Research Article

DIGITAL LITERACY OF HIGHER EDUCATION INSTRUCTORS IN THAILAND

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Abstract

Many students in post-secondary education nowadays expect online spaces for learning as they are used to be quasi-always online via social network services and streaming sites. How much can instructors cope with the challenges of digital technologies expected to be used in contemporary higher education institutions? Answers lead to the evaluation of digital literacy exhibited by students and instructors. Many definitions have been proposed to handle the concept of digital literacy adding to many more others that try to make the research and application of similar skill sets and competences manageable. This study aimed at assessing the level of digital literacy exhibited by instructors at higher education institutions in Thailand. Moreover, we investigated the attitudes towards the use of digital technologies for teaching expressed by the instructors. We collected data from a variety of institutions with the help of questionnaires as well as in-depth interviews and analyzed the data. Basic statistics such as mean, S.D. and percentage were used for quantitative data analysis. For qualitative data, content analysis technique was employed as a key method. According to the findings of the present study, the instructors showed moderate level of digital literacy and more than half of the participating instructors exhibited some key fundamental digital skills and literacy. In addition, they perceived positive uses of digital technologies. However several instructors still employed simple forms of digital technologies for their teaching and research work as they recognized the importance of TPACK, and some challenges and difficulties. The findings suggest that there is still a need for

specific training for enhancing their digital literacy in order for them to suitably leverage technology or digital tools for their teaching practice and research in an effective way.

Keywords: Digital Literacy, Higher Education Instructors, Thailand

Introduction

The joined OECD and UNESCO's review of the education system in Thailand revealed that it is essential to ´[c]reate a comprehensive information and communications technology strategy to equip all of Thailand's students for the 21st century, with an emphasis on improving teachers' skills to make the best use of technology in the classroom" (OECD/UNESCO, 2016).

The broad field of technology has changed every sector of society including the way institutions approach teaching and learning. Teaching is a social process supported by low to high level technologies, which all have their affordances and constraints. After a period of oral communication, eventually script was introduced to transfer information and knowledge from generation to generation. In the 16th century BC (c. 3600 years ago), the Teaching of King Ammenemes I to His Son Sesostris (Erman, 1966) appeared in Ancient Egypt as a poem with a plea for wise leadership written in hieroglyphs. For a long time before that invention such tools as the abacus and tables had been used to master mathematical tasks. Johannes Gutenberg's printing press paved the way to modern paper-based textbooks with such features as color illustrations and 3D pop-up models. At present, digital technology is being applied worldwide to teaching and learning, and it is evolving at an accelerating pace into such applications as the Internet of Things and 3D printing. The sharply rising number of students in all levels of education worldwide (Maslen, 2012; Worldbank, 2013) together with the demand for lifelong learning in many professional areas has led to the industrialization of the educational sector. From the commercial point of view, distance or online learning has been shown to be more cost-effective than pure traditional classroom teaching (Maloney et al., 2015) and offering such teaching opportunities needs staff that shows a high level of digital skills. This applies to blended-learning as well as flipped classrooms and hybrid approaches to teaching.

Moreover, many contemporary students in post-secondary education expect online spaces for their learning experiences (Walters et al., 2016) as they are used to be quasi-always online via social network services and streaming sites. As in the past with reading attitudes of

students, instructors can profit from habits nowadays by not only guiding their digital partners to appropriate and valuable digital resources but also providing them with such materials. This implies that instructors have to develop enough knowledge and skills to cope with modern day technologies used for designing, developing, analyzing and presenting learning materials as well as receiving, assessing and working with students' digitally created products. As a consequence, instructors have to exhibit a certain level of digital literacy, especially relating the use of the Internet with its valuable collection of educational resources. In many studies teachers' skills and knowledge have been identified as main obstacles to successful integration of technology into higher education; see for example the literature review provided by Hew and Brush (2007).

The term digital literacy needs careful attention. Many definitions have been proposed to handle the concept of digital literacy adding to many more others that try to make the research and application of such similar skill sets and competences as information literacy, computer literacy and media literacy manageable. Often researchers have defined sets of sub-skills to characterize digital literacy (Eshet, 2012; Van Dijk and Van Deursen, 2014). Indeed, such a variety of similar and overlapping concepts have been offered that many scholars have used the umbrella term "digital literacies" (Jones and Hafner, 2012). Digital literacies are seen by many scholars as a concept that includes operational skills, knowledge as well as social and ethical awareness (Van Laar et al., 2017; Blau and Eshet-Alkalai, 2017)). As a consequence, the measurement of digital literacies has turned out to be a major challenge for researchers. For instructors the task of assessing levels of digital literacies might be easier in certain environments, where they have the opportunity/necessity to apply standards (e.g., the National Educational Technology Standards for Students; International Society for Technology in Education, 2016).

Notwithstanding, the measurable key factors for assessing digital literacy are quite homogeneous among the various definitions and descriptions of the concept. We have to keep in mind, though, that almost all work on digital literacy has focused on students at various stages of their education and not so much on instructors (the authors' Google Scholar search identified a rough proportion of 85 to 15 percent of studies regarding students and teachers, respectively). Moreover, many of the studies focusing on instructors used small-scale groups including case studies of organizations, thus they missed a bigger picture of digital skills, competencies and literacies in the post-secondary teaching sector (Bennett, 2014). Therefore, some important factors

are missing, e.g. those that deal with the digital production of effective learning materials, for which multimodality is a key factor to consider when producing multimedia materials for teaching and learning (Clark and Mayer, 2011). Considering the situation of digital literacy among instructors in Thailand not much work has been carried out so far. As a result, there is a strong need for research studies in examining higher education instructors' digital literacy which is central to the present study.

A framework for assessing digital competency has been established in a European Community effort and has led to the Digital Competency Assessment (Calvani et al., 2008). This framework is based on three components (or dimensions): technology, cognition and ethics. They define digital competence as the ability "to explore and face new technological situations in a flexible way, to analyze, select and critically evaluate data and information, to exploit technological potentials in order to represent and solve problems and build shared and collaborative knowledge, while fostering awareness of one's own personal responsibilities and the respect of reciprocal rights/obligations."

Besides the continuous efforts to keep track of new developments in digital technology, instructors can rely on such basic skills as computational thinking to teach problem solving. Computational thinking requires creative minds to solve problems and build solutions with the help of digital technology. Although this appears to be universal, different disciplines certainly have their own understandings of the meaning of "digital literacy". This is based on the intrinsic needs of the disciplines: creative writing needs to be more focused on the effective production of content, whereas other fields require users to be able to critically consume digital content. We can call this diversity the horizontal dimension of digital literacy. In contrast, instructors at different institutions and at different levels of their career need respective levels of digital literacy, which we label as the vertical dimension of digital literacy. The following table may illustrate this concept. This supports structuring digital literacy skills and competences with finer granularity as can be seen in Table 1.

Table 1 E-skill levels supporting digital literacy

Digital Literacy E-skill Levels*	Description
Foundation e-skills 1.1 (AQF 1)	ICT skills at this level will be required by people wanting to gain the essential digital literacy skills in the routine use of a personal computer, software applications, the Internet and digital devices.
Foundation e-skills 1.2 (AQF 2)	ICT skills at this level will be required by people wanting to advance from foundation user competence to gain sufficient digital literacy to understand appropriate methods, tools and applications and perform a range of routine activities using communication technologies, the Internet, and software and the basic range of applications and functions associated with standard digital devices.
Foundation e-skills 1.3 (AQF 3)	ICT skills at this level will be required by people wanting to advance from foundation user competence to gain sufficient digital literacy to apply a methodical approach and understanding, and to perform a broad range of work, sometimes complex and non-routine, in a variety of environments.
Extension e-skills (Level 2-AQF 4-5)	ICT skills at this level will be required by people wanting to extend existing occupational competency to include advanced digital skills required to improve productivity, or to review and deploy information and communications technology consistent with standard methods, tools and applications within a specific context.
Strategic e-skills (Level 3-AQF 6+)	ICT skills at this level will be required by people wanting to extend digital skills to review technology and systems requirements, assess related resource requirements, build vendor relationships and deploy information and communications technology to enhance capacity to meet the strategic requirements of a business or community.

*While aligning to AQF the levels are also consistent with Skills Framework for the Information Age levels 1, 2, 3, 4 and 5-7 (www.sfia.org.uk).

Adopted from IBSA (2013, p. 17)

In practice the definition of e-skills is more complicated. If we consider the level of digital literacy exhibited by school administrators, the practical set of e-skills might not be that important rather the comprehension of current scope of digital literacy is necessary to provide leadership.

From the notion of the importance of digital literacy. The major research questions guiding the project work were as follows:

1. Which level of familiarity with contemporary digital technologies do Thai instructors actually exhibit?
2. How do they learn new digital technologies that they are not familiar with?
3. How do they develop teaching strategies that incorporate an understanding of the impact on students' learning by engaging digitally?
4. What are their attitudes towards using digital technologies for teaching?

The remainder of this paper is structured as follows. After the background information and overview of current knowledge, we elaborate on the methods used in this research, followed

by sections on the results and analysis. Finally, conclusions are drawn, and an outlook on further work is indicated.

Literature Review

In a recent report, OECD/UNESCO (2016) stated regarding the educational sector of Thailand that "teachers lack confidence and competence in the use of ICT, and the country needs to establish data-gathering mechanisms and a coherent, overarching ICT strategy to support the ongoing development of aligned, evidence-based policies in this area." As a result, the computer and information literacy of Thai students are below standards; therefore, Thai students lack digital skills necessary for being called digitally literate.

Digital literacy (including such related topics as digital skills and competencies) has gained increasing attention among scholars in recent years, both regarding theoretical and practical aspects of the field. Moreover, digital literacy studies have shifted from the emphasis of critical thinking (Gilster, 1997) to the inclusion of technological skills, literacies and competencies (Ferrari et al., 2012). Digital literacy has been identified as a main criterion for employability, improved quality of life and effective participation as citizen in modern society. Therefore, a vast amount of research has been reported on; most of the studies so far have been focused on the European Union with its 27 members and the English speaking world. Regarding the situation of digital literacy among instructors in Thailand not much work has been carried out so far.

Many frameworks and models for researching digital skills, literacies and competencies exist, and most of them are based on a common rationale: the need of preparing citizens (including students and teachers) for lifelong learning and democratic participation in the digital age (Ferrari, 2012).

The ECDL Foundation offered some results of a survey on digital literacy skills regarding Thailand and many other countries (ECDL Foundation, 2009). That survey did not cover mobile technologies and social network services, which were in their infancy at the time of carrying out the study. It showed a dramatic lack of confidence against digital technologies as far as Thai teachers were concerned, which did not reflect the actual skills. Nevertheless, the actual skill levels for Thais were much lower than the average of the 17 participating countries (mostly from Europe): 66% showing insufficient skills vs. 52% on average. The data reported cover the general population and are not validated for special groups of the population, e.g. instructors at higher

education institutions. It was found that 63% of the survey participants were 'digitally literate' at that time. In addition, 52% of respondents expressed their overall perceived computer skills as being insufficient. However, once asked to rate their confidence in the skill areas (hardware, online, application software and everyday technology) this dropped to less than 14%. Fewer than 3% of candidates were ranked as having insufficient skills when actually tested. The corresponding data for Thailand: 66% perception of insufficient skills, confidence 47% and actual insufficiency 0%, which is a quite surprising result (ECDL Foundation, 2009).

One of the most rigorous frameworks for digital literacy studies is the DIGCOMP model, which is used to develop and analyze digital competence in European context. DIGCOMP is based on an extensive review of 15 frameworks of ICT and digital literacy and consists of five layers, or levels, which differ in their granularities of expressing digital competencies and skills. It has been doubted, though, that the framework can be easily applied in practice, particularly because of the many indicators (altogether 39) it uses.

Some important frameworks gained from studies focusing on metrics for digital literacy of adults are the following:

Table 2: The metrics for digital literacy of adults

Framework	Description	References
CML Media Lit Kit	The CML (Centre for Media Literacy) provides the Media Lit Kit and establishes a basic framework featuring five core concepts and five key questions of media literacy. The framework aims to enable learners to deconstruct, construct and participate with media. It is seen as a reference for teachers, media librarians, curriculum developers, and researchers.	http://www.medialit.org/cml-medialit-kit (last accessed Jan. 23, 2018)
DigEULit	This project was set up by the EC eLearning initiative and led by the University of Glasgow to develop a general framework for Digital Competence. The main output of the project was a series of publications on a conceptual framework for	Martin and Grudziecki, 2006

Framework	Description	References
	the development of Digital literacy, which is seen as the convergence of several literacies.	
ECDL	ECDL is one of the leading authorities of computer skills certification programmes. It is a not-for-profit organisation providing about ten certification programmes ranging from entry-level for beginners to advanced level to professional programmes. The main focus of the most widespread programmes (ECDL/ICDL) is on the development of skills and knowledge necessary to use word processing, database, spreadsheet, and presentation applications.	http://ecdl.org/ (last accessed Jan. 25, 2018)
Pedagogical ICT License	The Pedagogical ICT Licence offers current and prospective teachers the opportunity to upgrade their ICT skills and to integrate ICT and media as a natural part of learning in school subjects. This certificate is obtained by successfully completing assignments in four basic modules and four elective modules. The aim is to use ICT and media for teaching and learning purposes.	https://cordis.europa.eu/project/rcn/78287_en.html (last accessed Feb. 1, 2018)
UNESCO ICT Competency Framework for Teachers	This framework aims to define various ICT competency skills for teachers in order to enable them to integrate technologies in their teaching and to develop their skills in pedagogy, collaboration, and school innovation using ICT. It consists of a policy framework, a set of competency standards and implementation guidelines. The standards include training in ICT skills as part of a comprehensive approach to education reform.	UNESCO (2011)

In addition, as the focus of the present study was placed on examining digital literacy and its associated constructs of higher education instructors, the metrics for digital literacy of adults was also reviewed and incorporated into the study. Drawing on the notions mentioned previously, the examination of digital literacy of Thai instructors has to take into account the frameworks for digital literacy studies of the DIGCOMP model and the metrics for digital literacy of adults. These were developed into a manageable assessment instrument with more specific characteristics of digital literacy and its related skills and practices. Therefore, some specific aspects of digital literacy were formulated and used such as: ability to determine the extent of information needed, to access the needed information effectively and efficiently, to evaluate information and its sources critically, to incorporate selected information into one's knowledge base, to use information effectively to accomplish a specific purpose, to understand the economic, legal, and social issues surrounding the use of information, and access and use information ethically and legally, etc.. In order to examine the higher education instructors' digital literacy, related notions mentioned were used and developed into the framework for studying digital literacy of the instructors in the present study, shown as follows.

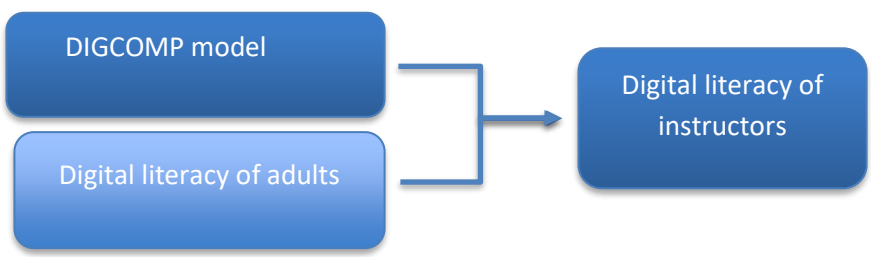

Figure1 Conceptual framework of the study

Methods

A variety of methods has been used to approach the research questions adopted in this research. They reach from quantitative research (mostly based on some form of questionnaires) to qualitative research (including case studies and interview techniques) as well as mixed-methods research, which applied both strands of approach in various degrees.

In terms of Gapski's (2007) description of digital literacy investigations, the level of analysis applied in this research was group-oriented (i.e. instructors or teachers), the context of

digital literacy applications was for teaching students in tertiary institutions, the object of measurements were processes (in contrast to structures), and the perspective method was mixed self/external observation with a mixed-method approach to data gathering and analysis.

The study of teaching with digital technologies deals with situated social practices, and, therefore, we used a mixed methods approach to guide our research. Regarding the research questions stated above, we applied an iterative process to avoid "tunnel vision" that would have prevented us from seeing alternative approaches and data potentially contributing to understanding (Mertens et al., 2016).

1. Quantitative research was based on an online questionnaire form (link to the questionnaire was sent to institutions and individuals for filling out)

2. Individual semi- structured interviews (face- to- face and email interviews) with purposefully identified experts in Thailand

In the following, these two approaches and their data integration in terms of a mixed- method research will be described in more detail. For the latter, we have used triangulation (described below) and made sure that one of the researchers (mb) was concerned with the quantitative data collection and the other (sc) with the qualitative data collection as well as their respective interpretations. This approach has been favorable acknowledged by Farmer et al. (2006).

Quantitative data collection

For quantitative part of data collection, the 111 higher education instructors participated in the present study as they responded to the questionnaire through online survey using google forms. These participants represented the instructors in higher education institutions across Thailand. The data collection tools for the quantitative approach in this research consisted of a questionnaire with 41 questions, 5 of which were open- ended, and the rest were formed as a Likert scale choice with 5 levels. The questions regarding the digital skill levels were formulated as task-oriented questions, from which we could estimate the skill levels.

We used an online tool for self- assessment applying Item Response Theory creating a flexible instrument for measuring underlying traits of the participants (Covello, 2010, App. A). To establish face validity we had the questionnaire reviewed by four experts, three of which focused on the content validity and one expert evaluated the question construction to limit the introduction of leading, confusing or double-barreled questions. After that we ran a pilot test with survey instrument and received responses from 23 participants, which was about 10 percent

of the estimated sample size of 200 participants for final survey. Two questions of the first version were singled out as weak and discarded, so that thirty-nine questions of the original forty-one remained.

Context and the Participants

The participants consisted of three male and four female instructors from different geographical areas in Thailand. Participants were diverse in all three main groups: two from social science, four from science and technology and one from health science. All participants have consistent education backgrounds which relate to their work fields. Participants' teaching and researching experiences were in range of 5 - 15 years. Each participants was given pseudonym for the sake of this research as presented. Brief information of participants are described as follows.

Saifon is an assistant professor in science education, holding bachelor degree of science in physics, teaching diploma in science and doctoral degree in science education. She has taught physics and science teaching methods for undergraduate students, and science education courses at graduate level in one university in Bangkok of Thailand. She has seven year experiences of teaching and researching.

Suthida is an associate professor in pharmacy, holding bachelor degree of pharmacy, master degree of science in pharmacy (hospital pharmacy) and doctoral degree in pharmacy and pharmaceutical science. She has taught various pharmacy courses at all levels, bachelor, master and doctoral levels, especially in hospital pharmacy related field, in faculty of pharmacy at one university in the northern part of Thailand for 15 years.

Wiwaporn is a chemistry assistant professor, holding bachelor, master and doctoral degrees in chemistry, in faculty of science at one university in Bangkok, Thailand, having 12 years of teaching and researching experiences in chemistry and other related fields, such as occupational safety and health.

Chanapa is a lecturer in western music program, she has bachelor and master degree in western music, specialized in violin instrument. She has taught music undergraduate program at faculty of humanity of one university in the northern part of Thailand for 11 years.

Manut is a lecturer in physics and physics education in one of universities in Bangkok, Thailand. He has all doctoral, master and bachelor degrees in physics. He has five years of teaching experience in physics education undergraduate program courses.

Somchai is an assistant professor in science education, holding bachelor degree of science in chemistry, diploma of science teaching and doctoral degree in science and technology education. He has taught chemistry for undergraduate students and science education program courses at graduate level, having nine years of teaching and researching experiences in faculty of science at one university in the northeastern part of Thailand.

Prapaan is an assistant professor in science education, holding bachelor degree of science in physics, diploma of science teaching and doctoral degree in science and technology education. He has taught physics for undergraduate students and science education courses at graduate level. He has nine years of teaching and researching experiences in faculty of science at one university in the northeastern part of Thailand.

Qualitative data collection processes

In the present study, in addition to the quantitative approach, qualitative method was also employed to get the insights of Thai higher education instructors' digital technology perceptions, understandings, skills and their practices in their classrooms. An unstructured interview with seven Thai higher education instructors was conducted through mobile calling and the selected three participants' classroom observations at his/her institutions were also done respectively. The seven participants were obtained by volunteering through the authors' connections and contacts. In order to do so, we had asked 14 Thai higher education instructors and only ten Thai instructors accepted our invitation for interview. According to initial information about ten volunteering Thai university instructors obtained through institution website searching process, seven Thai university instructors across country were selected to take parts in qualitative data collection phase. All of them were interviewed with a set of questions related to the research questions and purposes, each interview lasting between 30 and 50 minutes. Those questions were in line with the framework of questionnaire used in online data collection phase of the study. Those framed questions were:

1. What is digital technology in your point of views and how does this relate to your teaching?
2. How do you perceive digital technologies?
3. What is your level of digital literacy/ how confident are you when using digital technologies for your courses/classroom teaching?
4. How do you learn and develop your digital skills?

5. What are the digital technologies/tools used in your current classroom teaching?

6. What are your strategies of using digital technologies/ When and How? /Do you have any learning theory related or belief?

In addition to those questions, there were additional and supplemented questions used to clarify the interviewed participants in order to get more in-depth data. After having interviewing data, the obtained data were reviewed and initially checked in order to seek for some specific points that can be used as a criteria for selecting three participants for classroom observation. As first round interview data analyses, three Thai instructors were selected and asked to get involved and get their permissions for their classroom observation as a part of data collection. The selected three instructors were chosen according to their interview results and responses that interested the researchers in terms of their belief and practices reflected during interview. One of the researchers had an appointment with each participant for setting the schedule for classroom observations. The three participants gave the researcher permission to take a filed note and take some photos in their classroom teaching.

Findings and Discussions

1. Quantitative data

Demographics

The distribution of the questionnaire resulted in 111 responses from 50 male (45%) and 61 female (55%) respondents with 69 being lecturers (62%), 36 assistant professors (32%) and 6 associate professors (6%). The age distribution of the participants range from early 20s to 60s and the majority group is between 36-40: 31 (27.9%), the second group is between 41-45: 28 (25.2%), then respectively, 31-35: 21 (18.9%), 46-50: 12 (10.8%), 51-55: 9 (8.1%), 56> 4 (3.6%), while the group with ranges of 20-25: 3 (2.7%)and of 26-30: 3(2.7%) are the lowest and have the same number. For the number of participants with certain experience in years, the majority of the participants with 6 – 10 years of experience is found 31.5%, the second group with11-15 years of experience is found 22.5%, the third group with 16-20 years of expereinces is found 14.4%, the fourth group with 21-25 years of experiences is found 5.4%, and the last two groups with the same amout: the group with 0-5 years of experience is found 1.8% and the group with more than 25 years of experiences is also found 1.8%.

Use of ICT

All participants use a version of Microsoft Windows operating system. Using the operating system's security settings is not common among the participants: only 15 adapt settings within a 3-month period, 70 in a much longer period and 26 are not sure how to do that. The participants' experiences with uploads are shown in Fig. 2.

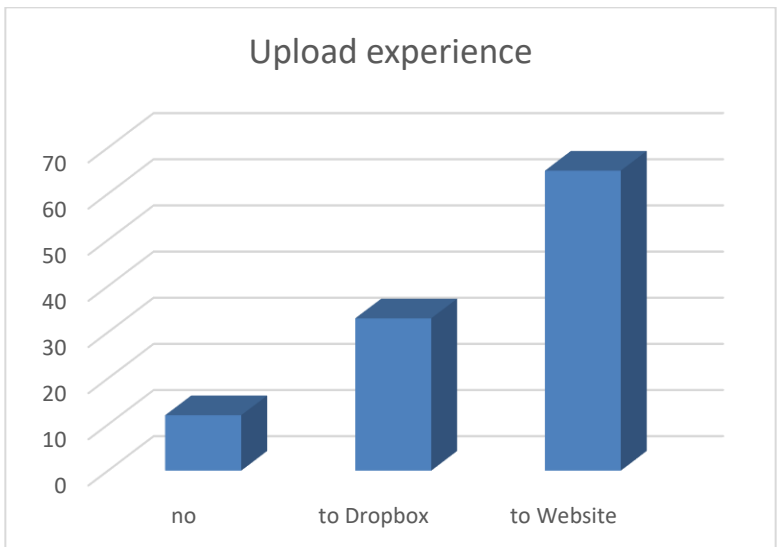

Figure 2 Upload experience

Regarding the use of social network service sites (e.g., Facebook) to contact their students, 95 of the participants use them on a regular basis, 13 sometimes and 3 are not sure to use them. Most participants are comfortable with installing software on their personal computers: 80 have done that in the last 12 months of response, 23 before that time and 8 have never done this. The use of antivirus software by the participants is depicted in Fig. 4, which shows both the use and the update mechanisms applied by participants (never updated, sometimes updated manually or updated automatically every day).

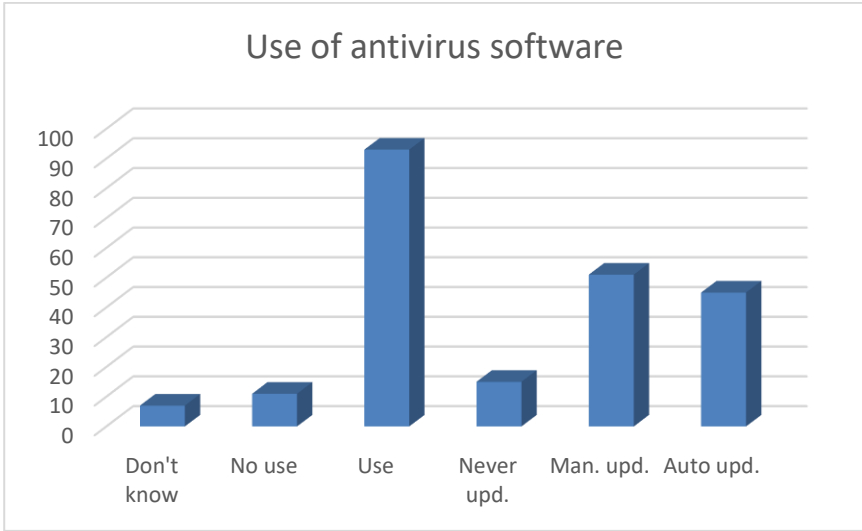

Figure 3 Use of antivirus software

Regarding the Web search, the overwhelming majority can use the history and bookmark function of their respective Web browser (103 to 8). The same holds for using the university's online catalog (OPAC), which was consulted by 98 participants but unknown by 13. The question regarding the search for journal articles was answered by participants as follows (Table 2):

Table 3 Search mechanisms for academic articles

Search for academic articles	Number of respondents
Article databases (Science Direct, Springerlink, with keyword search)	72
Google Scholar	3
No response	36
ResearchGate	0

It is noteworthy that such a small number of academics use such overall scientific databases as Google Scholar and ResearchGate. After all, ResearchGate is the leader in scientific communication with its more than 5 million researchers, who upload their papers for free or share

them on demand. In Fig. 3, the knowledge of copyright relating CC Commons is depicted. Less than a quarter of all participants has an understanding of this concept.

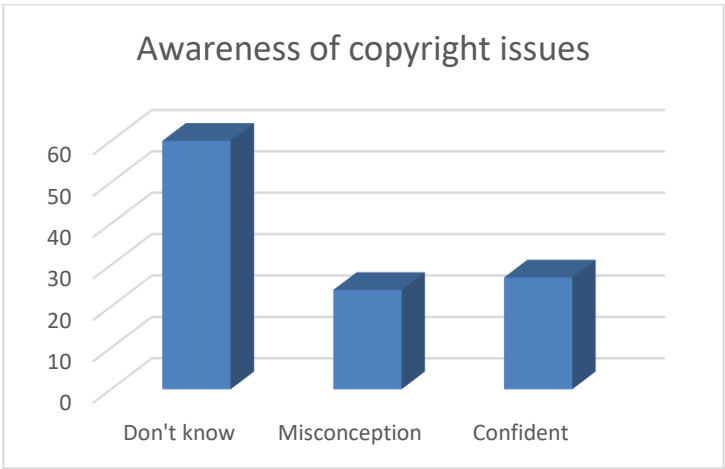

Figure 4 Copyright awareness

In overall, according to the quantitative data obtained, the results of the present study are similar to that of the survey research conducted by ECDL Foundation (2009) which examined digital literacy skills regarding Thailand and other 16 countries, indicating that the actual skill levels for Thais were much lower than the average of the 17 participating countries. Even though this present study focused on digital literacy of instructors at higher education institutions, the study still shows similar findings to that resulted from the research conducted with general population (ECDL Foundation, 2009). However, some digital literacy aspects such as the use of ICT in terms of uploading and using social network experiences were distinctly expressed by most of the participants. In addition, scientific databases and academic communication for work were also largely mentioned by the participants in the present study. This might be because most of the instructors have increasingly used emerging and freely available digital tools for their every work such as teaching and research and this resulted in the instructors expressed on copyright awareness, scientific databases as Google Scholar and ResearchGate, the use of antivirus software, the use of social network service sites.

2. Qualitative data

For qualitative data analysis, content analysis was employed as a key approach. In the analyzing process, all data obtained from individual interview with seven selected

participants and three cases of class observation were transcribed into text format. For processing the data, the four main stages suggested by Mariette Bengtsson (2016) was used. The four stages consisted of decontextualisation, recontextualisation. categorization, and compilation. In order to get the best validity of the study, the researcher and other two assistant researchers performed data analysis independently. After the separated data analyses were done, all the analyzed data were taken into discussion among the researchers and the assistant researchers to check the similarities and differences, resulting in the obtained consensus (Graneheim & Lundman, 2004). This process was performed for the sake of and as a form of triangulation. In addition, for the trustworthiness and rigors of the study, the being developed themes were sent back to the participants for member checking and verifying. According to the analyzed data, four main themes were generated such as

- Thai university instructors perceived digital technologies as supportive empowering learning tools for their students,

- TPACK is fundamental and necessary knowledge for effective use of digital technologies in Thai instructors' classrooms/courses, and

- Students' preferences and learning styles and technology availability are central to utilizing digital technologies in course and classroom teaching, and,

- Challenges and difficulties of utilizing digital technologies.

The mentioned four themes set as results and findings are presented. Some data are elaborated and discussed in the results and findings part.

3. Findings from qualitative part

To reach the themes obtained from data analyses, open coding process was carried out and then the codes were generated. Finally, all the categories and subcategories were collapsed into larger categories such as "Thai university instructors perceived digital technologies as supportive empowering learning tools for their students", "challenges and difficulties of utilizing digital technologies", "TPACK is fundamental and necessary knowledge for effective uses of digital technologies in Thai instructors classrooms/courses", and" students' preference and learning styles and technology availability are centric for utilizing digital technologies. Details of each themes are presented and discussed as follows.

Thai university instructors perceived digital technologies as supportive engaging and empowering learning tools for their students

All the interviewed participants have a very positive views on digital technologies and see them as very powerful tools for teaching and learning. The given technologies can have positive impacts on students' learning achievement. In addition, these technologies could be used to engage students in classroom teaching. The instructor participants all agreed that using digital technologies in course or classroom teaching would benefit them and their students in terms of learning and engagement. In terms of engaging and learning tools, Saifon, for instance, suggested that " when teaching general physics for undergraduate students, some animation and visualized experiments are always used for help students extend and conceptualize key concepts and the students appreciate and have positive reflection. " (Saifon). Accordingly, Manat and Somchai also similarly reflected that students in their class gain conceptual understanding more effectively when teaching with computer-based visualization and conducting visual laboratory investigation.

" When I (Instructor) teach in my class, I always try to get some digital technologies that match with the content and concepts I taught. For physics teaching, I like to use visualization and some visual laboratory experiments in my class and I think they [students] like it too because they [students] could grasp the concepts in the easier way". (Manat)

As engaged learning tools, digital technologies can be very useful for students when instructors assign them with meaningful tasks. Plickers, a paper code based tool for real time assessment, and Kahoot, a classroom response system tool, are exemplary tools for engaging students in classroom teaching. Manat illustrated that using Kahoot for lesson quiz at the beginning and at the end of the class is very engaging because it can get them [students] in competing with their peers while they can recall what they have learnt in the class. In addition, he suggested very positive effect of using Plickers in his class.

" Plickers is a very empowering tools for me. I always use it for checking students' presence and absence before starting my class. I also use it as a collecting tool of assessment because it [Plickers] can give me real time response and have individual information of each students". (Manat)

Figure 5 Students using Plickers in class

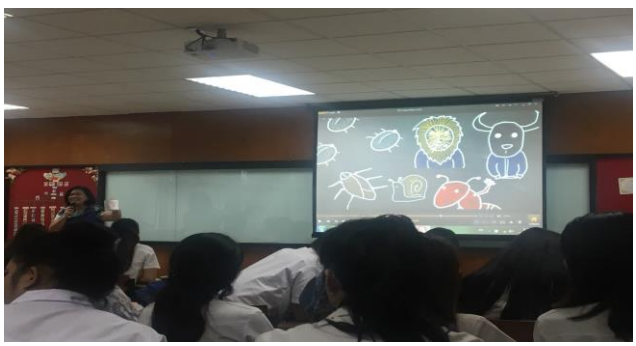

Figure 6 Instructor using Youtube for whole class activities

In addition to the exemplary tools mentioned previously, all of the participant also mentioned about using various forms online social media such as Facebook, Line or Tweeter with their students. All the participants reflected positive views and perceived digital technologies as engaging and empowering tools for their teaching at their institutions.

TPACK is fundamental and necessary knowledge for effective uses of digital technologies in Thai instructors' classrooms/courses

For developing instructors' knowledge and skills important for using digital technologies in their teaching practice, Manat, Somchai, Saifon, Suthida and Wiwapon suggested that instructors should have knowledge about how to integrate these technologies into their class. In addition, knowledge about how to design effective lesson using digital technologies is also very important. While Prapaan and Chanapa mentioned that knowing what to use and how to use all kinds of technologies is very important but we do not need to know everything because we

cannot use all of them. Saifon expressed the importances of the ways to use digital technologies for enhancing students' learning.

"I used to learn about PCK [Pedagogical Content knowledge] and that helped me design my lesson plans for my effective teaching and for integrating any kinds of digital technologies I think TPACK is another idea that can be brought into my lesson plan development. I think I have to learn more about this idea. Sometime, I need to study by myself. I do not know if my university have this kind of training or professional development". (Saifon)

Similarly, Manat also elaborated that for effective teaching, he had to have sufficient knowledge about how to use them [digital technologies] effectively. He added that he always learn these on his own and tried to get some trainings and workshops. In consistency with Manat, Somchai also expressed the importance of new knowledge that is imperative for integrating digital technologies for his effective teaching and learning. While others mentioned about the importance of knowledge on how to use technologies effectively, Chanapa reflected in opposite way for her western music class of undergraduate level.

"I might have some of them [students] watched technique and skills of how to play the tools [music instruments] from Youtube and I just used these as supplement after I taught them [students] in my class. I know it [digital technology] is very good tools for helping my students learn but I just do not think I need to know how to use it in my class. And I just use it by asking them [students] to search it [Youtube] and watch it". [Chanapa]

From these perspectives, the notion of Technological Pedagogical Content Knowledge (TPACK) has to be taken into consideration. This kind of knowledge was considered by the participants as very important when he or she come to use or integrate digital technologies into their teaching.

Students' preference, learning styles and technology availability are central to utilizing digital technologies in course and classroom teaching

As being Thai university instructors, they have perceived that teaching is considered as very important part of their careers. For developing and enhancing students' learning and class activities, all of the participants mentioned that incorporating digital technologies into their courses were very promising. One of the examples was illustrated by Manat's class observation. In Manat classrooms, he used various kinds of digital technologies during the class activities which were intentionally selected according to his students' feedback and reflection. He always collected

students' opinions and any feedback after classes. As a result, he could suitably use those digital technologies for next classes or with other classes. On the other hand, Wiwapon suggested that in trying any kinds of digital technologies, instructors need to consider the students' perspective and what their preferences about how they like to use it [digital technology]. She reflected about her class.

I did learn a few digital technologies and try some of them with my classes such online social network applications as Facebook and Line. One thing I always noticed that when it came to academics works or assignments, the uses of Facebook and Line applications would be more irritated for many of them [students]. Thus, this could result in negative communication problems between instructors and students. However, there were some positive feedback from some group of them [students]. This was because of that they [students] had difference learning styles. (Wiwapon)

Similarly, Somchai and Prapaan also reflected that students' preferences had to be part of course or lesson development. In addition, Somchai addressed that he and his department could not afford to get some learning technologies because of students' economic status and university budget policy. However, there were so many free applications and open freeware that available on the Internet. For making best uses of digital technologies for classroom teaching, all the participants agreed that students' need and feedbacks were very important as a fundamental for classroom or course integration of digital technologies. Another notion is that availability of current digital technologies is also the factor that instructors need to bear in mind during developing his/her course or lesson into which incorporate digital technologies.

Challenges and difficulties of utilizing digital technologies

In terms of integrating digital technologies into teaching, there were some concerns about challenges and difficulties expressed by the participants. One of the main concerns, for instance, is usability and design of some of digital technologies which have been used by many instructors. Somchai has used many kind learning management system (LMS) with his students such as Moodle and D4L+P (one university-owned LMS). After trying with his students, he found that there are some difficulties using those LMS. Some limitations users [students and instructors] have were the number of users using it at the same time were limited by the system, turning students away from using it. Another issue was that the complexity of the system and user interfaces were not user-friendly. It took so many steps to get what they want to reach and the

layouts got students confused easily. In short, problems with design and usability of given digital technologies employed have to be considered in order to maximize teaching and learning.

I got reflections and feedbacks from my class which I did try D4L+P LMS and Google classroom with and it [LMS used] was terrible from their [students] perspectives. They [students] encountered and had troubles getting into the pages they want to see. Sometimes, the system was not stable and its connectivity was not that good. These kinds of difficulties of the system [LMS] made me feel not comfortable using it [LMS]. These could turn me and my students away from using it [LMS]. (Somchai)

Similarly, Prapaan, Manat, Suthida and Saifon have resonated Somchai's problematic experiences of using digital technologies for his teaching. Saifon shared that she was disappointed with her uses of her A-Tutor, a university based LMS, because there are many difficulties while employing it for her classroom. Her students were confused with the system and expressed intention of not using it.

In addition, there were also some challenges about administrative and policy issues in some universities. Somchai admitted that he was not sufficiently supported from university administration and the IT support teams for getting digital technologies into workplaces. He had to learn and work on his own to figure out how LMS worked, taking him a big while to get know them. He added that he understood about the institutional economic status, but the university, at least, should have had supporting team and some trainings in order to exploit those digital technologies to enhance teaching and learning, resulting in quality education as expected.

Even though, positive perspectives of integrating digital technologies into teaching, there are also some obstacles on difficulties and challenges faced by the instructors. As thus, some modifications or adjustment in all stakeholders have to come to consider and figure the better ways for effective uses of digital technologies for enhancing teaching and learning.

We have collected data from a variety of participants regarding field of expertise, length of career as well as level of career. Digital literacy work takes place within rather different institutional settings but for the individuals it does not matter whether there is an institution wide approach or a less centralized build-up of communities of practice based on projects and interest groups. The findings reveal considerably diverse needs regarding access, practices and identities. As an example, master students needed a primary interface between the class members and the institution by which they could practice and communicate their learning outcomes. PhD students,

on the other hand, found it essential to have a tool at hand that supports detecting, investigating and sourcing information individually. It would have been rather surprising if we had not encountered these situations for the diverse groups of HEI instructors.

In discussing the findings, Mumtaz (2000), in his study, have examined how teacher receptivity to use digital media is influenced by a number of external factors, including access to equipment and other resources, quality of software and hardware, ease of use, incentives to change, support and collegiality in their school, school and national polices. This is similar to the emerged themes of the findings from the present study in terms of the higher education instructors' positive perception, challenges and difficulties of utilizing digital technologies in teaching practices. The findings about challenges and difficulties of utilizing digital technologies are also similar to the that of the study which researchers has identified attitudinal factors that influence how and why a teacher will (or will not) use digital media for teaching and learning in digital and media literacy (Flores-Koulish, Deal, McCarthy, McGuigan & Rosebrugh, 2011).

Conclusions and further work

In this research, we investigated the levels of knowledge, skills and competencies relating digital educational technology among instructors at higher education institutions in Thailand. Given that the most relevant amount of information is already available as digital information, may it be online or offline, the exhibition of appropriate digital skill sets are of utmost importance both for students and their instructors. This research has aimed at contributing to better understanding of this field of study by following two strands: the skill levels of instructors and their relative distance to those of their students.

In order to answer the research questions that investigated higher education instructors' digital literacy and their related competencies and practices, the findings suggest that the instructors have moderate level of digital literacy and more than half of the participating instructors exhibited some key fundamental digital skills and literacy which are related to their teaching practices and research work. Moreover, they perceived positive uses of digital technologies in their teaching practices in particular. However several instructors still employed simple forms with specific purposes of digital technologies for their teaching and research work as they recognized the importance of TPACK, and some challenges and difficulties. The findings suggest that there is still a need for specific training for enhancing their digital literacy in order for

them to suitably leverage technology or digital tools for their teaching practice and research in an effective way.

The outlook of necessary digital performances in the Industry 4.0 may lead to the notion of digital capacity of citizens, which has to be built in secondary and post-secondary education. Providing opportunities for critical thinking, creativity, problem solving and innovation may then empower learners to participate in a sustainable digital future (Confalonieri, 2015).

Non-specialists, i.e. laymen, increasingly participate in research projects worldwide by contributing either source data or use digital sources to conduct their own research. Scholars in the digital literacy field must include this part of the population as well when conducting their studies: quantitative, qualitative, or with a mixed methods approach. This may well lead to insights into the actual status of lifelong learning of digital skills among interested cohorts and the needs for offering informal learning platforms and opportunities by higher educational institutions.

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