



# Complete Research Report

## Project Title: Digital Literacy among Instructors of Higher Education Institutions in Thailand

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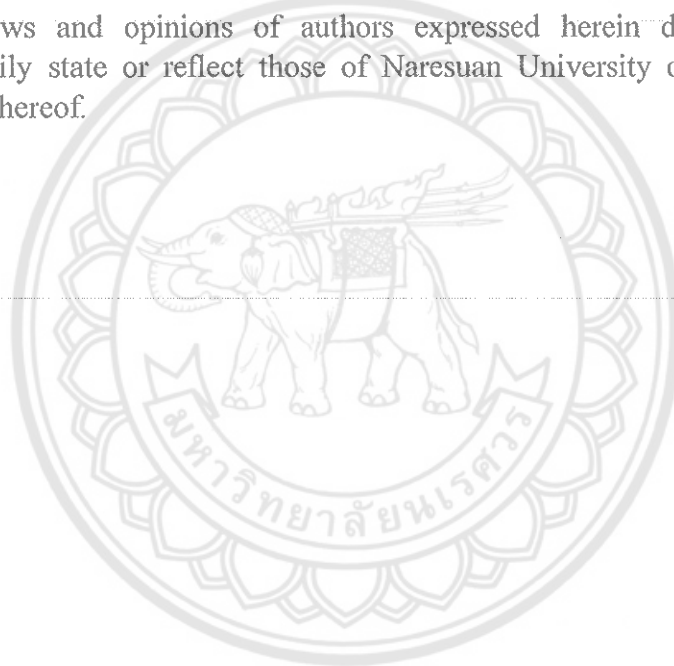
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## Executive summary

Thailand is striving to become a first-world nation. The recently announced framework Thailand 4.0 has been introduced to make Thai citizens ready for this endeavour. Shifting teachers' skills and the teaching processes needs *teaching the teachers* in the field of digital work. Consequently, instructors at higher education institutions need profound digital competencies to meet the demands of educating today's teachers for the future digital challenges. Even for the so-called digital natives the digital world is not self-explained. Being able to use a smartphone is more like being a passenger in a car and not necessarily being able to drive it. What Thailand 4.0 needs is citizens, particularly teachers, with a 'driving license' for digital technologies.

Digital literacy has gained increasing attention among scholars in recent years, both regarding theoretical and practical aspects of the topic. Moreover, the field of digital literacy studies has shifted from the emphasis of critical thinking to technological skills, literacies and competencies. Therefore, a vast amount of research has been reported on; nevertheless, 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 students for lifelong learning in the digital age.

A diverse set of digital skills and literacies is needed to meet the demands of the 21<sup>st</sup> century citizen at work and in personal matters. This changes expectations regarding the teachers' profession at all levels of the educational system including that involved in higher education.

In this research we have built on the concept of *TPACK*, or *Technological Pedagogical Content Knowledge*, which covers the whole set of knowledge areas teachers in the 21<sup>st</sup> century must master to be professional. The 'content' is the body of knowledge the students need to be able to work with, whereas the 'pedagogical knowledge' must be applied by the teachers to create the content knowledge in their students' minds. The third part of TPACK refers

to the extent teachers are able to use (digital) technology to make teaching effective and efficient within the boundaries of the curriculum and the conditions at their institutions.

In this mixed-method research we have applied a questionnaire in Thai language as the main data collection tool, which was available online. The data covered are, besides demographics, on technology use and attitudes towards technology in and for the classroom. Thailand is striving to become a first-world nation. The recently announced framework Thailand 4.0 has been introduced to make Thai citizens ready for this endeavour, and a major challenge thereby is to change the education system accordingly. The reform

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aims at *"transforming [the] learning ecosystem to purposeful learning, generative learning, mindful learning, and result-based learning. These shifts will lead to changes in goals and administration of the education system, teachers' skills and teaching paradigm, curriculum and teaching/learning methods"*<sup>1</sup>.

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*.

Regarding the educational sector, ASEAN countries including Thailand have to overcome a number of obstacles. Kearney (2015) states that ASEAN countries continue to teach content that is no longer relevant, using teaching methods that no longer benefit young students' minds. Further it is stated that ASEAN students need to learn new skills traditionally not considered as in those conservative societies: critical thinking, creativity, problem solving and digital literacy.

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<sup>1</sup> <http://thaicmbdc.org/agenda-1-prepare-thais-4-0-for-thailand-becoming-a-first-world-nation/> (accessed 2017-07-09)

Shifting teachers' competencies and the teaching processes needs teaching the teachers in the field of digital work. Consequently, instructors at higher education institutions need profound digital competencies to meet the demands of educating today's teachers for the future digital challenges. Even for the so-called digital natives the digital world is not self-explained. Being able to use a smartphone is more like being a passenger in a car and not necessarily being able to drive it. What Thailand 4.0 needs is citizens, particularly teachers, with a 'driving license' for digital technologies, i.e. digital competence. Competence has been defined for many different reasons and from various perspectives. There is no unified view on this concept, so we rely for practical reasons on the definition elaborated by the OECD (2002) as *"the ability to meet demands or carry out a task successfully, and consists of both cognitive and non-cognitive dimensions."* As a consequence, competency (or competence) is a broader concept than knowledge and skill and includes both.

Digital Literacy exists in a continuum, relative to currency of technology and also cultural and socio-economic contexts. The term encompasses many domains and meanings, "the question of what counts as technological literacies is complex" (Lankshear & Knobel, 1997) and many terms have been used synonymously to refer to Digital Literacy (European Commission, 2003) including: ICT Literacy (Educational Testing Service, 2002), ICT fluency (NRC, 1999), computer literacy (Williams, 2003), ICT skills (QCA, 2005), Technological literacy (ISTE, 1998), Media literacy (2005), information literacy (ACRL, 2004), (Bundy, 2004), eliteracy (Martin, 2000), Multiliteracies (Cope & Kalantzis, 2000) and 21st century literacies (Partnership for 21st Century Skills, 2002).

Many frameworks, standards, policies and benchmarking have been applied to the determination of digital literacy. Research undertaken has attempted to apply these, using various methodologies. Predominantly, this has included four main approaches for determining digital literacy levels - Surveys/questionnaires (majority of research to date), skills tests (considered expensive and time consuming), numbers achieving certification, or e-skill shortages. There has been minimal research employing combinations of these approaches to determine the validity and reliability of findings. This

survey represents the first substantive attempt at combining methodologies.

There are many frameworks for a measure of digital competency<sup>2</sup>, and for this report we have picked the most significant exponents for further and deeper evaluation. The more advanced frameworks tell us that there is no single measure that fits all purposes. Rather, a **diverse set of digital skills and literacies** is needed to meet the demands of the 21<sup>st</sup> century citizen at school, work and in personal life. This changes expectations regarding the teachers' profession at all levels of the educational system including higher education. When it comes to measuring digital skills and literacies conceptual confusion may arise due to the different approaches to the topic and to the convergence between digital literacy, media literacy and trans-literacy (Jordache et al., 2017).

Digital literacy also builds the basis for economic progress as has been stated in a recent report regarding ASEAN Economic Community 2025 (Kearney, 2015). The report proposes among other measures:

- *Revamp K-12 and higher education systems to develop the skills required for the 21st century, while digitizing other sectors of the local economy*
- *Ensure the digital ecosystem is ready to be an active enabler; for example, 100 percent broad-band access in all schools (urban, suburban, and rural areas) and colleges in ASEAN by 2020*
- *Nurture and protect local innovation by ensuring that they are digitally led (and thus ready for the 21st century) and get sufficient protection for intellectual property rights*

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<sup>2</sup> Also called digital driving license

*If ASEAN can implement these policies effectively, the region will be propelled into the vanguard of the digital revolution, making ASEAN's national economies more competitive and enriching the lives of citizens. Realizing this opportunity should be a top priority for the new ASEAN Economic Community. The first step is for ASEAN to create a Digital Economy Promotion Board to make recommendations on the digital economy, conduct market analysis, and establish and track metrics on ASEAN-wide digital progress to ensure this ASEAN digital revolution becomes a reality.*

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A major problem arises if we are to measure the level of digital literacy. Although a number of tools have been proposed in recent years, there is no generally accepted instrument for assessing digital literacy even for a specific group of population, e.g. junior high school students. Relating instructors, two frameworks have been proposed to cover the necessary skills and knowledge areas for being digitally literate: the Pedagogic ICT Licence and the UNESCO ICT Competency Framework for Teachers.

#### **Pedagogic ICT Licence**

This Danish initiative 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. To achieve this aim, teachers work in cooperation with a supervisor to choose those modules which are closer to their everyday teaching. Target group: current and prospective teachers.

#### **UNESCO ICT Competency Framework for Teachers**

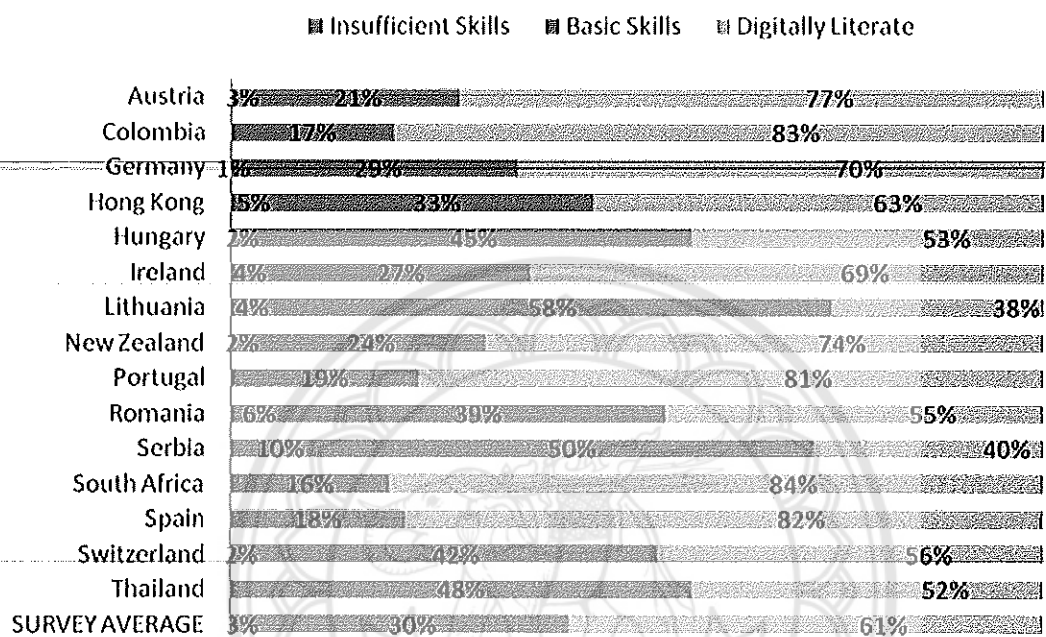
This framework aims to define various ICT competency skills for teachers in order to enable them to integrate technologies in their teaching and to develop their skills in pedagogy, collaboration, and school innovation using ICT. The UNESCO ICT-CFT project





Thailand: 66% perception of insufficient skills, confidence 47% and actual insufficiency 0%, which is a quite surprising result (ECDL Foundation, 2009).

## Actual Digital Literacy



Quite a few models of digital literacies have been proposed, most of which focus on students' practices and achievements. One such model was published by Sharpe and Beetham (2010) and has gained attention among practitioners and researchers (Bennett, 2014; Nerantzi, 2014). In contrast to most other models being based on a variety of digital literacies, Sharpe and Beetham offered a generic hierarchical model with access, skills, practices, and attributes to becoming a confident adopter of digital technologies in personal, academic and professional fields.

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:

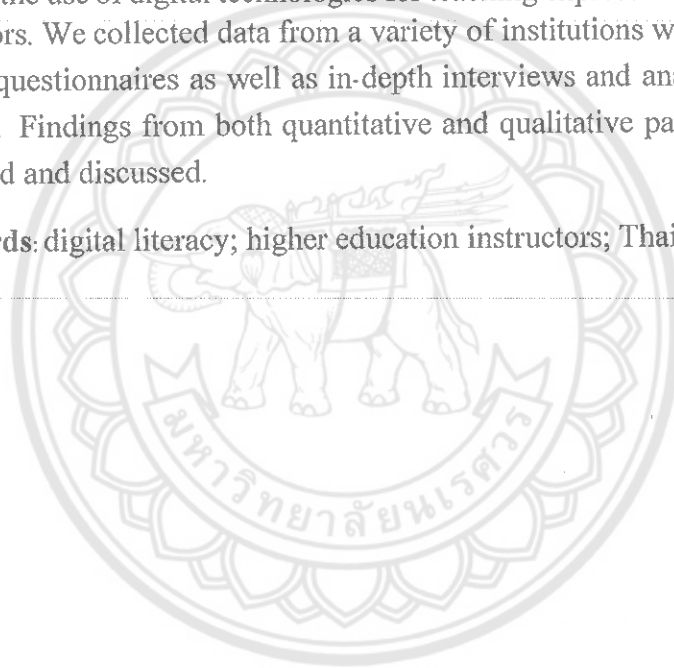
Framework	Description	References
CML Media Lit Kit	The CML (Centre for Media Literacy) provides the MediaLit Kit and establishes a basic framework featuring five core concepts and five key questions of media literacy. The framework aims to enable learners to deconstruct, construct and participate with media. It is seen as a reference for teachers, media librarians, curriculum developers, and researchers.	<a href="http://www.medialit.org/cml-medialit-kit">http://www.medialit.org/cml-medialit-kit</a> (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 the development of Digital literacy, which is seen as the convergence of several literacies.	Martin and Grudziecki, 2006

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.	<a href="http://ecdl.org/">http://ecdl.org/</a> (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.	<a href="https://cordis.europa.eu/project/rcn/78287_en.html">https://cordis.europa.eu/project/rcn/78287_en.html</a> (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)

## Abstract

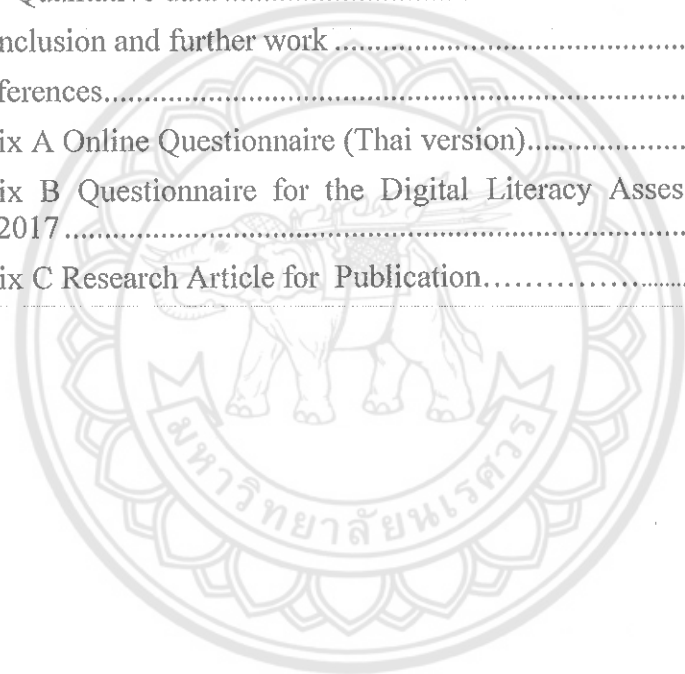
Many students in post-secondary education nowadays expect online spaces for learning as they are used to be quasi-always online via social network services and streaming sites. How much can instructors cope with the challenges of digital technologies expected to be used in contemporary higher education 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. Findings from both quantitative and qualitative parts are presented and discussed.

**Keywords:** digital literacy; higher education instructors; Thailand



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## 1. 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

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a period of oral communication, eventually script was introduced to transfer information and knowledge from generation to generation.

In the 16<sup>th</sup> 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).

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 (IBSA, 2013)**

<b>Digital Literacy E-skill Levels*</b>	<b>Description</b>
<b>Foundation e-skills 1.1 (AQF 1)</b>	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.
<b>Foundation e-skills 1.2 (AQF 2)</b>	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.
<b>Foundation e-skills 1.3 (AQF 3)</b>	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.
<b>Extension e-skills (Level 2-AQF 4-5)</b>	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.
<b>Strategic e-skills (Level 3-AQF 6+)</b>	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 (mmsf.io.org.uk).*

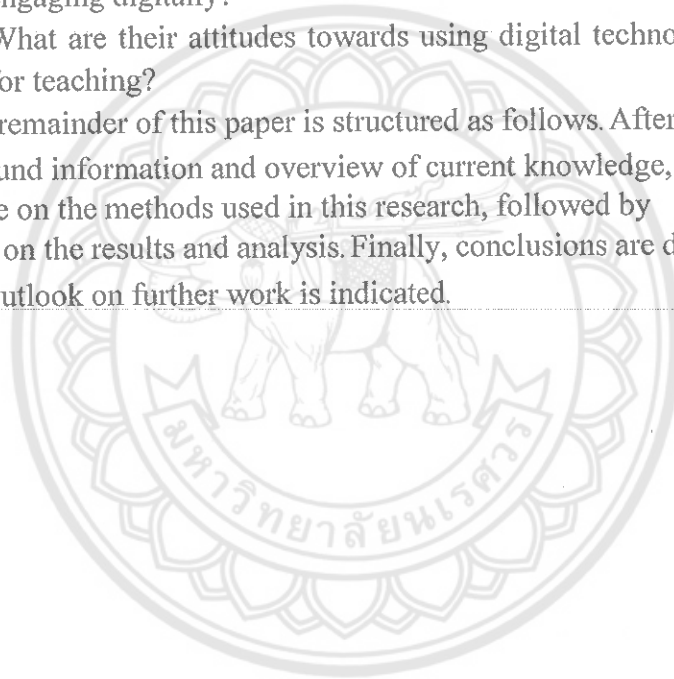
In practice the definition of e-skills is more complicated. If we consider the level of digital literacy exhibited by school administrators, the practical set of e-skills might not be that important rather the comprehension of current scope of digital literacy is necessary to provide leadership.

## Research Questions

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.



## 2. 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, Iordache 2016).

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 MediaLit 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.	<a href="http://www.medialit.org/cml-medialit-kit">http://www.medialit.org/cml-medialit-kit</a> (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	Martin and Grudziecki, 2006

	Competence. The main output of the project was a series of publications on a conceptual framework for 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.	<a href="http://ecdl.org/">http://ecdl.org/</a> (last accessed Jan. 25, 2018)
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### 3. 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).

#### 3.1 Quantitative part

The data collection tool 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.

### 3.2 Qualitative part

#### 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 participant 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.

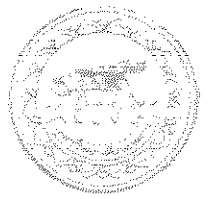
**Manut** is a lecturer in physics and physics education in one of universities in Bangkok, Thailand. He has all doctoral, master and bachelor degrees in physics. He has five years of teaching experience in physics education undergraduate program courses.

**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 and analysis**

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:

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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 field note and take some photos in their classroom teaching.

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. In the stage one of decontextualisation, the researcher reads through the transcribed text in order to get whole view of the happenings and then broke down the data into smaller meaning units which contain some insights or aspects answering the questions framed around the research purposes. Then, the researcher labeled the processed meaning units with code that can be understood accordingly to the context, as a part of open coding process (Berg, 2001). After identified, the meaning units with their codes were checked if they were covered and related to the research questions and purposes in the stage two of recontextualisation. Then, in the stage three of categorization, the researcher created the categories. In this process, themes and categories were identified. Sub-categories and sub-themes were also sorted. At the last stage of compilation, the researcher started to analyze and write down the results according to the themes and categories established.

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.



## 4. Findings and Discussions

### 4.1 Quantitative data

#### Demographics

The distribution of the questionnaire resulted in 111 responses from 50 male and 61 female respondents with 69 being lecturers, 36 assistant professors and 6 associate professors.

The age distribution of the participants is depicted in Fig. 1.

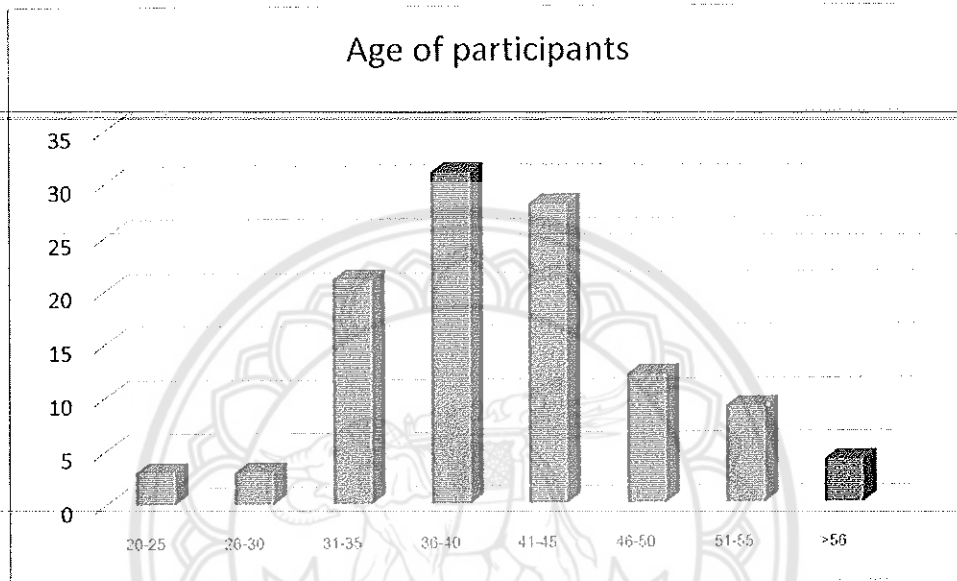


Figure 1. Age distribution of participants

The number of participants with certain experience in years is shown in Fig. 2.

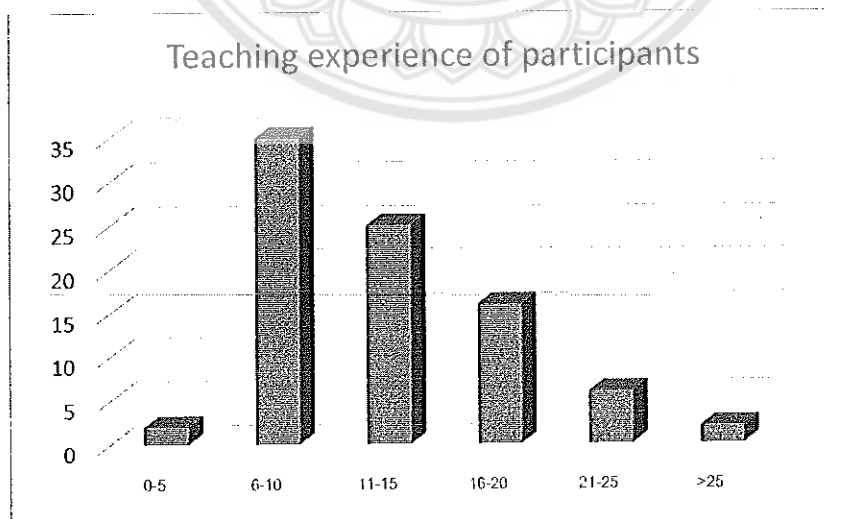


Figure 2 Experience in years

### 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. 3.

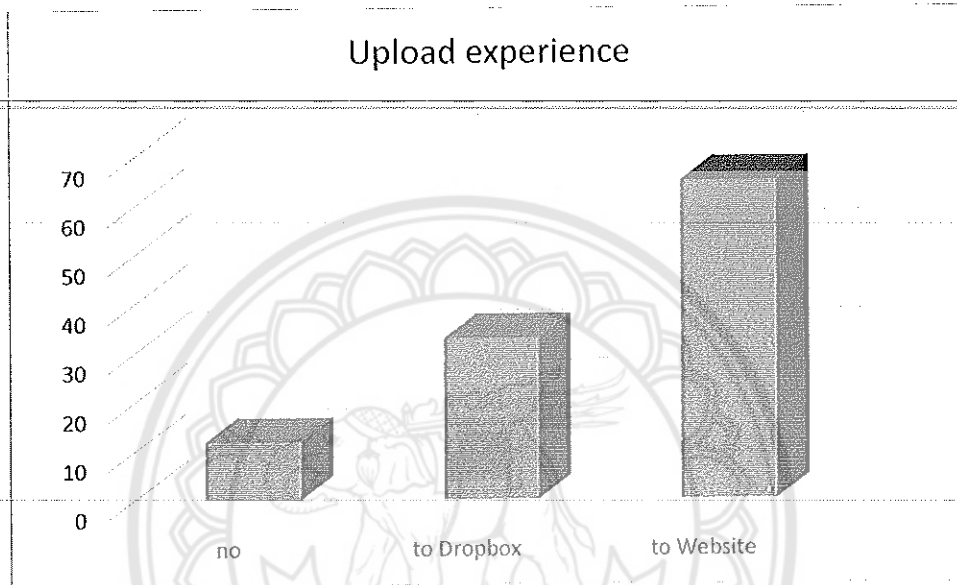


Figure 3 Upload experience

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).

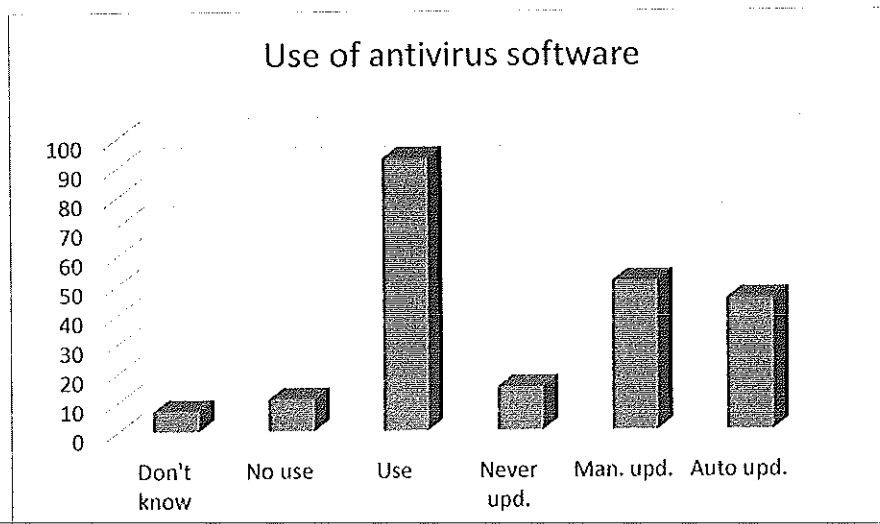


Figure 4 Use of antivirus software

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 3):

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. 5, the knowledge of copyright relating CC Commons is depicted. Less than a quarter of all participants has an understanding of this concept.

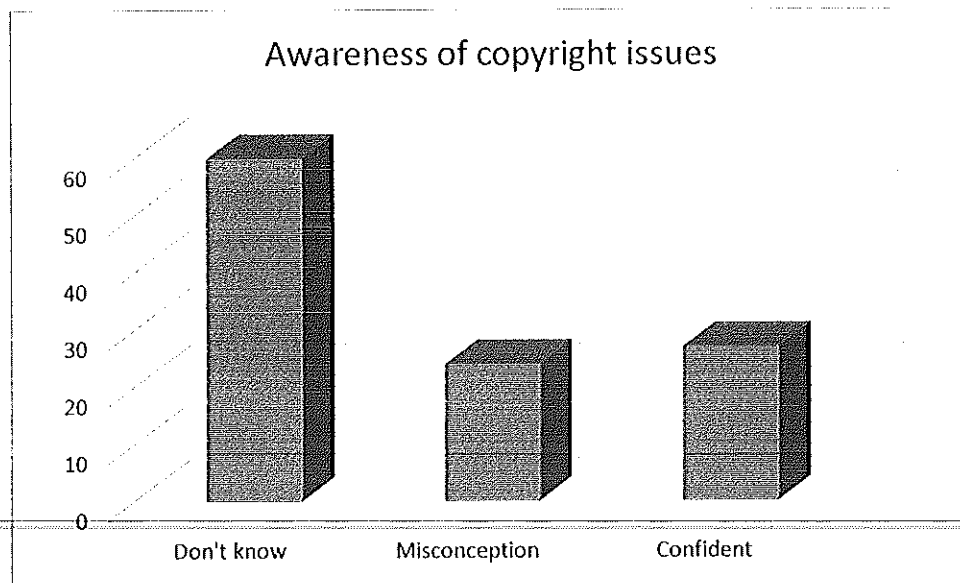


Figure 5 Copyright awareness

#### 4.2 Qualitative data

##### 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

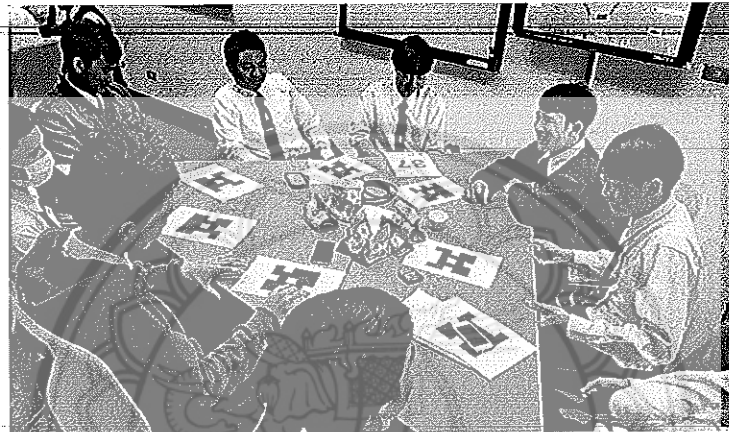


of learning and engagement. In terms of engaging and learning tools, Saifon, for instance, suggested that “when teaching general physics for undergraduate students, some animation and visualized experiments are always used for help students extend and conceptualize key concepts and the students appreciate 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. 6 Students using Plickers in class*



*Figure.7 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



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.

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## 5. 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. 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.

### *Implications and Practical steps*

Institutional SWOT analysis (Strength, Weaknesses, Opportunities, Threats)

A SWOT analysis for educational institutions is a tool that can provide hints to the governors, management teachers and staff involved in the analysis of what is effective and less effective in the institutional systems and procedures. Often used in preparation for a plan of some form (that could be an audit, assessments, quality checks etc.). In fact a SWOT can be used for any planning or analysis activity which could impact future finance, planning and



management decisions of the school or establishment. It can enable you ( the governors and management) to carry out a more comprehensive analysis.

*Lessons learned (recommendations to NU authorities)*

It is quite obvious that many people involved in tertiary education are critical of current administrative and operational processes. Moreover, many experience a lack of effective support towards teaching. The sole use of digital technology for teaching will not fix any such problems. Digital technology is being built for a variety of purposes, which have nothing in common with higher education. ~~The use of such digital technology products for teaching at universities will therefore not be effective in a straightforward way.~~ This leads to the following statement:

*University faculty and staff should be encouraged to build their own digital tools, which they need and feel comfortable with, instead of using prefabricated digital products that are designed to serve other purposes than teaching in higher education.*

Working with a wide variety of stakeholders in a large and complex organization many professionals have found that internal communications are a top priority. In order to encourage change we have also think that it is important to emphasize the benefits of developing digital literacy in order to make the most of the opportunities presented by the digital age. Rather than dictating standards we believe that highlighting innovative practice also gets people thinking creatively about their own accepted ways of doing things. We are encouraging peer group networks to share innovative ideas and examples of practice across professional and student groups. This is an ongoing process which never ends. There will always be a need to reflect and revise digital practice as new technologies emerge and therefore we believe that it is essential to embed and encourage iterative reflection.<sup>3</sup>

Implementation plan regarding the teaching staff:

- develop and implement coherent and cohesive skill support for digital technologies

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<sup>3</sup> <http://jisdesignstudio.pbworks.com/w/page/50732611/Digidol%20project>

- specify digital literacy expectations relating PDR, recruitment and personal development



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## Appendix A. Online Questionnaire (Thai version)

### แบบสอบถามสำหรับการประเมินการรู้ดิจิทัล

คำอธิบายเกี่ยวกับแบบสอบถามนี้

แบบสอบถามฉบับนี้ใช้สอบถามเกี่ยวกับการรู้ดิจิทัลของอาจารย์ระดับอุดมศึกษา โดยใช้เก็บข้อมูลระดับการรู้ดิจิทัลของผู้ร่วมตอบแบบสอบถามและความต้องการของตนเองในการพัฒนาทักษะด้านการรู้ดิจิทัลในอนาคต

แบบสอบถามฉบับนี้มีวัตถุประสงค์ในการหา ความเข้าใจเกี่ยวกับดิจิทัล การสืบค้นหาข้อมูลออนไลน์ การใช้ข้อมูลสารสนเทศดิจิทัล และการสร้างสรรค์เนื้อหาและสื่อดิจิทัลเพื่อการเรียนการสอน ข้อคำถามมุ่งศึกษาเกี่ยวกับสภาพการปฏิบัติจริงของผู้ตอบแบบสอบถามที่มีการใช้เทคโนโลยีดิจิทัลในการจัดการงานของตนเอง ดังนั้นแบบประเมินนี้ไม่ได้มุ่งวัดประเมินความรู้แต่เป็นการวัดประเมินสภาพการปฏิบัติงานจริงของแต่ละบุคคล

ข้อแนะนำในการทำแบบสอบถาม

ขอความกรุณาผู้ตอบแบบสอบถามทุกท่านเพื่อสละเวลาในการตอบแบบสอบถามนี้ เพื่อใช้เป็นข้อมูลในการทำวิจัยเกี่ยวกับการรู้ดิจิทัลและมุมมองของอาจารย์ผู้สอนในระดับอุดมศึกษาที่มีต่อการรู้ดิจิทัล ผู้วิจัยขอขอบพระคุณสำหรับการสละเวลาและความจริงใจในการตอบแบบสอบถามในครั้งนี้เป็นอย่างสูง

แบบสอบถามนี้แบ่ง ออกเป็น 4 ส่วน ดังต่อไปนี้

ส่วนที่ 1 : ข้อมูลพื้นฐานทั่วไปของผู้ตอบแบบสอบถาม Respondent's demographics

ส่วนที่ 2 การประเมินการรู้ดิจิทัลและสภาพการปฏิบัติการใช้ดิจิทัล Digital practice and literacy

ส่วนที่ 3 เจตคติที่มีต่อเทคโนโลยีดิจิทัล Attitude towards digital technology

ส่วนที่ 4 การรู้ดิจิทัลในการทำงาน Digital literacy at work

กรุณาทำเครื่องหมาย (✓) หรือ/และ เติมข้อความลงในช่องการประเมินอย่างตรงไปตรงมา

ส่วนที่ 1 ข้อมูลพื้นฐานทั่วไปของผู้ตอบแบบสอบถาม

- 1.1 เพศ  ชาย  หญิง
- 1.2 อายุ (ปี)  20- 25  26-30  31-35  36- 40  
 41- 45  46- 50  51-55  56 ขึ้นไป
- 1.3 ระยะเวลาของประสบการณ์ด้านการสอน/วิจัย (ปี)  
 0 – 5  6-10  11- 15  16 – 20    
21 -25      มากกว่า 25 ปี ขึ้นไป
- 1.4 วุฒิการศึกษาสูงสุด  
 ปริญญาตรี  ปริญญาโท  ปริญญาเอก   
หลังปริญญาเอก
- 1.5 ตำแหน่งวิชาการ  
 อาจารย์  ผู้ช่วยศาสตราจารย์  รอง   
ศาสตราจารย์      ศาสตราจารย์
- 1.6 กลุ่มคณะ/วิทยาลัย/สำนักวิชาที่ท่านสอน/วิจัย  
 กลุ่มวิทยาศาสตร์และเทคโนโลยี  กลุ่ม  
วิทยาศาสตร์การแพทย์  
 กลุ่มมนุษยศาสตร์และสังคมศาสตร์  กลุ่มอื่น  
(โปรดระบุ).....
- 1.7 สาขาวิชาที่ท่านสนใจและมีความเชี่ยวชาญเป็นพิเศษ (เช่น  
ประวัติศาสตร์ไทย วิศวกรรมไฟฟ้า เคมีอินทรีย์ และอื่นๆ  
เป็นต้น )  
.....

## ส่วนที่ 2 การประเมินการรู้ดิจิทัลและสภาพการปฏิบัติการใช้ดิจิทัล

Digital practice and literacy

### ส่วนย่อยที่ 2.1 ความเข้าใจเกี่ยวกับสภาพการปฏิบัติการใช้ดิจิทัล

2.1.1 นอกจากระบบปฏิบัติการวินโดวส์ของไมโครซอฟท์ ท่านได้ใช้

ระบบปฏิบัติการใด

ข้าพเจ้าได้ใช้..... ข้า  ไม่แน่ใจ

2.1.2 ข้าพเจ้าได้มีการปรับตั้งค่าความเป็นส่วนตัว

ข้าพเจ้าได้ทำเป็นปกติสม่ำเสมอ ทุกๆ 3 เดือน



- ข้าพเจ้าได้ทำ แต่ไม่ค่อยสม่ำเสมอ  
 ข้าพเจ้าไม่แน่ใจว่าจะต้องทำอะไร  
 2.1.3 ข้าพเจ้าได้อัพโหลดไฟล์เข้าระบบเว็บไซต์อินเทอร์เน็ต (ไม่ใช่เพียงแค่  
 การแนบไฟล์ในอีเมล)  
 ข้าพเจ้าได้ทำการอัปโหลดเว็บไซต์  
 ข้าพเจ้าได้อัพโหลดไฟล์เพียง 1 เว็บไซต์ เช่น ใน Dropbox  
 ข้าพเจ้าไม่แน่ใจว่าจะต้องทำอะไร  
 2.1.4 ข้าพเจ้าใช้บริการสังคมออนไลน์ (เช่น Facebook หรือ Line) ในการ  
 ติดต่อนักเรียน   
 ข้าพเจ้าได้ทำใช้เป็นประจำ  
 ข้าพเจ้าได้ทำแต่ไม่สม่ำเสมอ  
 ข้าพเจ้าไม่แน่ใจว่าจะต้องทำอะไร  
 2.1.4 ข้าพเจ้าได้ทำการติดตั้งซอฟต์แวร์แอปพลิเคชันใหม่ ลงบนใน  
 คอมพิวเตอร์  หนึ่งตัว  
 ใช่ ข้าพเจ้าได้ทำภายในช่วง 12 เดือนที่ผ่านมา  
 ใช่ ข้าพเจ้าได้ทำในช่วงมากกว่า 12 เดือนที่ผ่านมา  
 ไม่ใช่ ข้าพเจ้าไม่เคยทำ  
 2.1.5 ข้าพเจ้าได้ใช้โปรแกรมซอฟต์แวร์ป้องกันไวรัส  
 ใช่ ข้าพเจ้าได้ใช้  
 ไม่ใช่ ข้าพเจ้าไม่ได้ใช้  
 ข้าพเจ้าไม่แน่ใจว่าจะต้องทำอะไร  
 2.1.6 ข้าพเจ้าได้ทำการอัปเดตโปรแกรมซอฟต์แวร์ป้องกันไวรัส  
 ข้าพเจ้าได้ทำการอัปเดตแบบอัตโนมัติประจำทุกวัน  
 ข้าพเจ้าได้ทำการอัปเดตด้วยตัวเองบ้าง บางครั้ง  
 ข้าพเจ้าไม่เคยทำ  
 2.1.7 ข้าพเจ้าได้ใช้เครือข่ายไวไฟ  
 ข้าพเจ้าได้ใช้ในช่วง 1 สัปดาห์ที่ผ่านมา  
 ข้าพเจ้าได้ใช้ในช่วงเวลามากกว่า 1 สัปดาห์ที่ผ่านมา  
 ข้าพเจ้าไม่เคยใช้ หรือไม่แน่ใจว่าสิ่งนี้คืออะไร  
 2.1.8 ข้าพเจ้าได้แชร์การเชื่อมต่อไวไฟ (เช่น แชร์การเชื่อมต่อไวไฟจาก  
 มือถือ)  
 ข้าพเจ้าได้ทำในช่วง 1 เดือนที่ผ่านมา  
 ข้าพเจ้าได้ทำในช่วง 1 ปีที่ผ่านมา

ข้าพเจ้าไม่เคยทำ หรือไม่แน่ใจว่าสิ่งนี้คืออะไร

2.1.9 ข้าพเจ้าได้ทำการติดตั้งแอปพลิเคชันลงในมือถือของตัวเอง

ข้าพเจ้าได้ทำในช่วง 1 เดือนที่ผ่านมา

ข้าพเจ้าได้ทำในช่วง 1 ปีที่ผ่านมา

ข้าพเจ้าไม่เคยทำ หรือไม่แน่ใจว่าต้องทำอะไร

ส่วนย่อยที่ 2.2 การประเมินการรู้ดิจิทัลและสภาพการปฏิบัติการใช้ดิจิทัล

2.2.1 ข้าพเจ้ารู้วิธีการใช้ Boolean operators (เช่น AND, OR)

ในเซิร์ทเอนจินทางอินเทอร์เน็ต

ใช่ ข้าพเจ้ารู้

ข้าพเจ้าไม่แน่ใจว่าต้องทำอะไร

2.2.2 ข้าพเจ้าได้ใช้เครื่องมือสำหรับการสืบค้นเว็บไซต์ที่ข้าพเจ้าได้ทำการสืบค้นมาก่อนหน้า

ใช่ ข้าพเจ้าทำได้

ข้าพเจ้าไม่แน่ใจว่าต้องทำอะไร

2.2.3 ข้าพเจ้าเคยสืบค้นหาสื่อวัสดุเนื้อหาแบบไม่เสียค่าใช้จ่ายเพื่อใช้ในการเรียนการสอนแบบออนไลน์ของตนเอง เช่น Open Learning Resources หรือ Wikiversity

ใช่ ข้าพเจ้าเคย

ไม่ ข้าพเจ้าไม่เคย

ข้าพเจ้าไม่

แน่ใจว่าต้องทำอะไร

2.2.4 ข้าพเจ้าเคยเปลี่ยนจำนวนหน้าสำหรับการแสดงผลการค้นหาในเซิร์ทเอนจินทางอินเทอร์เน็ต

มากกว่า 20 ผลการค้นหาต่อหน้า  20 ผลการค้นหาต่อหน้า

ข้าพเจ้าไม่แน่ใจว่าต้องทำอะไร

2.2.5 ข้าพเจ้าเคยสืบค้น จากระบบ OPAC ของห้องสมุดมหาวิทยาลัย

ได้สืบค้นในช่วง 12 เดือนที่ผ่านมา

ได้สืบค้นมากกว่า 12 เดือนที่ผ่านมา

ข้าพเจ้าไม่แน่ใจว่าต้องทำอะไร

2.2.6 ข้าพเจ้าเคยใช้ฐานข้อมูลออนไลน์ของมหาวิทยาลัยเพื่อสืบค้น  
รายงานและบทความ

- ได้สืบค้นในช่วง 12 เดือนที่ผ่านมา
- ได้สืบค้นมากกว่า 12 เดือนที่ผ่านมา
- ข้าพเจ้าไม่แน่ใจว่าต้องทำอะไร

2.2.7 ระบุฐานข้อมูลออนไลน์ที่ดีที่สุด (ในสาขาของท่าน)

- ไม่มี
- ไม่แน่ใจว่าชื่อฐานข้อมูลอะไร

2.2.8 ข้าพเจ้าระบุชนิดของไฟล์ (เช่น PDF) ในการสืบค้น  
ฐานข้อมูลออนไลน์

- ใช่
- ไม่แน่ใจว่าทำอะไร

2.2.9 ท่านจะอย่างไรเมื่อท่านต้องการสืบค้นบทความทั้งหมดที่อยู่  
บนฐานข้อมูลหนึ่งที่ท่านสนใจ

ส่วนย่อยที่ 2.3 การใช้ข้อมูลดิจิทัล

2.3.1 ข้าพเจ้าตรวจสอบข้อมูลที่ได้จากการสืบค้นออนไลน์ก่อน  
นำมาใช้ในการสอน

- ได้ตรวจสอบทุกครั้ง
- ได้ตรวจสอบบางครั้ง
- ไม่แน่ใจว่าต้องทำอะไร

2.3.2 ข้อมูลที่อยู่ภายใต้ “สัญญาอนุญาตครีเอทีฟคอมมอนส์  
(Creative Commons licenes : CC Licenes)” คือ

- ข้อมูลที่ได้รับการสนับสนุนให้มีการแจกจ่ายฟรี
- ข้อมูลที่ผู้ถือลิขสิทธิ์ต้องเห็นชอบในการแจกจ่ายข้อมูลเป็น  
รายบุคคลไป

- ข้าพเจ้าไม่ทราบ

2.3.3 Torrent files คือ

- ไฟล์ที่มีการแบ่งปันข้อมูล
- สิ่งที่เกิดกฎหมาย
- ข้าพเจ้าไม่ทราบ

2.3.4 ข้าพเจ้าคัดลอกและวาง (Copy and Paste) ข้อความจากอินเทอร์เน็ต โดย

- มีการอ้างอิงแหล่งข้อมูล
- มีการเรียบเรียงข้อความใหม่ แต่ไม่ได้อ้างอิงแหล่งข้อมูล
- ไม่อ้างอิงแหล่งข้อมูล (ข้าพเจ้าไม่ทราบว่าต้องทำอะไร)

2.3.5 ข้าพเจ้ามีข้อมูลใน SD card

- ในช่วง 12 เดือนที่ผ่านมา
- มากกว่า 12 เดือนที่ผ่านมา
- ไม่มี หรือ ข้าพเจ้าไม่แน่ใจว่าต้องทำอะไร

2.3.6 ข้าพเจ้าใช้ flash drive เพื่อจัดเก็บข้อมูล

- ในช่วง 12 เดือนที่ผ่านมา
- มากกว่า 12 เดือนที่ผ่านมา
- ไม่มี หรือ ข้าพเจ้าไม่แน่ใจว่าต้องทำอะไร

2.3.7 ท่านใช้อะไร (เช่น Google Drive/Docs) สำหรับการทำงานร่วมกันแบบออนไลน์

ส่วนย่อยที่ 2.4 การสร้างข้อมูลดิจิทัล

2.4.1 ท่านสร้างหรืออัปเดตข้อมูลออนไลน์ (เช่น เพจบน World Wide Web หรือ เพจใน Wiki) ครั้งล่าสุดเมื่อไหร่

- ภายใน 3 เดือน
- มากกว่า 3 เดือนที่ผ่านมา
- ไม่เคย

2.4.2 ท่านถ่ายรูปหรือวิดีโอผ่านทางโซเชียลมีเดีย ครั้งล่าสุดเมื่อไหร่

- เดือนที่แล้ว
- มากกว่า 1 เดือนที่ผ่านมา
- ไม่เคย

2.4.3 ท่านแก้ไขรูปภาพหรือวิดีโอผ่านทางโซเชียลมีเดีย ครั้งล่าสุดเมื่อไหร่

- ในช่วง 12 เดือนที่ผ่านมา
- มากกว่า 12 เดือนที่ผ่านมา
- ไม่เคย

2.4.4 ข้าพเจ้าเคยแบ่งปันข้อมูลให้นักเรียนโดยใช้ cloud services

- เคย แต่ไม่ใช่ข้อมูลส่วนตัว
- เคย รวมถึงข้อมูลส่วนตัว
- ไม่เคย หรือ ข้าพเจ้าไม่แน่ใจว่าต้องทำอะไร

2.4.5 ข้าพเจ้าเคยใช้โซเชียลมีเดียที่สร้างขึ้นสำหรับครูโดยเฉพาะ (ที่ไม่ใช่ Facebook, Google Plus, LinkedIn, Pinterest, Twitter, WhatsApp หรืออื่นๆ)

- ในช่วง 12 เดือนที่ผ่านมา
- มากกว่า 12 เดือนที่ผ่านมา
- ฉันรู้จัก Facebook แต่ไม่ทราบว่า Facebook มีบริการ

สำหรับครูโดยเฉพาะ

2.4.6 ข้าพเจ้าใช้ layer ในโปรแกรมกราฟฟิก เช่น Photoshop

- ในช่วง 12 เดือนที่ผ่านมา
- มากกว่า 12 เดือนที่ผ่านมา
- ไม่เคย

2.4.7 ข้าพเจ้าแก้ไขวิดีโอดิจิทัล

- ในช่วง 12 เดือนที่ผ่านมา
- มากกว่า 12 เดือนที่ผ่านมา
- ไม่เคย

ส่วนที่ 3 เจตคติต่อเทคโนโลยีดิจิทัล

ข้อ	เห็นด้วยอย่างยิ่ง	เห็นด้วย	ไม่แน่ใจ	ไม่เห็นด้วย	ไม่เห็นด้วยอย่างยิ่ง
3.1 เทคโนโลยีดิจิทัลมีความสำคัญ เมื่อข้าพเจ้าต้องการสืบค้นข้อมูลออนไลน์ต่างๆ					
3.2 เทคโนโลยีดิจิทัลมีความสำคัญ เมื่อข้าพเจ้าต้องการเข้าถึงอินเทอร์เน็ต					

3.3	เทคโนโลยีดิจิทัลมีความสำคัญ เมื่อข้าพเจ้าต้องการทราบเทคโนโลยีล่าสุด					
3.4	ข้าพเจ้ารู้สึกไม่สบายใจเมื่อไม่มีโทรศัพท์					
3.5	ข้าพเจ้ารู้สึกไม่สบายใจเมื่อไม่มีอินเทอร์เน็ต					
3.6	ข้าพเจ้าต้องพึ่งพาเทคโนโลยี					
3.7	เทคโนโลยีช่วยแก้ปัญหาต่างๆ ของข้าพเจ้า					
3.8	เทคโนโลยีทำให้ทุกอย่างเป็นไปได้					
3.9	เทคโนโลยีช่วยให้ข้าพเจ้าประสบความสำเร็จมากขึ้น					
3.10	เทคโนโลยีใหม่ๆ ทำให้ข้าพเจ้าเสียเวลามากขึ้น					
3.11	เทคโนโลยีใหม่ๆ ทำให้ชีวิตข้าพเจ้าซับซ้อนยิ่งขึ้น					
3.12	เทคโนโลยีใหม่ๆ ทำให้ข้าพเจ้าออกห่างจากสังคมมากขึ้น					

#### ส่วนที่ 4 การรู้ดิจิทัลในการทำงาน

##### 4.1 ท่านสอนรายวิชา/เนื้อหาใด

4.2 ท่านนำเทคโนโลยีใดมาใช้สำหรับการสอน (เช่น โปรแกรมนำเสนอผลงาน (Power point) หรือ กระดานอัจฉริยะ (smart-board))

4.3 ท่านมีแนวทางหรือกลยุทธ์ใดในการนำเทคโนโลยีมาใช้ในชั้นเรียน (นำเทคโนโลยีมาใช้อย่างไร)

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4.4 ท่านมีวิธีการพัฒนาความรู้และทักษะด้านดิจิทัลสำหรับการสอน  
ของท่านอย่างไร

4.5 ท่านเคยเข้าร่วมกิจกรรมเสริมหลักสูตรเกี่ยวกับการใช้เทคโนโลยี  
เพื่อการสอนหรือไม่ (เช่น โครงการอบรมเชิงปฏิบัติการ ต่างๆ )

- เคย  ไม่เคย  
[ถ้าเคย : โปรดระบุระยะเวลาย้อนหลัง  
ล่าสุด \_\_\_\_\_ ปี/เดือน/สัปดาห์]  
กิจกรรมหรือโครงการที่เคยเข้าร่วม

4.6 ท่านคิดว่าการอบรมเกี่ยวกับการใช้เทคโนโลยีทางการศึกษา  
เพิ่มเติมจะเป็นประโยชน์ต่อการสอนของท่านหรือไม่

- ใช่  ไม่ใช่ [เพราะเหตุ  
ใด \_\_\_\_\_ ]

4.7 ท่านคิดว่าท่านอยากใช้เทคโนโลยีใดเพื่อการเรียนการสอนของ  
ท่าน เช่น เทคโนโลยีเสมือนจริง Virtual Reality หรือ เทคโนโลยี  
การพิมพ์แบบสามมิติ 3D printing

## Appendix B. Questionnaire for the Digital Literacy Assessment Project 2017

The questionnaire is the second instrument to measure digital skills of instructors in Higher Educational Institutions (HEI). It is used for gathering data (1) on the skill levels of the participants and (2) on their personal needs for further development of the skills. Whereas the data on (1) are collected by objective measurement, the data on (2) are subjective.

### 1. Guiding ideas for the questionnaire design

~~The questionnaire aims to measure the following constructs~~

- Understanding digital practices
- Finding information online
- Using digital information
- Creating digital products for teaching and learning

The questions are usually targeted at the actual practices that respondents use to manage tasks with digital technology. Consequently, the questionnaire is not about self-assessment of knowledge but of individual practice.

Example:

*Instead of asking "How confident are you to find an expert in your field online?" we ask "Have you ever found an expert in your field online?" and if the answer is "Yes", we detail the level of difficulty by asking "How long did this process take?"*

Most of the questions in the questionnaire are closed questions with three answer choices. The answers are weighted but each question has its own weights according to the relative maturity respondents have to show in order to answer the question, or in other words the relative importance of the question topic.

Examples:

*The answers to the question "I have installed new application software on my personal computer" have a higher weight than the answers to the question "I have shared files with my students using cloud services" because the former is a basic task when maintaining one's personal*



computer and the latter task can be achieved through different means, e.g. sending email attachments.

The questions of the questionnaire focus primarily on practices and skills related to personal computers. This is due to three aspects:

1. Whereas the straightforward questions relating to the knowledge of the participant can also be answered by smartphone users and gain a high score, the questions regarding the practical aspects (creating and using information) need the participant to be able to use personal computers or similar powerful devices. M-learning might be an exception here.
2. Most instructors at higher educational institutions have been raised and taught with personal computers, so it would place unnecessary bias towards smartphones if we would focused on those devices.
3. The contemporary working environments in many fields of business still rely on the use of personal computers and sometimes even mainframe computers. Teachers should have a broad understanding of related technologies to prepare the future workforce (i.e., their students) for these environments.

## **2. Questionnaire (in English, the basis for translation into Thai language)**

Besides the more technical/pedagogical questions, there are questions about the demographics of the respondents (sex, age, years of experience and so on).

Moreover, we want to know which aspects regarding the guiding principles are of importance to the respondents (understand the use of tools, find information, create information, etc.).

It would be useful to create an online questionnaire employing the Item Response Theory employing the Rasch Method. This means the questions would vary from respondent to respondent according to their responses.

The questions usually have three answer choices that are matched to three levels of digital literacy.

Category	Question	Level 1	Level 2	Level 3
	1. I have used a different Operating System than Windows	Yes	No, I have used only Microsoft Windows.	I am not sure.
	2. I adjust my privacy settings	Regularly, e.g. every three months	Not regularly	I am not sure how to do this.
	3. I have uploaded files to Internet sites (not just as email attachments)	To different sites	To one site, e.g. Dropbox	I am not sure how to do this.
<b>Understanding digital practices</b>	4. I use social network service (e.g. Facebook or Line) to contact my students.	I usually do this.	Not regularly	I am not sure how to do this.
	5. I have installed new application software on my personal computer.	Yes, within the last 12 months.	Yes, more than 12 months ago.	Never.
	6. I use antivirus software.	Yes	No	I am not sure how to do this.
	7. I update my antivirus software ...	automatically every day.	manually sometimes.	never.
	8. I last used a Wifi network ...	during the past seven days.	more than a week ago.	never, or I am not sure what this is.
	9. I have shared my Wifi connection	during the last month.	during the last year.	I am not sure what this is.
	10. I have installed apps on my smartphone ...	during the last month.	during the last year.	I am not sure how to do this.
<b>Finding information online</b>	11. I know how to use Boolean operators in my Internet search engine.	Yes	-	I am not sure how to do this.

	12. I use a feature for finding Websites I have visited before	Yes	-	I am not sure how to do this.
	13. I have searched for free teaching materials online, e.g. Open Resource and Wikiversity	Yes	No	I am not sure how to do this.
	14. I have changed the number of search results in my Internet search engine to	more than 20 per page.	20 per page.	I am not sure how to do this.
	15. I have searched the OPAC from my institution's library.	During the last 12 months	More than 12 months ago	I am not sure how to do this.
	16. I have used an academic online database (e.g. Springerlink, Ebsco or ERIC) to find reports and papers.	During the last 12 months	More than 12 months ago	I am not sure how to do this.
	17. Which is the best online resource for your broader field of work (e.g., science, technology, education, mathematics)?	.....	There is none.	I am not sure what this is.
	18.			
	19. I use the feature for finding only online search results with specific file types (e.g. PDF)	Yes		I am not sure how to do this.
	20. I can search for all the references to a specific academic article online.	Yes		I am not sure how to do this.

	21. I verify information from online sources before I use it for teaching.	I usually do this.	Not regularly	I am not sure how to do this.
	22. Information licensed under the CC License supports ...	free distribution of digital materials.	the copyright holder, who must agree to further individual distribution of the information	something that I don't know.
<b>Using digital information</b>	23. Torrent files are ...	for sharing information and materials.	always illegal.	something that I don't know.
	24. I copy and paste text from the Internet ...	and cite the source.	and paraphrase the text without references.	without references - or, I am not sure how to do this.
	25. I have SD card information	during the last 12 months	longer than 12 months ago	never, or I am not sure how to do this
	26. I have used flash drives for transferring files	during the last 12 months	longer than 12 months ago	never, or I am not sure how to do this
	27. cooperative work online	Google docs	Dropbox	
<b>Creating digital information</b>	28. When was the last time you changed or created online text, e.g. a page in the World Wide Web?	Within the last 12 months.	More than 12 months ago.	Never.
	29. When was the last time you took pictures on a digital camera or digital video recorder?	Within the last 12 months.	More than 12 months ago.	Never.

	30. When was the last time you edited digital pictures or digital videos?	Within the last 12 months.	More than 12 months ago.	Never.
	31. I have shared files with my students using cloud services.	Yes but not private data.	Yes including private data.	Never, or I am not sure what this is.
	32. I have used social network services especially created for teachers (not Facebook, Google Plus, LinkedIn, Pinterest, Twitter, WhatsApp, and similar services).	Yes, more than twice a year.	Yes, less than twice a year.	I know Facebook but I am not sure about specific services for teachers.
	33. I have used layering in such graphics programs as Photoshop.	Within the last 12 months.	More than 12 months ago.	Never.
	34. I have edited digital videos	Within the last 12 months.	More than 12 months ago.	Never.

\*Knowledge is fading, so longer interruption leads to down-rating

### 3. Questions about demographics

Sex: male/female

Age: years

Years of working experience as a teacher or researcher: years

Highest degree earned: bachelor, master, doctoral, Assistant Prof., Associate Prof., Professor (full)

At which faculty do you teach and/or do research?

What are your fields of interest? (e.g., Thai history, organic chemistry, electrical engineering)

Which course/s do you teach regularly?

Which technologies do you mainly use for teaching? (e.g. presentation programs, smart-board)

What are the strategies or ways of using technologies in your classes (how to use)?

Have you ever attended an extracurricular activity on educational technology? yes/no (If yes, how long ago: years)

Do you think that further training in educational technologies would be beneficial for your teaching? yes/no

Is there any technology that you would like to use in your teaching?  
Examples: Virtual Reality, 3D printing, ...

#### 4. Questions about attitudes

These attitude scales include 12 items, which comprise four subscales: Positive Attitudes Toward Technology (6 items), Anxiety About Being Without Technology or Dependence on Technology (3 items), and Negative Attitudes Toward Technology (3 items) applying a 5-point Likert scale for all items (scoring in parentheses): Strongly agree (5), Agree (4), Neither agree nor disagree (3), Disagree (2), Strongly disagree (1).

- (Positive attitudes) I feel it is important to be able to find any information - whenever I want - online.
- (Positive attitudes) I feel it is important to be able to access the Internet any time I want.
- (Positive attitudes) I think it is important to keep up with the latest trends in technology.
- (Anxiety/dependence) I get anxious when I don't have my cell phone.
- (Anxiety/dependence) I get anxious when I don't have the Internet available to me.
- (Anxiety/dependence) I am dependent on my technology.

- (Positive attitudes) Technology will provide solutions to many of our problems.
- (Positive attitudes) With technology anything is possible.
- (Positive attitudes) I feel that I get more accomplished because of technology.
- (Negative attitudes) New technology makes people waste too much time.
- (Negative attitudes) New technology makes life more complicated.
- (Negative attitudes) New technology makes people more isolated.

## 5. Validation process

The validation process will be guided by the Item-Objective Congruence (IOC) and assessed by experts from the Dep. of Educational Measurement and Research at the Faculty of Education, NU. In addition, we apply content analysis procedures and triangulated methods.

## 6. Implementation of the questionnaire

The questionnaire will be offered online to instructors of higher education institutions in Thailand. The language is Thai.

Some face to face / online interviews will be also conducted in particular cases such as Science Faculty at Ubon Ratchathani Rajabhat, Chiang Mai University and other places, and then concurrent probing is being used.

## Glossary (adapted from Artino et al., 2014)

**Closed-ended question** – A survey question with a finite number of response categories from which the respondent can choose.

**Cognitive interviewing (or cognitive pre-testing)** – An evidence-based qualitative method specifically designed to investigate whether a survey question satisfies its intended purpose.

**Concurrent probing** – A verbal probing technique wherein the interviewer administers the probe question immediately after the respondent has read aloud and answered each survey item.

**Construct** – A hypothesized concept or characteristic (something “constructed”) that a survey or test is designed to measure. Historically, the term “construct” has been reserved for characteristics that are not

directly observable. Recently, however, the term has been more broadly defined.

**Content validity** – Evidence obtained from an analysis of the relationship between a survey instrument's content and the construct it is intended to measure.

**Factor analysis** – A set of statistical procedures designed to evaluate the number of distinct constructs needed to account for the pattern of correlations among a set of measures.

**Open-ended question** – A survey question that asks respondents to provide an answer in an open space (e.g. a number, a list or a longer, in-depth answer).

**Reliability** – The extent to which the scores produced by a particular measurement procedure or instrument (e.g. a survey) are consistent and reproducible. Reliability is a necessary but insufficient condition for validity.

**Response anchors** – The named points along a set of answer options (e.g. not at all important, slightly important, moderately important, quite important and extremely important).

**Response process validity** – Evidence of validity obtained from an analysis of how respondents interpret the meaning of a survey scale's specific survey items.

**Retrospective probing** – A verbal probing technique wherein the interviewer administers the probe questions after the respondent has completed the entire survey (or a portion of the survey).

**Scale** – Two or more items intended to measure a construct.

**Think-aloud interviewing** – A cognitive interviewing technique wherein survey respondents are asked to actively verbalize their thoughts as they attempt to answer the evaluated survey items.

**Validity** – The degree to which evidence and theory support the proposed interpretations of an instrument's scores.

**Validity argument** – The process of accumulating evidence to provide a sound scientific basis for the proposed uses of an instrument's scores.

**Verbal probing** – A cognitive interviewing technique wherein the interviewer administers a series of probe questions specifically designed to elicit detailed information beyond that normally provided by respondents.



## Appendix C: Research Article for Publication

### 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. Findings from both quantitative and qualitative parts are presented and discussed.

Keywords: digital literacy; higher education instructors; Thailand

## 1 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 16<sup>th</sup> 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,



structuring digital literacy skills and competences with finer granularity as can be seen in Table 1.

**Table 1 E-skill levels supporting digital literacy (IBSA, 2013)**

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 relating to AQF the levels are also consistent with Skills Framework for the Information Age levels 1, 2, 3, 4 and 5-7 ([www.sfa.org.au](http://www.sfa.org.au)).

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.

The major research questions guiding the project work were as follows:

5. Which level of familiarity with contemporary digital technologies do Thai instructors actually exhibit?
6. How do they learn new digital technologies that they are not familiar with?
7. How do they develop teaching strategies that incorporate an understanding of the impact on students' learning by engaging digitally?
8. 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, Iordache 2016).

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:

Framework	Description	References
CML Media Lit Kit	The CML (Centre for Media Literacy) provides the MediaLit 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.	<a href="http://www.medialit.org/cml-medialit-kit">http://www.medialit.org/cml-medialit-kit</a> (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 the development of Digital literacy, which is seen as the convergence of several literacies.	Martin and Grudziecki, 2006
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.	<a href="http://ecdل.org/">http://ecdل.org/</a> (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.	<a href="https://cordis.europa.eu/project/rcn/78287_en.htm">https://cordis.europa.eu/project/rcn/78287_en.htm</a> (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)



## 2 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).

3. Quantitative research was based on an online questionnaire form (link to the questionnaire was sent to institutions and individuals for filling out)
4. 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).

### 1.1 Quantitative data collection

The data collection tool 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



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 method**

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 field note and take some photos in their classroom teaching.

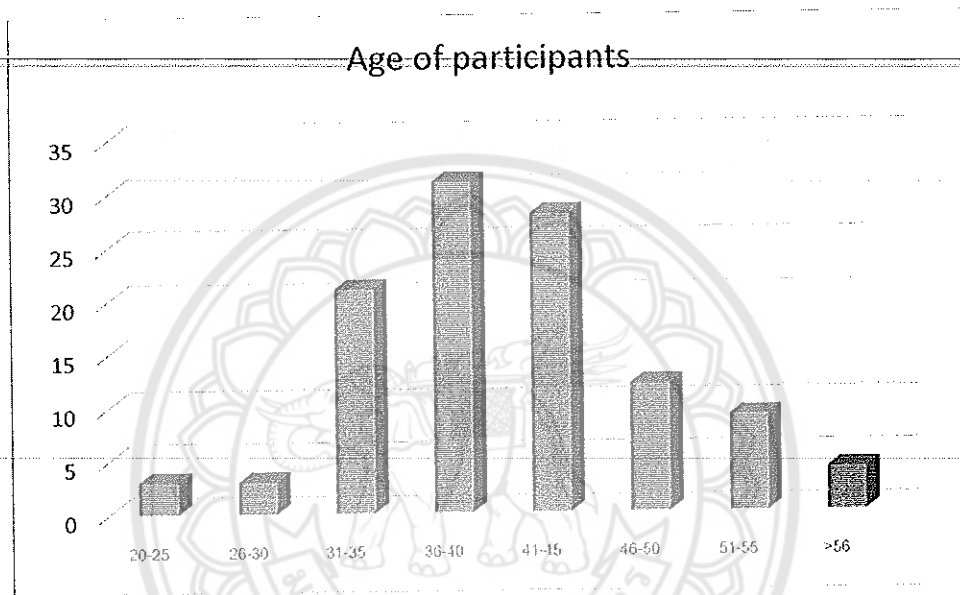
### 3 Findings and Discussions

#### Quantitative data

##### *Demographics*

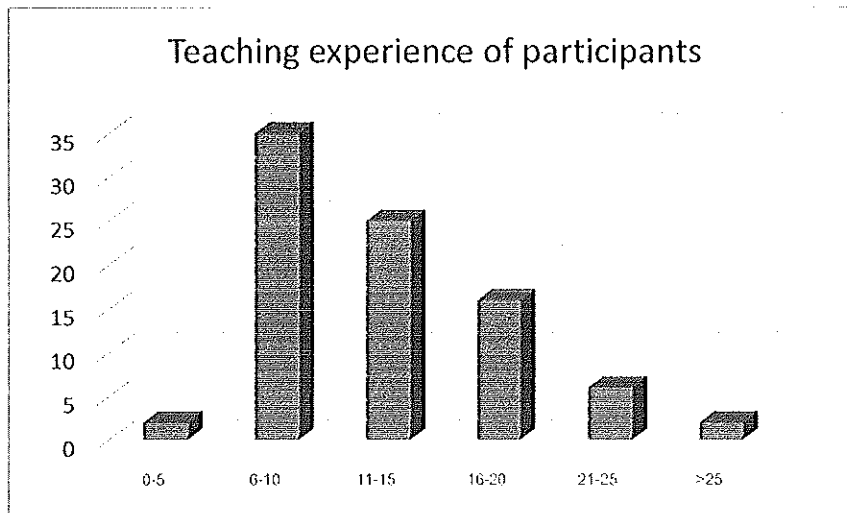
The distribution of the questionnaire resulted in 111 responses from 50 male and 61 female respondents with 69 being lecturers, 36 assistant professors and 6 associate professors.

The age distribution of the participants is depicted in Fig. 1.



*Figure 6. Age distribution of participants*

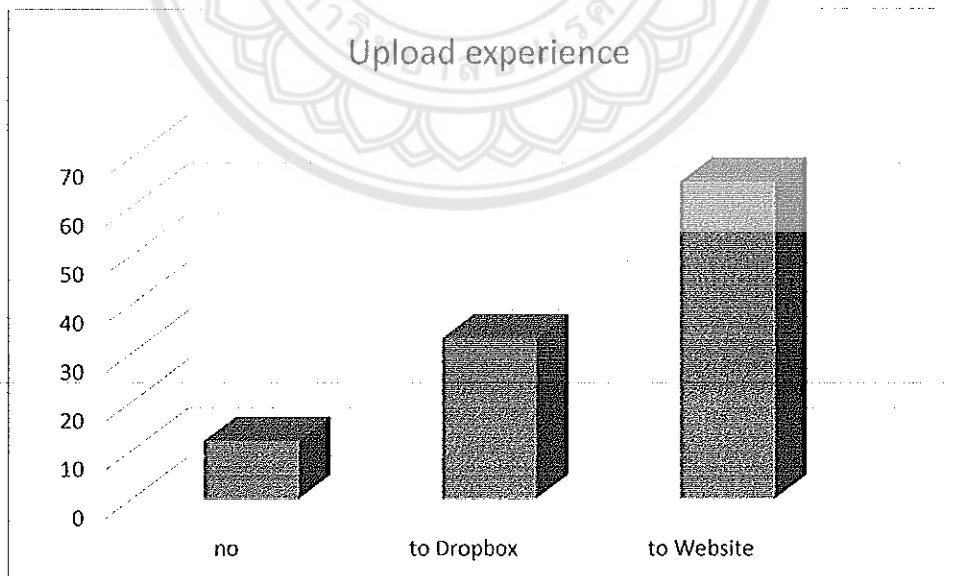
The number of participants with certain experience in years is shown in Fig. 2.



*Figure 7 Experience in years*

### *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. 3.



*Figure 8 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).

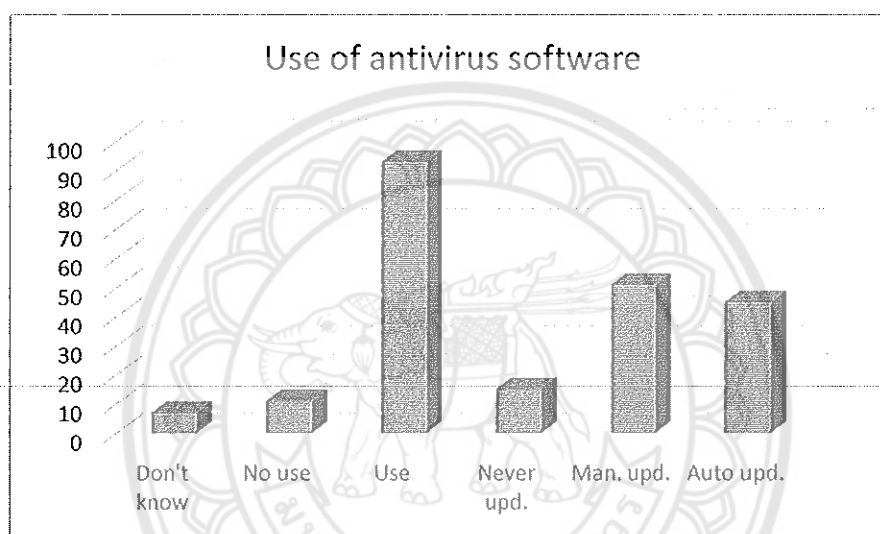


Figure 9 Use of antivirus software

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 2. 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. 5, the knowledge of copyright relating CC Commons is depicted. Less than a quarter of all participants has an understanding of this concept.

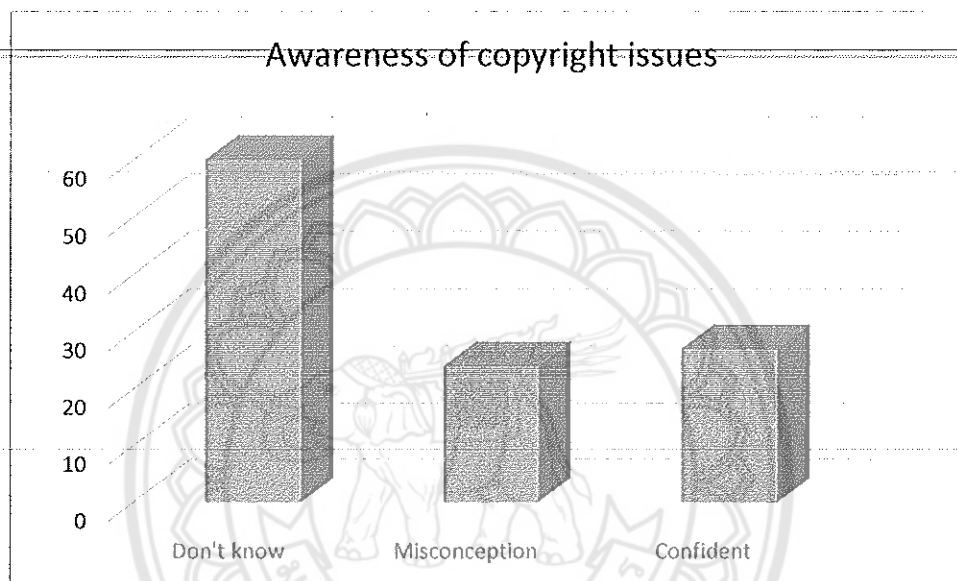


Figure 10 Copyright awareness

#### 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. In the stage one of decontextualisation, the researcher reads through the transcribed text in order to get whole view of the happenings and then broke down the data into smaller meaning units which contain some insights or aspects answering the questions framed around the research purposes. Then, the researcher labeled the processed meaning units with code that can be understood accordingly to the



context, as a part of open coding process (Berg, 2001). After identified, the meaning units with their codes were checked if they were covered and related to the research questions and purposes in the stage two of recontextualisation. Then, in the stage three of categorization, the researcher created the categories. In this process, themes and categories were identified. Sub-categories and sub-themes were also sorted. At the last stage of compilation, the researcher started to analyze and write down the results according to the themes and categories established.

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.

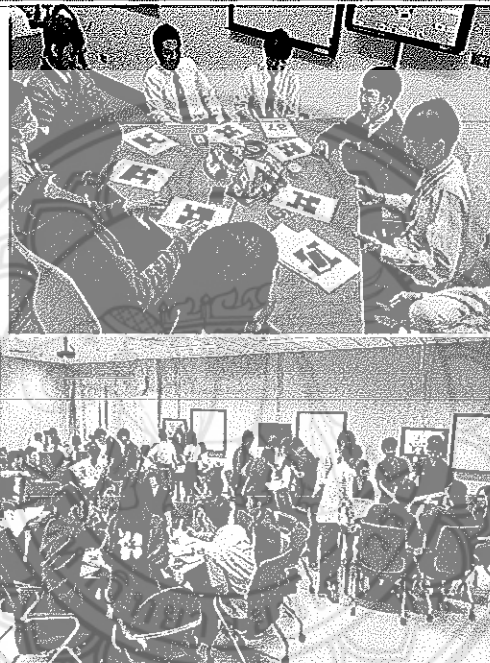
#### **Findings from qualitative part**

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



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)



*Fig. 6 Students using Plickers in class*



*Fig.7 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.

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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.

### **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. 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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## แบบแจ้งยืนยันการนำผลงานวิจัยไปใช้ประโยชน์

เรียน อธิการบดี มหาวิทยาลัยนเรศวร

ตามที่ ผู้ช่วยศาสตราจารย์ ดร. สกนธ์ชัย ชะนูนันท์ อาจารย์ประจำคณะศึกษาศาสตร์  
สังกัดมหาวิทยาลัยนเรศวร ได้ดำเนินผลงานวิจัยเรื่องการรู้ดิจิทัลของอาจารย์ผู้สอนในสถาบันระดับอุดมศึกษาใน  
ประเทศไทยและดำเนินการเสร็จสิ้นเมื่อวันที่ 1 มิถุนายน 2561 นั้น

ผลงานวิจัยสามารถนำไปใช้ประโยชน์ในการดำเนินงานของคณะวิทยาศาสตร์และเทคโนโลยี  
มหาวิทยาลัยสวนดุสิต โดยมีรายละเอียดการนำไปใช้ประโยชน์ ดังนี้

- พื้นที่/กลุ่มเป้าหมายในการถ่ายทอด คณะอาจารย์คณะวิทยาศาสตร์และเทคโนโลยี
- จำนวนผู้ที่ได้รับประโยชน์ 30 คน
- สามารถนำไปใช้ประโยชน์ในด้านใดบ้าง (โปรดใส่เครื่องหมาย ✓ ในด้านที่ใช้ประโยชน์)

➤ การใช้ประโยชน์เชิงสาธารณะ

- ด้านการส่งเสริมประชาธิปไตยภาคประชาชน
- ด้านการบริหารจัดการสำหรับหน่วยงานภาครัฐ
- ด้านศิลปะและวัฒนธรรม
- ด้านวิถีชีวิต

➤ การใช้ประโยชน์เชิงนโยบาย

- นำไปประกอบเป็นข้อมูลการประกาศใช้กฎหมายหรือกำหนดมาตรการ กฎเกณฑ์  
ต่าง ๆ โดยองค์กรหรือหน่วยงานภาครัฐและเอกชน
- นำไปประกอบเป็นข้อมูลในการจัดทำหรือปรับปรุงนโยบาย ยุทธศาสตร์ แผนงาน  
โครงการ กิจกรรม โดยองค์กรหรือหน่วยงานภาครัฐและเอกชน

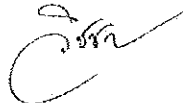
➤ การใช้ประโยชน์เชิงพาณิชย์

- นำไปสู่การพัฒนานวัตกรรม สิ่งประดิษฐ์หรือผลิตภัณฑ์ซึ่งก่อให้เกิดรายได้ หรือ  
นำไปสู่การเพิ่มประสิทธิภาพการผลิตหรือการบริการ ทั้งองค์กรหน่วยงานภาครัฐ  
และเอกชน

➤ การใช้ประโยชน์ทางอ้อม/ด้านอื่น ๆ (โปรดระบุ) ใช้ประกอบการเรียนการสอนในลักษณะ  
ของตัวอย่างวิจัย ใช้เป็นข้อมูลพื้นฐานประกอบในการเตรียมพัฒนาบุคลากรโดยเฉพาะคณาจารย์  
ด้านการรู้ดิจิทัลและการสมรรถนะด้านการประยุกต์ใช้สื่อดิจิทัลในการเรียนการสอนและการวิจัย  
ในการนี้ จึงใคร่ขอขอบคุณในความกรุณาของหน่วยงานท่านเป็นอย่างสูง

จึงเรียนมาเพื่อโปรดทราบ

ขอแสดงความนับถือ



(ผู้ช่วยศาสตราจารย์ ดร. วิชชา

ตำแหน่ง คณบดี

หน่วยงาน คณะวิทยาศาสตร์และเทคโนโลยี

มหาวิทยาลัยสวนดุสิต

