

**INVESTIGATING ICT COMPETENCIES FOR
UNDERGRADUATE STUDENTS AT
NAKHON SI THAMMARAT RAJABHAT UNIVERSITY**

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ABSTRACT

This research seeks to study Information and Communication Technology (ICT) competencies for undergraduate students at Nakhon Si Thammarat Rajabhat University (NSTRU). Using academic documents as the main data source, the analysis was categorized based on two broad domains: the cognitive domain and the psychomotor domain. A total of 21 volumes of academic documents were purposively sampled and selected from two sources in Thailand and abroad. The first covers the academic documents in Thailand and abroad from primary sources, and the second covers the academic documents in Thailand and abroad from secondary sources. The research employs a qualitative data work sheet after analyzing academic documents from both sources in Thailand and abroad. The result shows that ICT competencies of the students consists of 7 elements that cover the cognitive and psychomotor domains. The composition needs of the students' ICT competencies consisted of 14 competencies, and 131 variables to consider by focus group discussions in the next phase.

Keywords: Competencies, information and communication technology, undergraduates

INTRODUCTION

The social changes of the 21st century and the initiative of Thailand 4.0 pose significant impacts on the lifestyle of the Thai society (EDUCA, 2016). Mankind dwells in an environment driven by media and information technology (Ministry of Digital Economy and Society, 2017). Rich and diverse information can be conveniently accessed, leading to the development of new knowledge and a student-centered approach to education. Students are developed to possess high moral standards, excellent skill sets, and a passion for learning. The current era of Thai education seeks to prepare students to excel in the national and international environments while feeling a sense of joy. It is evident that information and communications technology (ICT) play a pivotal role in operating, creating, and developing innovations. Given its imperative purpose, all sectors assign high priorities to strengthening skills in implementing and administering ICT. This is reflected by the development of the national ICT strategic plan and the draft of the Third Thailand Information and Communication Technology Master Plan (2014-2018). The plan supports a modern approach to supporting, creating and enhancing ICT education amongst students. The first strategy of the national plan underscores the importance of improving human

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capital to possess keen knowledge for developing and implementing ICT in their daily lives and professional careers. In the year 2018, human capital in ICT shall possess knowledge for developing and implementing ICT based on the precepts of Sufficiency Economy, exercising professionalism, innovativeness, and service-mindedness in their fields of expertise. The National Information Technology Committee proposed the following three preliminary objectives for the government to execute with the highest priority – investment in national information technology infrastructure, investment in civilian development, and investment in good governance and public service delivery (National Information Technology Committee, 2014: 7). To accomplish these objectives, strategies must be developed to achieve effective results on a national scale. Based on the aforementioned problems, changes, and necessities, the researchers are interested to conduct a study of ICT skills that are relevant to students of NSTRU. Results of the research shall be applied to strengthen the ICT skills of the university students in the form of a training course for new entry students. The course shall serve the purpose of equipping the entering students with ICT skills according to the objectives of the university, which will benefit the students with tech-savvy knowledge to support their studies and career in a rapidly changing society. This research focuses on ICT competencies in the cognitive and psychomotor domains that are relevant to the students, developed in the form of training courses under NSTRU. This falls under the announcement of the Ministry of Education under the subject of “Curriculum Standards of the Bachelor’s Degree” in the year 2015 (Office of the Higher Education Commission, 2017).

RESEARCH OBJECTIVES

To study ICT competencies in the cognitive and psychomotor domains which are relevant to university students through the method of document analysis.

RESEARCH SCOPE

Information Scope and Selection

To conduct the research under the topic of “The Study of ICT Competencies relevant to the Students of NSTRU,” research scopes were established by selecting information from documents and literatures relevant to the subject of ICT competencies in the cognitive and psychomotor domains relevant to university students. These documents were further analyzed, where only literary pieces that meet at least two-thirds of the research scope or the definition of “ICT competencies” according to the research are used. A total of 21 works of literature were used in this research, containing information that was published during the years 2013-2017. The sources of information are classified in Table 1.

Table 1

Sources of Information, Types of Information, and the Number of Documents used in the Research

Sources of Information	Types of Information	The Number of Documents used in the Research
In Thailand	1.From complete researches/doctoral level theses and research papers	6
	2.From ICT textbooks.	1
Overseas	1.From complete researches/doctoral level theses and research papers	6
	2.From ICT textbooks.	8
	Total	21

According to Table 1, the sources of information used in this research include completed researches, doctoral level theses, research papers, as well as books published and disseminated in Thailand and overseas.

Research-specific Terms

(1) Competencies refer to behavioral characteristics of an individual that affect their work, operations, and performance effectiveness. This research focuses on two aspects of competencies- the cognitive and psychomotor domains (Adapted from the three competencies domains of Punnee Leekitchwatana et al., 2013: 105).

(1.1) Cognitive competencies refer to the knowledge accumulated by the individual from studies, informational sources, and news. The cognitive domain is the individual's perception of all surroundings, which include the individual's ability to remember, understand, apply, analyze, evaluate, and create.

(1.2) Psychomotor competencies refer to the individual's ability to perform by applying cognitive abilities of knowledge and expertise, which are developed through practice and experience. This domain of competencies includes the individual's perception, set, guided response, mechanism, complex overt response, adaptation, and origination.

(2) The students' ICT competencies refer to behavioral ICT characteristics of students that affect their work, operations, and performance effectiveness. These competencies include the cognitive and psychomotor domains of NSTRU students in their freshman year. The cognitive and psychomotor competencies of the students cover the following seven aspects: 1. Fundamentals of Computer and Information Technology 2. Accessing Information 3. Integrating Information 4. Creating Information 5. Communicating Information 6. Managing Information and 7. Evaluating Information.

Variables

Variables refer to factors pertaining to ICT competencies that are relevant to the students. These variables cover cognitive and psychomotor competencies and their aforementioned 7 aspects: 1. Fundamentals of Computer and Information Technology 2. Accessing Information 3. Integrating Information 4. Creating Information 5. Communicating Information 6. Managing Information and 7. Evaluating Information.

RESEARCH METHODOLOGY

Sources of Information

This qualitative research collects information through document analysis of completed researches, doctoral level theses, research papers, as well as books published and disseminated in Thailand and overseas that pertain to the topic of the research. The procedures in gathering information are as follows:

1) The researchers gathered documents and literature pertaining to the topic of necessary ICT skills for students. These documents were selected for analysis to obtain information on cognitive and psychomotor competencies of students on ICT. The researchers used a non-probabilistic approach to document selection, which involved specifically searching for Thai and foreign language papers that match the key words of "relevant ICT competencies for university students."

2) Researchers divided studies into the following two levels: (1) studying from complete researches/doctoral level thesis and research papers; (2) studying from textbooks. The researches reviewed the credibility of the information and its sources by evaluating the institutions that administered the research and the clarity and accuracy of the research methodologies used. Only documents that were published during the years 2013 – 2017 were selected. To increase the validity and reliability of the study, in addition, the study was operated alongside suggestions from the research supervisor, the co-advisor, and the researcher.

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Research Tools

The tool used in research includes a framework for collecting qualitative information obtained from document analysis. The procedures for creating the framework for evaluating the quality of the information are as follows: (1) reviewing documents and related researches to develop a guideline for creating the framework for collecting qualitative information in the form of a frequency worksheet; (2) determining the scope and key points for document analysis; (3) creating the framework for collecting qualitative information; (4) proposing the framework to the thesis advisor and co-advisor to obtain feedback for further adjustments.

Data Collection Procedures

The researchers collected qualitative information from 21 documents and related researches pertaining to the topic of relevant ICT competencies for university students. The objective of collecting qualitative information was to obtain key variables of the two main research factors - cognitive and psychomotor domains. Each of the domains possessed the following 7 components: 1. Fundamentals of Computer and Information Technology. 2. Accessing Information. 3. Integrating Information. 4. Creating Information. 5. Communicating Information. 6. Managing Information. And 7. Evaluating Information. The researchers summarized the variables pertaining to the research topic that were obtained from the qualitative data collection framework. The findings were proposed to the thesis advisor and co-advisor to review informational accuracy. The duration of the research was from 14 August 2016 - 1 October 2016.

Data Analysis Procedures

The information gathered in the framework for collecting qualitative information from documents and related researches are analyzed in terms of content and frequency. A frequency table was created to assess content that pertain to the research topic of relevant ICT competencies for university students. The frequencies were then evaluated, with a frequency level of 50 percent (Skonwan Paruang, 2013: 280) as the selection criteria for information relevant to the research topic. The information obtained from the frequency evaluation shall be used as a draft to conduct further analysis in the later stages of the research.

FINDINGS

The results of the research on relevant ICT competencies for university students obtained from document analysis indicated two key factors – the cognitive and psychomotor domains. Each of these domains possesses seven additional components, as displayed in Table 2 and Table 3. The numerical values assigned to these components have the following interpretations: Number 1: Fundamentals of Computer and Information Technology. Number 2: Accessing Information. Number 3: Integrating Information. Number 4: Creating Information. Number 5: Communicating Information. Number 6: Managing Information. And number 7: Evaluating Information.

Table 2*Analysis Summary of Components pertaining to ICT Competencies*

Name- Surname	Components pertaining to ICT Competencies		
	Cognitive domains	Psychomotor domains	Affective Domain
Oversea Scholar			
Seung Eun Chaa, et. al. (2013)	✓	✓	✓
United Nations Educational (2013)	✓	✓	✓
T. Marusic, I. Viskovic (2013)	✓	✓	✓
Alexiou-Ray, J., Wilson, E., Wright, V., & Periano, A. (2013)	✓	✓	✓
Kabilan, Muhammad Kamarul (2014)	✓	✓	✓

Table 2
(continuous)

Name- Surname	Components pertaining to ICT Competencies		
	Cognitive domains	Psychomotor domains	Affective Domain
Thailand Scholar			
Seekhao, S.(2013: 10)	✓	✓	✓
Paruang, S.(2013: 29)	✓	✓	✓
Dangintawat, S.(2012: 25)	✓	✓	✓
Harinon, U. (2014: 147)	✓	✓	✓
Saengloetuthai, J. (2015: 41)	✓	✓	✓
Leekitchwatana, P. et. al. (2013: 105)	✓	✓	✓

Table 2 summarizes the analysis of components pertaining to ICT competencies, which refer to behavioral characteristics of an individual that affect their work, operations, and performance effectiveness. This research focuses on two aspects of competencies – the cognitive and psychomotor domains (Adapted from the three competencies domains of Punnee Leekitchwatana et al., 2013: 105).

Table 3
Summary of Components pertaining to ICT Competencies

Scholar	Components of ICT Competencies						
	1	2	3	4	5	6	7
Nation Academic of Science (2016)		✓	✓	✓	✓	✓	✓
The Minnesota Governor’s Council on Developmental (2016)		✓	✓	✓	✓	✓	✓
Teresa Egan (2016: 1)	✓	✓	✓	✓	✓	✓	✓
Elena Dm. Griaznova. (2015)	✓	✓	✓	✓	✓	✓	✓
Antonio Cartelli (2013)	✓	✓	✓	✓	✓	✓	✓
Kopaiboon, W. et. al. (2013)	✓	✓	✓	✓	✓	✓	✓
United Nations Educational (2013)		✓	✓	✓	✓	✓	✓
Australian Curriculum Assessment and Reporting Authority: Acara (2013 : 1)	✓	✓	✓	✓	✓	✓	✓
Irvin R. KATZ (2014)	✓	✓	✓	✓	✓	✓	✓
California Emerging Technology Fund : CETF (2015: 3)	✓	✓	✓	✓	✓	✓	✓
Saenglerutai, C (2013: 27)		✓	✓	✓	✓	✓	✓
Leekitchwatana, P. et. al. (2013: 105)	✓	✓	✓	✓	✓	✓	✓

Table 3 summarizes a total of 14 components under the cognitive and psychomotor domains of ICT competencies. A summarizes two key factors of the students’ ICT competencies – cognitive domain and psychomotor domains. These factors possess 14 components and a total of 131 variables. This information was applied to create the model framework for presenting the ICT competencies of NSTRU students in 2 domains. This information was applied to create the model framework for presenting the ICT competencies of NSTRU students in Table 4.

Table 4
Model Framework for presenting the ICT Competencies of NSTRU Students

Domains and Components of ICT Competencies	Variables of ICT Competencies
Cognitive domain: Fundamental knowledge of computers and information technology. (8 variables)	Knowledge of: <i>First</i> , the principles, roles, and benefits of computers. <i>Second</i> , assembling, installing, and maintaining computers. <i>Third</i> , installing computer accessories, equipment, and drivers. <i>Fourth</i> , installing basic computer operational programs. <i>Fifth</i> , installing basic computer utility programs. <i>Sixth</i> , the principles and methods for problem solving with ICT. <i>Seventh</i> , computer maintenance. <i>Eighth</i> , communication and basic computer network.
Cognitive domain: Knowledge of Accessing Information. (6 variables)	Knowledge of: <i>First</i> , evaluating information obtained. <i>Second</i> , effective information usage. <i>Third</i> , determining the needs, types, forms, costs, benefits, and scopes of ICT. <i>Fourth</i> , using the internet to access information, such as online searching and accessing databases and information relevant to the students’ career. <i>Fifth</i> , using Search Engines, Web Browser. <i>Sixth</i> , Sources to search for information.
Cognitive domain: Knowledge of Integrating Information. (10 variables)	Knowledge of: <i>First</i> , evaluating the quality of information from its source. <i>Second</i> , integrating information valuably. <i>Third</i> , integrating information ethically. <i>Fourth</i> , selecting and integrating information appropriately. <i>Fifth</i> , analyzing informational integration. <i>Sixth</i> , synthesizing information appropriately. <i>Seventh</i> , evaluating information obtained. <i>Eighth</i> , integrating information effectively. <i>Ninth</i> , integrating information creatively. <i>Tenth</i> , integrating information with discernment.
Cognitive domain: Knowledge of Creating Information. (9 variables)	Knowledge of: <i>First</i> , word processing software, such as Microsoft Word, for preparing documents in the workplace. <i>Second</i> , using software with tables for calculating numerical values, such as Microsoft Excel. <i>Third</i> , creating information. <i>Fourth</i> , analyzing, developing, designing, and producing creative information. <i>Fifth</i> , synthesizing the process of creating information. <i>Sixth</i> , evaluating the information created. <i>Seventh</i> , creating innovative information. <i>Eighth</i> , creating information with discernment. <i>Ninth</i> , creating information effectively.
Cognitive domain: Knowledge of Communicating Information. (6 variables)	Knowledge of: <i>First</i> , using software to conduct professional presentations, such as Microsoft PowerPoint. <i>Second</i> , selecting communication techniques for sending-receiving information over the internet. <i>Third</i> , communicating information by using ICT to boost effectiveness. <i>Fourth</i> , communicating the benefits and examples of ICT. <i>Fifth</i> , communicating information and the future potential of ICT. <i>Sixth</i> , communicating information and the changes brought by the use of ICT.
Cognitive domain: Knowledge of Managing Information. (11 variables)	Knowledge of: <i>First</i> , selecting management communication techniques, or storing information through the internet. <i>Second</i> , managing the process of information collection. <i>Third</i> , managing the process of information review. <i>Fourth</i> , managing the process of information evaluation. <i>Fifth</i> , managing the process of information preservation. <i>Sixth</i> , managing the process of transforming existing information or information obtained from research into the desired outcome. <i>Seventh</i> , managing the process of filing information. <i>Eighth</i> , classifying types of information and grouping information systematically.

Table 4
(continuous)

Domains and Components of ICT Competencies	Variables of ICT Competencies
Cognitive domain: Knowledge of Evaluating Information. (10 variables)	<i>Ninth</i> , Knowledge of organizing information in a manner that is convenient for searching and using as references. <i>Tenth</i> , evaluating information according to needs and objectives. <i>Eleventh</i> , applying information for practical purposes.
Psychomotor domains: Fundamental Skills in Computer Science and Information Technology. (6 variables)	Knowledge of: <i>First</i> , measuring and evaluating information. <i>Second</i> , evaluating the value and quality of information. <i>Third</i> , analyzing and selecting information. <i>Fourth</i> , synthesizing information. <i>Fifth</i> , the information evaluation process. <i>Sixth</i> , the principles of evaluating information. <i>Seventh</i> , determining the value of information according to situational needs. <i>Eighth</i> , evaluating the accuracy of information, including the process of validating such information. <i>Ninth</i> , evaluating the credibility of information. <i>Tenth</i> , evaluating the information's modernity.
Psychomotor domains: Skills for Accessing Information. (8 variables)	Capable of: <i>First</i> , using tools and equipment to assemble, installs, and maintains computers. <i>Second</i> , installing programs for basic operating systems. <i>Third</i> , installing utilities programs or basic applications such as Microsoft Office. <i>Fourth</i> , solving problems with information technology processes. <i>Fifth</i> , conducting computer maintenance and repair. <i>Sixth</i> , Equipped with the skills to install computer accessories or equipment with drivers such as printers and scanners.
Psychomotor domains: Skills for Integrating Information. (13 variables)	Capable of: <i>First</i> , effectively using all forms of information for analysis and/or capable of proficiently using computers. <i>Second</i> , using information while being able to identify the types and forms of relevant information sources. <i>Third</i> , conducting information retrieval and determining effective retrieval strategies from online sources or personnel. These diverse methods include extracting, saving, and managing information. <i>Fourth</i> , evaluating and summarizing the key points of the information gathered. Capable of evaluating the information and its sources. <i>Fifth</i> , using the internet to access information, including searches for information, work-related information, and research databases. <i>Sixth</i> , using Search Engines and Web Browsers. <i>Seventh</i> , using the internet to access information. <i>Eighth</i> , accessing sources of information and information relevant to work, such as research databases.
Psychomotor domains: Skills for Creating Information. (11 variables)	Capable of: <i>First</i> , integrating information for evaluating its quality from its sources. <i>Second</i> , integrating information valuably. <i>Third</i> , integrating information ethically. <i>Fourth</i> , selecting information integration with discernment. <i>Fifth</i> , integrating information for analysis. <i>Sixth</i> , integrating information for appropriate synthesis. <i>Seventh</i> , integrating information for evaluation purposes. <i>Eighth</i> , integrating existing information with newly acquired information to plan and create projects. Capable of presenting and disseminating projects to the public effectively. <i>Ninth</i> , integrating information creatively. <i>Tenth</i> , integrating information with discernment. <i>Eleventh</i> , searching for information. <i>Twelfth</i> , determining the quality of information from their sources. <i>Thirteenth</i> , integrating information valuably.
Psychomotor domains: Skills for Communicating Information. (14 variables)	Capable of: <i>First</i> , using word processing software, such as Microsoft Word, for preparing documents in the workplace. <i>Second</i> , using software with tables for calculating numerical values, such as Microsoft Excel. <i>Third</i> , creating information. <i>Fourth</i> , analyzing, developing, designing, and producing creative information. <i>Fifth</i> , synthesizing the process of creating information. <i>Sixth</i> , evaluating the information created. <i>Seventh</i> , creating innovative information. <i>Eighth</i> , creating information with discernment. <i>Ninth</i> , creating information effectively. <i>Tenth</i> , producing different types of information. <i>Eleventh</i> , exercising creativity to develop various types of information.
Psychomotor domains: Skills for Managing Information. (14 variables)	Capable of: <i>First</i> , adjusting and applying computer tools and equipment to safely and accurately communicate information. <i>Second</i> , using software to conduct professional presentations, such as Microsoft PowerPoint. <i>Third</i> , selecting communication techniques for sending-receiving information over the internet. <i>Fourth</i> , accurately using information and communication technology. <i>Fifth</i> , using information and communication technology for sending-receiving information. <i>Sixth</i> , using information technology media creatively. <i>Seventh</i> , using information technology media with discernment. <i>Eighth</i> , using information technology media swiftly and proficiently. <i>Ninth</i> , launching, adjusting, and applying computer tools and equipment to safely and accurately communicate information. <i>Tenth</i> , using the communicated information and resolving complex problems that may occur. <i>Eleventh</i> , responding effectively according to objectives when integrating or resolving complex problems of communicating information. <i>Twelfth</i> , responding based on the assigned directions pertaining to informational communication. <i>Thirteenth</i> , knowledge of communicating information to boost performance effectiveness with information and communication technologies, such as hardware and software. <i>Fourteenth</i> , Prepared to execute assigned tasks pertaining to communicating information.
Psychomotor domains: Skills for Evaluating Information. (5 variables)	<i>First</i> , Preparedness to select management communication techniques or store information over the internet. <i>Second</i> , Skills to respond based on the assigned directions pertaining to information management. <i>Third</i> , Skills to respond to the complexities of information management. <i>Fourth</i> , Skills to adjust necessary factors to be most appropriate for information management. <i>Fifth</i> , Initiation skills for information management. <i>Sixth</i> , Capable of collecting and gathering information. <i>Seventh</i> , Skills for reviewing information for its management. <i>Eighth</i> , Skills for evaluating information for its management. <i>Ninth</i> , Skills for preserving information for its management. <i>Tenth</i> , Skills for managing the process of transforming existing information or information obtained from research into the desired outcome. <i>Eleventh</i> , Skills for classifying types of information systematically for convenience, swiftness, and accuracy in information management. <i>Twelfth</i> , Capable of organizing information in a manner that is convenient for evaluating, searching, and using as references in the future. <i>Thirteenth</i> , Capable of managing information that requires detailed and accurate results, since the information acquired may consist of both texts and numerical values that must be averaged or summed. <i>Fourteenth</i> , Capable of managing information through the most complex evaluation method of writing research reports, which serve the purpose of disseminating information in the future. The administrator must summarize information to create reports that correspond to situational needs, while presenting the reports in a manner that aligns with the objectives of information management.

CONCLUSION

The relevant ICT competencies for students in the cognitive and psychomotor domains consist of 7 components from 2 sides, which are derived from 131 variables. These results shall be used to determine the relevant ICT competencies for students in a focus group discussion with experts.

DISCUSSION

Research results indicated that the relevant ICT competencies for students in the cognitive and psychomotor domains consisted of 7 components from 2 sides, which were derived from 131 variables. The analyzed variables have proven to be relevant and can be used to determine the relevant ICT competencies for students in a focus group discussion with experts. The variables analyzed were also supported by documents and researches. The researchers thoroughly studied

a breadth of documents and related researches to identify key variables that were relevant to the two major frameworks of competencies, which were cognitive and psychomotor domains. These findings corresponded to the research of Chanthima Saengloetuthai (2013: Abstract), who studied the topic of developing a special curriculum to enhance the information and communication technology competencies of students under the Teaching Profession program. Skonwan Paruang (2013: 303) also studied the improvement of information and communication technology competencies of students under the Teacher Education Program. The results of the studies corresponded to the findings of Irvin R. KATZ (2014), who conducted research under the topic of the components of information and communication technology competencies. Teresa Egan (2016: 1) also conducted research and determined that ICT competencies consisted of 7 components, which pertained to the two domains of competencies.

RECOMMENDATIONS

The research results of this study can be adapted and applied to all competencies and variables, such as improving training programs or activities to strengthen various competencies of students. In relation to further studies should be conducted on the components of relevant ICT competencies for university students through other forms of research, such as focus group discussions and Confirmatory Factor Analysis (CFA).

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