their own interests that would lead them to make their decision in choosing or controlling for their own learning from varied information, without influences from other external factors (Tschofen & Mackness, 2012).

Connectedness   Connectedness refers to learning engagement within an online community that comes from social learning where learners can exchange, access, and assess various information from different resources (Tschofen & Mackness, 2012). Therefore, connectivist learners should have a preference for interacting, connecting, and accessing various resources and they should have sufficient abilities and knowledge in using tools to access resources and interact with others to create successful learning.

Diversity   Diversity refers to abilities and knowledge regarding managing and accommodating diversity within the networked learning environment, such as diverse perspectives, beliefs, information, and people. Thus, connectivist learners should have high levels of competence in choosing, analyzing, and accepting those diversities that will benefit their learning.

Openness   Openness is related to curiosity, exploration, creativity, and unusual ideas which means that connectivist learners usually prefer to receive and search for new information and resources. Tschofen and Mackness (2012) stated that learners within a connectivist environment prefer to put themselves into unusual learning ventures that motivate them to learn and face new challenges in learning.

Technology readiness
Technology readiness plays a critical role in the adoption of mobile learning (Hyman et al., 2014). Rogers (2003) divided technology readiness among learners into five levels, which include (a) Laggards, (b) Late Majority, (c) Early Majority, (d) Early Adopters, and (e) Innovators. Those levels reflect the individual attitude and abilities in using new technologies in the learning process. In terms of attitudes, those levels represent attitudes in four dimensions, which are (a) optimism, (b) innovativeness, (c) discomfort, and (d) insecurity.

Optimism   Parasuraman (2000) defined optimism as a positive view of technology and belief in the benefits of technology in increasing learning efficiency and enhancing people's lives at work and home. Learners who are Early Adopters and Innovators usually have optimism at a high level in which they will be motivated to use technology

for learning and it will encourage them to be able to learn within a technology environment effectively.

Innovativeness   The second dimension is innovativeness which refers to learner leadership in trying out new technology-based products. Learners who are in groups of Early Majority, Early Adopters, and Innovators usually have high innovativeness in which they will be able to adapt themselves to new learning approaches and be open to using new technologies to support their learning efficiently. Optimism and Innovativeness are two dimensions that are the 'contributors' that may increase technology readiness among learners and learners who have skills, knowledge, and attitudes that are related to optimism and innovativeness will seldom have any learning issues in learning through technologies.

Discomfort   Discomfort is the third dimension that refers to a perceived lack of control over technology and a lack of confidence in using the new technologies properly among learners. Learners who feel discomfort will have difficulties studying through technology successfully. Learners who are Laggards and Late Majority usually have discomfort at a high level.

Insecurity   Insecurity is the last dimension which is defined as distrust of technology-based transactions and skepticism about learners' ability to work and learn properly. Learners who have discomfort and insecurity will have difficulty learning successfully within the technology-based learning environment, including mobile learning. Learners who are in groups of Laggards mostly have insecurity at a high level. Therefore, to create successful mobile learning, the instructor should decrease discomfort and insecurity among learners.

Self-directed learning

Lee and Jeon (2020) stated that self-directed learning is related to self-efficacy which is one of the important factors of mobile learning readiness. It refers to the vital ability of online learners to control their own learning and monitor themselves which encourages them to achieve study goals. Self-directed learning is the psychological process that purposely directs learners to gain knowledge and understand how to solve problems. Since mobile learning is one type of online learning that allows learners to be independent and have freedom in accessing content and activities anytime and anywhere, self-directed learning becomes a required learning skill that mobile learners should have. This is supported by Jeong (2022) who stated that mobile learning enhances sustainable self-directed learning and mobile technologies are currently used for supporting self-directed learning for professional development (Curran et al., 2019).

In terms of learners, self-directed learners usually participate in individual learning tasks, such as reading online learning material and planning and evaluating milestones of learning (Geng et al., 2019). Kizilcec et al. (2017), stated that learners who are skilled in self-directed learning will visit course materials more frequently,

which will lead them to be successful in all learning types, including mobile learning. According to, Hiemstra (1999), five major principles of self-directed learning represent the essential competence of self-directed learners. These principles are (a) self-planned learning, (b) autonomous learning, (c) informal education, (d) self-education, and (e) open learning. The first principle is self-planned learning which means that self-directed learners should be able to develop a plan or have the ability to control themselves in learning that leads them to achieve their study goals. The second principle is autonomous learning which means that self-directed learners usually engage in learning development. Self-directed learners prefer to keep improving themselves to have better learning performance and motivation is the key to increasing autonomous learning among self-directed learners.

The third principle is informal education which refers to the learning style of self-directed learning in which learners have the freedom to access and make a decision in choosing their studies that are related to their interests and abilities. Thus, information literacy is a required skill for learners in encouraging them to be successful in the digital learning environment. The fourth principle is self-education which demonstrates the attitude and points of view of learners toward the goals of learning. Self-directed learners believe that the knowledge and skills that they gain from learning need to fulfill their needs rather than meet course requirements and standards. Intrinsic motivation is the key to fostering self-directed learners' attitudes toward self-education.

The last principle for self-directed learning is open learning which means that self-directed learners should have sufficient tools that support them to have further access to various resources that help them to have wider perspectives and gain more knowledge. In addition, self-directed learners should have abilities to share their attitudes and make decisions to choose and develop their own learning (Hiemstra, 1999).

Netiquette

Issues regarding ethics and netiquette are important dimensions of learning through technology, including mobile learning (Iraki, 2015) and how it impacts motivation within an online learning environment (Heflin et al., 2017). Netiquette for online learning refers to professionalism through network communication (Mintu-Wimsatt et al., 2010) which contains proper ways of using tools for communicating and participating within a networked community. Netiquette contains several rules that represent appropriate and inappropriate ways of communicating within an online environment that fosters courtesy (Shea, 1994).

Preece (2004) indicated three considerations that online learners should be concerned about in creating netiquette within online learning. These considerations are (a) showing respect, (b) creating a safe online community, and (c) solving learning conflicts. The first consideration is showing respect which means that online learners should accept different viewpoints or attitudes from other online learners. According to Hartsell (2008), the Internet is the place where online users are allowed to express and exchange their thoughts, viewpoints, and information, as well as for online learning where communication tools are mediums for sharing, delivering, and discussing various content among teachers and students. Therefore, agreement regarding classroom communications must be set up in advance to prevent miscommunication within an online learning

environment that may lead to issues and problems (Kallos, 2004). Sample communication rules within online learning are to use polite or official language for communicating and avoid topic discussions, such as personal backgrounds, politics, and religion.

The second consideration is creating a safe online community. Netiquette refers to the abilities of learners in creating a safe online community, such as information literacy and digital literacy. Online learners should be able to analyze and exchange quality information from reliable resources with others. They also need to avoid sharing illegal information and fake news within an online community (Atalay, 2019).

The last consideration is solving learning conflicts which means that online learners should have problem-solving skills that encourage them to solve issues and avoid conflicts that come from participation or communications within an online environment. In terms of learning, activities such as classroom seminars or group discussions are basic learning activities in all online courses. Therefore, online learners must have the abilities and knowledge to recognize ways of expressing their thoughts and viewpoints, including exchanging information and sharing knowledge with others within an online learning environment.

Methodology

Participants

A total of 583 Thai college students participated in this study and all of them had their own smartphones and tablets as the main tools for accessing learning materials. Most participants came from various fields of study in several educational institutions in Thailand, such as Social Science (N=349, 59.86%), Agriculture (N=98, 16.81%), Engineering and Computer Science (N=69, 11.84%), and Science (N=67, 11.49%). In addition, most of the participants were female (n=410, 77.33%), between 18 and 30 years old (n=449, 77.02%), and studying at the undergraduate level (n=416, 71.36%). Finally, more than half of the total participants spent more than 6 h per day accessing the Internet (n=322, 55.23%) and had more than 10 years of experience in accessing the Internet (n=353, 60.55%) (See Table 1).

Survey instrument

We designed a survey to examine the competency levels of mobile learning readiness and influential factors of mobile learning readiness of learners in higher education. All survey questions were divided into four sections to examine the behaviors, knowledge, and attitudes of participants that related to each influential factor. In this study, we adapted survey questions from a previous study by Yusof et al. (2015) to inspect the competencies of connectivist learners and the study by Khiat (2015) to examine the competencies of self-directed learning among learners. However, survey questions in the technology readiness and netiquette sections were developed by us because we did not find suitable research instruments from the literature.

After we finished developing all the survey questions, we sent all questions to three experts to validate them before the data collection started. Those experts were professors from the Curriculum and Instruction and Educational Technology departments who had related research and teaching experiences in online and mobile learning. These three experts were asked to validate all survey questions by using scales of

Table 1 Participant demographic information

Participant demographics	Numbers	Percentage
Gender		
Male	173	29.67
Female	410	70.33
Ages		
18–30 years old	449	77.02
31–40 years old	83	14.24
More than 40 years old	51	8.75
Educational level		
Undergraduate	416	71.36
Master	107	18.35
Doctoral	60	10.29
Fields of study		
Social science	349	59.86
Agricultural	98	16.81
Engineering and computer science	69	11.84
Science	67	11.49
Average hours for Internet access		
1–2 h per day	8	1.37
3–4 h per day	65	11.15
5–6 h per day	188	32.25
More than 6 h per day	322	55.23
Experience with internet access		
1–5 year	31	5.32
5–10 year	199	34.13
More than 10-year	353	60.55

N = 583

index of item objective congruence (IOC) rate that indicated the appropriateness of questions with the objectives of the study. The indices of IOC were calculated by the summation of scores from each expert and divided by the number of experts in this study in which IOC index range from 0.67 to 1.00 represents good content validity (Pengruck et al., 2019). In this study, the results of IOC's index of survey questions ranged from 0.67 to 1.00 which represented that all survey questions are appropriate and accepted by the experts for use to examine impacted factors of mobile learning readiness among Thai college students (See Table 2).

The final survey instrument included two main parts. The first part contained seven questions that aimed to collect participant demographics, such as gender, age, educational level, fields of study, etc. The second part contained 25 questions that aimed to investigate the overall competency levels and the influence of four important factors on mobile learning readiness among college students in higher education. These four factors are (a) connectivist learners (6 items), (b) technology readiness (6 items), (c) self-directed learning (7 items), and (d) netiquette (6 items). In this part, participants needed to evaluate themselves through a five-point Likert scale ranging from "Strongly disagree" to "Strongly Agree".

Table 2 Results of IOC indices

Questions	Expert 1	Expert 2	Expert 3	Average	Results
Connectivist learners					
CON1	1	1	1	1	Accepted
CON2	1	1	1	1	Accepted
CON3	0	1	1	0.67	Accepted
CON4	1	1	1	1	Accepted
CON5	0	1	1	0.67	Accepted
CON6	1	0	1	0.67	Accepted
Technology readiness					
TECH1	1	0	1	0.67	Accepted
TECH2	1	0	1	0.67	Accepted
TECH3	1	1	1	1	Accepted
TECH4	1	1	1	1	Accepted
TECH5	1	1	1	1	Accepted
TECH6	1	1	1	1	Accepted
Self-directed learning					
SDL1	1	1	1	1	Accepted
SDL2	1	1	1	1	Accepted
SDL3	1	1	1	1	Accepted
SDL4	0	1	1	0.67	Accepted
SDL5	1	1	1	1	Accepted
SDL6	1	1	1	1	Accepted
SDL7	1	1	1	1	Accepted
Netiquette					
NET1	1	1	1	1	Accepted
NET2	1	1	1	1	Accepted
NET3	1	1	1	1	Accepted
NET4	1	1	1	1	Accepted
NET5	1	1	1	1	Accepted
NET6	1	1	1	1	Accepted

Table 3 Discriminant validity of the measurement model

	CON	TECH	SDL	NET
CON	**0.71**			
TECH	0.495**	**0.71**		
SDL	0.616**	0.71**	**0.73**	
NET	0.355**	0.407**	0.633**	**0.73**

Connectivist Learners (CON), Technology Readiness (TECH), Self-Directed Learning (SDL), and Netiquette (NET)

In addition, we also conducted reliability testing in which its results showed that Cronbach's alpha of the questionnaire was 0.91, which indicated that the survey instrument had high internal consistency. The results of discrimination of validation of the measurement model were between 0.71 and 0.73, which is more than the correlation among constructs. Therefore, all constructs were suitable for analysis using the confirmatory factor analysis model (see Table 3).

Furthermore, the construct reliability was tested by Cronbach's alpha and composite reliability. All alpha values and composite reliability (CR) values exceed 0.70, which indicates that the reliability of each construct was reasonably satisfied. The results showed that the value of average variance extracted (AVE) is greater than 0.5, which means that less error remains (Hair et al., 2011). Therefore, all survey questions were acceptable to measure the mobile learning readiness of learners in higher education.

Data collection procedure

We reviewed literature that aimed to explore factors that may impact mobile learning readiness among learners. We found and focused on four factors that may influence learner's mobile learning readiness which include the competence of constructivist learners, technology readiness, self-directed learning, and netiquette. We then developed a survey that contained questions that aimed to explore the overall competency levels and influence of four important factors on mobile learning readiness among college students in Thailand. After that, the questions were developed, and we invited three professionals in the fields of educational technology and curriculum and instructions in Thailand to validate the survey before we started working on the IRB process. After the IRB approval, we sent a survey link with an official invitation letter to several departments and institutions in higher education in Thailand asking college students to participate in the study. The data collection period lasted for four months and all of the data were saved in a safe place to which only we had access to it.

Data analysis

The descriptive analysis method was used to answer the first research question regarding the overall competency levels of mobile learning readiness of college students in Thailand. Descriptive statistical procedures were performed on the quantitative data to determine central tendencies, standard deviations, and rankings. The confirmatory factor analysis was used to answer the second research question to determine whether the competencies of connectivist learners, technology readiness, self-directed learning, and netiquette influence the mobile learning readiness of college students in Thailand.

Results

Research question 1. what are the overall competency levels of mobile learning readiness among college students in Thailand?

Table 4 shows that the overall mobile learning readiness among participants was at a high level ($\bar{x} = 4.08$, SD $= 0.47$). It also shows that all four competencies of connectivist learners (CON), technology readiness (TECH), self-directed learning (SDL), and netiquette (NET) were all rated at high levels ($\bar{x} > 3.90$).

In terms of participants' competence as connectivist learners, the overall mobile learning readiness among participants was at a high level ($\bar{x} = 4.25$, SD $= 0.52$). Most of the participants agreed that diverse knowledge and attitudes create successful learning (CON3, $\bar{x} = 4.41$, SD $= 0.75$), and the quality and updated online information impacted the success of learning within mobile learning (CON5, $\bar{x} = 4.24$, SD $= 0.73$). However, several of them indicated that learners needed to recognize their own learning interests (CON6, $\bar{x} = 4.21$, SD $= 0.81$) and they believed that the ability to find connections among

Table 4 Results of mobile learning readiness

	Mobile Learning Readiness	$\bar{x}$	SD
Connectivist learners			
CON1	I always find connections between various online information from different resources	4.23	0.83
CON2	Search engine such as Google is the best tool for helping me to see connections between online information and knowledge	4.22	0.86
CON3	I believe that diverse knowledge and attitudes create successful learning	4.41	0.75
CON4	The ability to learn in finding connections between various information is required to be successful in mobile learning	4.18	0.75
CON5	Quality and updated online information impact the success of learning within mobile learning	4.24	0.73
CON6	It is necessary for learners to recognize their own learning interests	4.21	0.81
		4.25	**0.52**
Technology readiness			
TECH1	I asked for some help from friends and professionals to fix my learning tools	4.02	0.88
TECH2	I always collect user feedback before choosing or buying technology to support my learning	3.95	0.85
TECH3	I always find and choose the new and best technology to support my learning	4.13	0.76
TECH4	I usually integrate various technologies to support my learning	4.02	0.79
TECH5	Technology is important and beneficial that help me to better my learning performance	4.06	0.84
TECH6	I am ready to use new technologies to support learning	4.31	0.72
		4.08	**0.55**
Self-directed learning			
SDL1	I believe that successful learning comes from continuous learning	4.25	0.74
SDL2	I prefer to learn about topics that I am interested in only	3.85	0.96
SDL3	I prefer to design and plan my own learning	4.08	0.78
SDL4	I study for myself, not for others	3.97	0.88
SDL5	I always manage my schedule and control myself to complete all activities that will lead me to achieve my goal of study	4.02	0.82
SDL6	I am aware of my learning and check the validity of course content	4.01	0.82
SDL7	I am open to new learning approaches and ready to adapt myself to fit in that learning environment	4.22	0.68
		4.05	**0.55**
Netiquette			
NET1	I always avoid conflicts within the online community by not sharing any opinions	3.59	1.17
NET2	If I have a problem working with other online learners, I will try to find solutions and communicate with other learners as much as possible	3.99	0.89
NET3	I always use formal language for communicating within an online learning environment	3.85	0.94
NET4	I always make references and check online sources before sharing any information	3.93	0.89
NET5	I never share any other personal information and try to stop cyberbullying	4.11	0.89
NET6	I understand and accept different perspectives from other online learners	4.13	0.90
		3.93	**0.65**
	Overall mean	**4.08**	**0.47**

Connectivist Learners (CON), Technology Readiness (TECH), Self-Directed Learning (SDL), and Netiquette (NET)

the information is important for encouraging them to be successful in mobile learning (CON4, $\bar{x} = 4.18$, SD $= 0.75$).

In terms of participants' technology readiness, the overall mobile learning readiness among participants was at a high level ($\bar{x} = 4.08$, SD $= 0.55$). The results showed that most of the participants were open to new learning technologies (TEC6, $\bar{x} = 4.31$, SD $= 0.72$) and they preferred to choose the best technologies for learning (TECH3,

$\bar{x} = 4.13$, SD $= 0.76$). Nevertheless, many participants indicated that they integrate several technologies to support their learning (TECH4, $\bar{x} = 4.02$, SD $= 0.79$), they asked for help from friends and professionals to fix their learning tools (TECH1, $\bar{x} = 4.02$, SD $= 0.88$), and online comments and reviewers had impacted their decisions in choosing their personal learning technology (TECH2, $\bar{x} = 3.95$, SD $= 0.85$).

In terms of participants' self-directed learning, they had knowledge and skills of self-directed learning at a high level as well ($\bar{x} = 4.05$, SD $= 0.55$). They agreed that successful learning came from continuous learning (SDL1, $\bar{x} = 4.25$, SD $= 0.74$). They were ready for new learning approaches and willing to adapt themselves to fit into that learning environment (SDL7, $\bar{x} = 4.22$, SD $= 0.68$). However, many of them stated that they studied for themselves (SDL4, $\bar{x} = 3.97$, SD $= 0.88$) and they preferred to learn topics that they were interested in mobile learning (SDL2, $\bar{x} = 3.85$, SD $= 0.96$).

In terms of participants' netiquette, their competence in online communication was at a high level ($\bar{x} = 3.93$, SD $= 0.65$) as well. The results indicated that participants understood and accepted different perspectives from other online learners (NET6, $\bar{x} = 4.13$, SD $= 0.90$). They never shared any other personal information (NET5, $\bar{x} = 4.11$, SD $= 0.89$). Nevertheless, several participants indicated that they used formal language for online communication (NET3, $\bar{x} = 3.85$, SD $= 0.94$) and they preferred not to share their opinions to avoid conflicts within the online community (NET1, $\bar{x} = 3.59$, SD $= 1.17$).

Research question 2. to what extent do competencies of connectivist learners, technology readiness, self-directed learning, and netiquette affect mobile learning readiness among college students in Thailand?

As shown in Table 5 and Fig. 1, the factor of technology readiness has the highest gamma coefficient ($\gamma = 0.98$). This indicates that technology readiness can explain the learning readiness of learners in the mobile learning environment more than the other three factors, which are connectivism learners ($\gamma = 0.77$), self-directed learning ($\gamma = 0.91$), and netiquette ($\gamma = 0.84$).

Second-order factor model

Figure 1 shows the second-order confirmatory factor analysis that involved the evaluation of the relationship between four first-order factors (connectivist learners, technology readiness, self-directed learning, and netiquette) and a second-order factor (mobile learning readiness). The results of the measurement model are shown in Table 6 indicating that the data fit the model very well. Other fit indices revealed similar results (CFI $= 0.998$; NFI $= 0.971$; AGFI $= 0.954$; IFI $= 0.998$; RMSEA $= 0.010$; RMR $= 0.021$).

Discussion

For research question 1, the overall mobile learning readiness among Thai college students is at a high level ($\bar{x} = 4.08$) which represents that Thai college students have competencies that enhance them to be successful in learning within mobile learning. In addition, among the four competencies, Thai college students have competency as connectivist learners at the highest level which means they realized the importance of quality and updated information that impacted the success of their learning. They also prefer

Table 5 Results of the measurement model

Construct		λ	α	SE	*t*-value	R² (%)	AVE	CR
Connectivist learners		0.77	0.74			59	0.50	0.75
CON1	Abilities of information connectedness	0.52		–	–	27		
CON2	Ability to use tools for finding information connectedness	0.40		0.09	8.86**	16		
CON3	Attitudes of information diversity	0.54		0.10	9.49**	30		
CON4	Attitudes of openness	0.63		0.12	9.30**	40		
CON5	Importance of updated information	0.70		0.13	9.33**	49		
CON6	Autonomy learners	0.67		0.14	9.23**	45		
Technology readiness		0.98	0.77			97	0.50	0.78
TECH1	Technology problem solving	0.55		–	–	30		
TECH2	Abilities in technology selection	0.61		0.10	10.85**	37		
TECH3	Recognition of technology and learning	0.64		0.09	11.30**	41		
TECH4	Recognition of technology adaptation	0.70		0.10	11.47**	49		
TECH5	Recognition of the importance of Technology	0.57		0.09	12.08**	40		
TECH6	Openness to technology	0.63		0.09	9.67**	33		
Self-directed learning		0.91	0.79			84	0.53	0.78
SDL1	Autonomous Learning	0.59		–	–	34		
SDL2	Learning Motivation	0.50		0.12	9.45**	25		
SDL3	Self-planned learning	0.65		0.10	11.62**	42		
SDL4	Self-education	0.59		0.11	10.98**	35		
SDL5	Self-monitoring	0.62		0.11	11.08**	39		
SDL6	Informal education	0.61		0.11	10.95**	37		
SDL7	Openness learning	0.57		0.09	10.63**	32		
Netiquette		0.84	0.76			71	0.53	0.73
NET1	Ability to create online communication	0.41		–	–	17		
NET2	Problem-solving in online communication	0.54		0.12	8.24**	29		
NET3	Recognition of using official languages	0.69		0.15	9.25**	48		
NET4	Online information validity	0.70		0.16	8.35**	49		
NET5	Decreasing cyber bullying	0.55		0.13	7.68**	30		
NET6	Respect different attitudes	0.49		0.13	7.31**	24		

**Significant level at .001

to access various information from different resources to explore the connection and validity of the information. Furthermore, the results also showed that college students in Thailand had positive attitudes toward technology and they were willing to adapt themselves to new learning approaches that integrate new technology. Both competencies of connectivist learners ($\bar{x}=4.25$) and technology readiness ($\bar{x}=4.08$) are related to digital literacy which is one of the essential literacies that the Thai government enhanced for all Thai citizens. According to the Office of National Digital Economy and Society Commission (2016) in Thailand, the Digital Literacy Curriculum was developed and released in 2016 to be used in schools for teaching and preparing Thai students to have better digital literacy. Therefore, this may explain why Thai college students have these competencies at a high level.
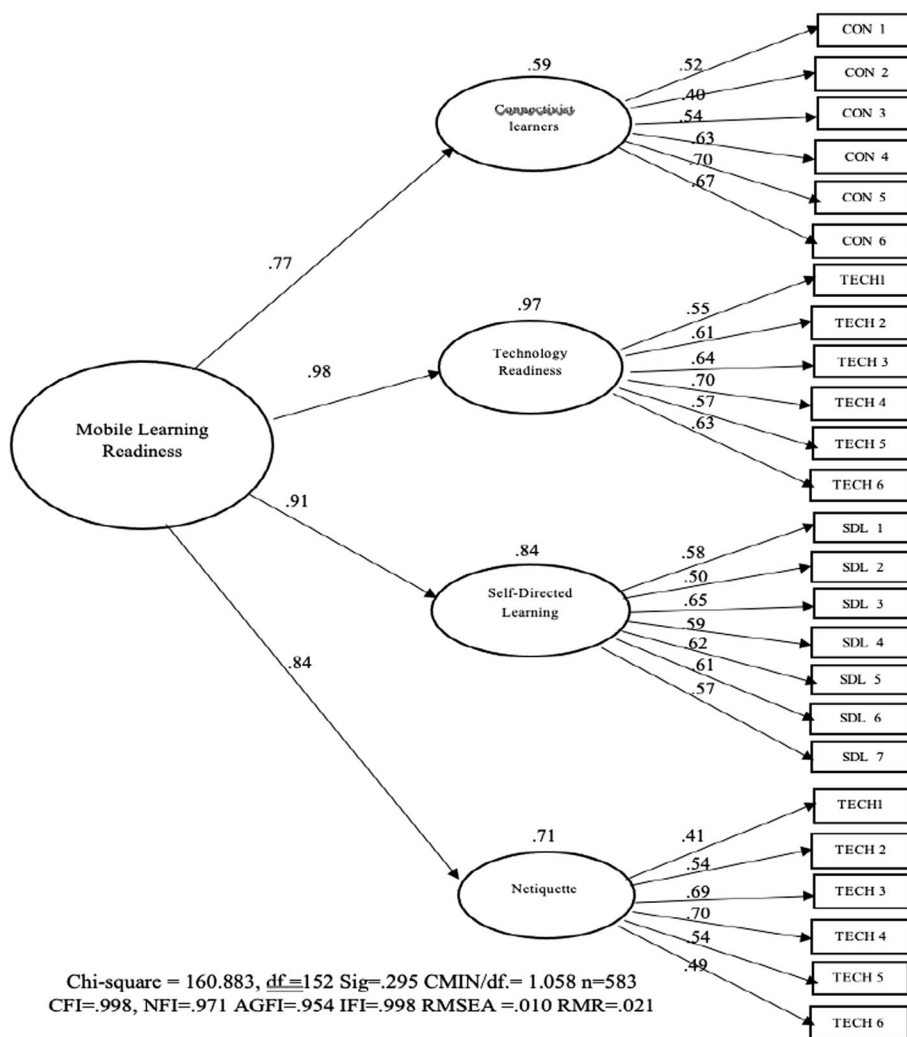
Fig. 1 Second-order model

Table 6 Model fit indices

Statistic	Recommended value (*P*)	Obtained value	References
Chi-Square = 160.883 *df* = 152			
Sig	> 0.05	0.295	Bollen (1989), Hair et al. (2006)
CMIN/df	< 2.0	1.058	Bollen (1989), Diamantopoulos and Siguaw (2000)
CFI	> 0.90	0.998	Mueller (1996), Hair et al. (2006)
NFI	> 0.90	0.971	Mueller (1996), Hair et al. (2006)
AGFI	> 0.80	0.954	Durrande-Moreau and Usunier (1999), Harris (2001)
IFI	> 0.90	0.998	Mueller (1996), Hair et al. (2006)
RMSEA	< 0.05	0.010	Browne and Cudeck (1993), Hair et al. (2006)
RMR	< 0.05	0.021	Diamantopoulos and Siguaw (2000)

However, among the four influential factors, the results showed that competency in netiquette was at the lowest level ($\bar{x}$ = 3.93), which indicated that Thai college students do not have sufficient skills and attitudes in online communication and collaboration.

The first possible reason is that most mobile learning courses in Thailand do not require students to participate or communicate with others. Therefore, many students do not realize the importance of competency in netiquette to their learning. Another reason is that instructions or curriculum in Thai schools rarely focus on enhancing students' online communication skills such as online collaboration or public sharing information, rather, it focuses on the recognition of ethics and law in using technology for learning appropriately. Therefore, the Thai education sector should pay attention to increasing the students' competency in netiquette and encourage them to be successful in digital learning, including mobile learning in the future.

For research question 2, the results of the study showed that the competencies of connectivist learners, technology readiness, self-directed learning, and netiquette are all influential factors of mobile learning readiness among learners in higher education in Thailand. The competency of technology readiness was the most influential factor in mobile learning readiness, followed by competencies of self-directed learning and netiquette. These results were consistent with Hyman et al. (2014) who stated that technology readiness plays a critical role in the adoption of mobile learning and Geng et al. (2019) who indicated that technology readiness is related to the success of learning within the online environment. In addition, Insorio (2021) also explains that technology readiness influences the success of mobile learning which does not only refer to mobile ownership but also includes the competence of learners in utilizing the use of mobile tools for learning frequently (Kukulska-Hulme, 2007; Sarrab et al., 2016).

Self-directed learning is the second most influential factor of mobile learning readiness. The results are related to Curran et al. (2019) and Lee and Jeon (2020) who agreed that self-directed learning represents mobile learning readiness among individuals. Moreover, the results are supported by Karimi (2016) who stated that personal learning styles are related to the adoption of mobile learning by learners in higher education, in which learners who are able to control and monitor themselves in learning will have a better chance to learn more within the online environment. The results also confirmed that netiquette is the third most influential factor that influences the mobile learning readiness of Thai college students, which includes online communication skills, problem-solving, and information literacy. The results are correlated with Iraki (2015) who indicated that netiquette is an important dimension of mobile learning because it impacts learners' learning motivation within the online learning environment (Heflin et al., 2017).

Finally, the study revealed that the competence of connectivist learners was the least influential factor whereas abilities and attitudes as connectivist learners among Thai college students had the highest-ranked factor. The conflict of those results indicated that Thai students have abilities and knowledge as connectivist learners, but they do not apply their abilities and knowledge to support their learning in the mobile environment. The possible reason is that learning in Thailand is qualified as teacher-centered where instructors still play an important role in learning and teaching, including online and mobile learning environments. Therefore, even if the institutions offered mobile learning courses to students, those courses are designed as blended learning where students are accustomed to learning from instructors and following instructions that instructors designed strictly.

Moreover, in an open university where most courses are delivered as e-learning and mobile learning, teachers are still an important component of any successful mobile learning courses in which their main tasks are to design learning materials and provide assistance to students (Sirikunpipat et al., 2021). Therefore, students do not need to explore or create their own experiences within a mobile environment by themselves. This may be another potential reason that explains why the competency of connectivist learners does not strongly influence mobile learning readiness among Thai college students.

Implications

The results of examining these influential factors for mobile learning are beneficial in four ways. First, the results highlighted the importance of online learner preparation and development in which mobile learners should not only have the skills in using technologies, but they also should be aware, control, and monitor themselves in learning within a mobile environment, including having sufficient communications skills that support them to learn through mobile technology successfully.

Second, the results also pointed out the importance of communication that directly relates to learning motivation that determines the success of online learning courses. Therefore, the tasks of online instructors should not only focus on creating effective communication or interaction but should also include creating a motivating learning environment where learners respect communication rules within the course, such as sharing reliable information, avoiding discussing sensitive topics, and cyberbullying.

Third, the results remind instructors to be aware of various levels of technological skills among learners within mobile courses. Since technology readiness is the most influential factor of mobile learning readiness, mobile instructors must be concerned about including technical support within mobile learning courses that aim to serve and provide assistance with technological issues to learners.

Fourth, the study revealed that the competence of connectivist learners was the least influential factor of mobile learning readiness among learners in higher education in Thailand which conflicts with several research findings that stated that connectivism occurs from the advancement of technologies used for learning and it is an important theory for digital learning, including mobile learning (Herrington et al., 2007; Keskin & Metcalf, 2011; Mallawaarachchi, 2019). The results from this study confirm that successful mobile learners do not necessarily need to have the skills and attitudes of connectivist learners, rather, they are supposed to be learners who have the ability to use technologies for learning, the ability to control and monitor themselves to complete activities, and the abilities in communicating effectively and eloquently within the online community.

Future research and conclusion

In terms of future research, since the study only collected data from college students in Thailand, the first recommendation could focus on comparing results from participants who are learners in different countries to confirm or disconfirm if those factors are influenced by the mobile learning readiness of learners in higher education globally. Another future study could focus on the exploration of other related factors, such as cultural,

educational systems, or government supports that may influence mobile learning readiness among learners in higher education.

In conclusion, the results of the study showed that participants had the abilities, knowledge, and attitudes that encouraged them to be able to learn within the mobile learning environment efficiently. The most influential factor of mobile learning readiness among learners is the competencies of technology readiness, followed by the competencies of self-directed learning and netiquette, which become essential skills that should be supported to all learners in helping them to be able to learn and communicate within mobile learning courses successfully.

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