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Functional Competency Development Model for Academic Personnel Based on International Professional Qualification Standards in Computing Field

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Abstract

This research proposes a functional competency development model for academic personnel based on international professional qualification standards in computing field and examines the appropriateness of the model. Specifically, the model consists of three key components which are: 1) functional competency development model, 2) blended training system for academic personnel, and 3) test for computer science certifications. For functional competency development model, there are five sub-components which are: 1) objective, 2) qualities of academic personnel, 3) trainers, 4) content (curriculum), and 5) training plan. Next, the proposed blended training system consists of six different training modules which are: 1) pre-test, 2) face-to-face training, 3) e-Video lecture, 4) e-Web cooperation, 5) post-test, and 6) feedback. Lastly, for the third key component, there are 3 levels of certifications which are: 1) basic level, 2) specialist level, and 3) professional level, accordingly. The assessment result, based on opinions of 9 experts in the form of 5-point Likert scale, reveals that these three components and all their sub-components are rated as the highly appropriate ($\bar{x}$ = 4.50).

Keywords: functional competency development model, academic personnel, International professional qualification standards in computing field

1. Introduction

Despite the country's effort to promote a digital economy, Thailand is now facing a quantitative and qualitative shortage of personnel in computer science, especially in educational institutions. To ensure the quality of the personnel in computing field according to international professional qualification standards, the country has identified an approach which is consistent with the ICT Policy Framework 2011-2020 of Thailand (ICT2020) (Thailand's Ministry of Information and Communication Technology, Thailand, 2011), the Second ICT Model Scheme 2009-2013 (Thailand's Ministry of Information and Communication Technology, Thailand, 2001), ASEAN ICT Master Plan 2015 (Thailand's Ministry of Information and Communication Technology, 2013), and the Second ICT Model Scheme of the Ministry of Education 2009-2013 (Thailand's Ministry of Education, 2009). Specifically, standards for academic personnel in computer science also include Thai Qualifications Framework for Higher Education (TQF: HED) so-called Bachelor-Level Qualifications standards for Computer Science 2009 (Thailand's Ministry of Education, 2009). This results in even more limited number of qualified and competent academic personnel in computing field, according to those standards. Therefore, it is of great interest of the country, and of the the researchers in this paper, to develop a model to enhance functional competency of academic personnel in computing field based on international professional qualification standards in computing field.

First, the key element of the proposed model, International Professional Qualification Standard in the field of computing for academic personnel, has been developed, as shown in Figure 1. Specifically, the standard is divided into two levels: international professional qualification standard in the field of computing and functional competency. The first level can then be further classified into 3 levels: 1.1) Basic level which 4 certificates are

considered, 1.2) Specialist level which 6 certificates are considered and, 1.3) Professional level which 8 certificates are considered. For the second level, functional competency certificates, they can also be further classified into 5 levels: 2.1) knowledge, 2.2) training pass, 2.3) certificate, 2.4) instructors and, 2.5) trainers (Piriyasurawong, Tumthong, & Jeerungsuwan, 2013). Particularly, these computing certificates are an instrument used to certifies the professionalism of IT personnel and partly ensures their quality from customers, employers, and colleagues's point of view (Rajamangala University of technology national act, 2005; Eimsherangkoon, 2013). Therefore, personnel who hold those certificates will be internationally certified in terms of knowledge and skills in computing field. In addition, the blended training model that combines the advantages of different training mechanisms has been proposed. In particular, the key characteristic of the proposed system is the hybridtraining style that highlights the importance of both teaching elements through electronic systems, and practicing element as supportive learning instrument through operational assignment. The aim of this blended training model is to develop personnel competency based on integrated e-Web teaching management. This activities management is flexible and has a variety of teaching strategies consisting of media, activities, online learning, and face-to-face learning. Such varieties of training styles would better satisfy different needs of the students and could help them achieve their study goals (Thailand's Research Ministry of Education and Office of Education Council Development Department, 2009; Pisarnput & Ketsakorn, 2005; Jiemjitjong, 2011; Tumtong, 2013; Vannapirun, 2008).

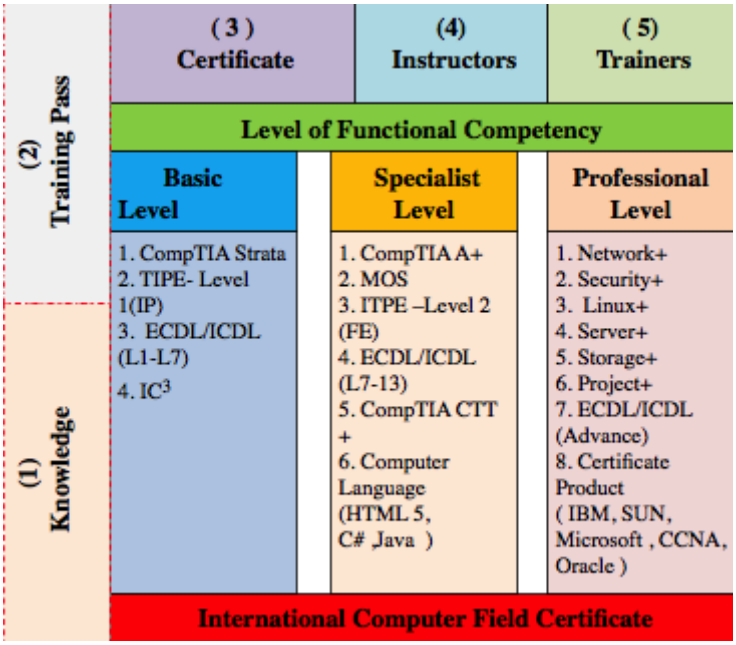

Figure 1. International professional qualification standard in the field of computing for academic personnel

1.1 Scope of the Study

The goal of this study is to develop a functional competency development model for academic personnel based on international professional qualification standards in computing field that is appropriate for application.

Variables: Independent variable is the functional competency development model for academic personnel based on international professional qualification standards in computing field. Dependent variable is the assessment result of the academic personnel competency development model based on international professional qualification standards in computing field.

Subjects: Participants in our study are the experts in the field of computing, educational technology, and curriculum development and assessment. The samples are 9 experts selected by the purposive sampling method. All these experts hold a PhD degree in education (specialized in ICT education) and have at least 5 year experiences in teaching and training computing subjects. Specifically, three of these are in the field of ICT and two are the course designer of e-learning system for computing subjects.

2. Research Methodology

The process of developing the functional competency development model for academic personnel based on international professional qualification standards in computing field is divided into 3 stages: literature review, model development, and model's appropriateness assessment. Details for each stage are the following.

2.1 Literature Review

In computing field, several new deciplines have emerged during the last decades (WitConnolly et al., 2015). Therefore, there is a real need to constantly improve the competency of academic personnels in the field in order to keep the curriculum up-to-date.

Conventionally, in higher education, learning and teaching mainly takes place in traditional classroom. However, the traditional classroom instruction typically requires all students to attend all classes at the same time. Due to this limitation and together with the advancement of digital technology, blended training system, the training or teaching practice that combines teaching methods from both face-to-face and online learning (Garrison, 2011), has emerged as a new training paradigm that could provide multiple benefits to students. In particular, the concept of blended trainning has widely been adopted in many educational areas. In 2008, the concept has been applied to support Continuing Professional Development (CPD) (Wall & Ahmed, 2008). Recently, in 2013, this blended trainining approach has beed proposed for the physical safety training course (Stuart, 2014). In Thailand, such the approach has also been proposed as a training model for higher education in university level (Sriprasertpap, 2015).

In this paper, a model to develop competency of academic personnel is designed based on blended training in order to provide timing flexibility to academic personnels and to provide timing usage efficiency for them who may have different level of background knowledge.

2.2 Model Development

In the second stage, the draft of the functional competency development model for academic personnel based on international professional qualification standards in computing field is developed based on the findings discovered from the documents reviewed in the first stage. Then, the draft of the academic personnel competency development model based on international professional qualification standards in computing field is examined and it is revised according to recommendations of the experts in the field. The final model is demonstrated in Figure 2. Additional details for each of the components are described in the next section.

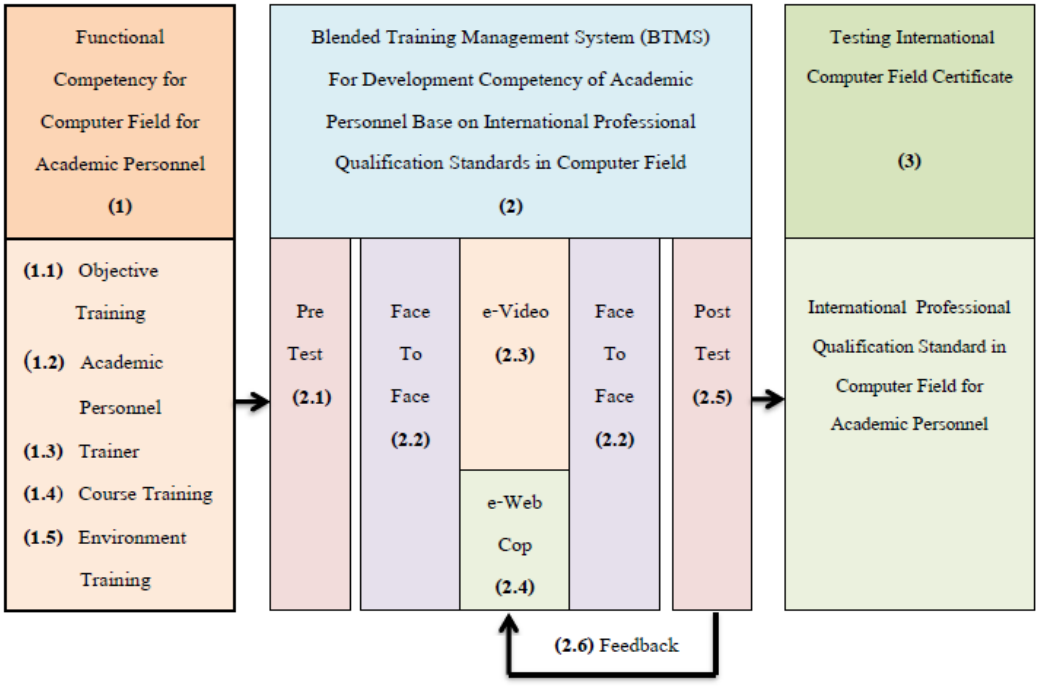

Figure 2. Functional competency development model for academic personnel base on international professional qualification standards in computing field

2.3 Assessment Result of the Model's Appropriateness

In this final stage, the instrument for assessing the appropriateness of the proposed functional competency development model is developed. Then, the appropriateness of the model is assessed by the 9 selective experts. Specifically, the assessment is performed on 5-point Likert Scale. Then the mean and standard deviation statistics for each and every component of the model are derived from the experts'opinions.

3. Functional Competency Development Model for Academic Personnel Based on International Professional Qualification Standards in Computing Field

The proposed academic personnel competency development model based on international professional qualification standards in computing field is developed based on three key components which are: 1) functional competency of academic personnel, 2) blended training system for academic personnel competency development, and 3) test for computing field's certification. The details of each component are the following.

3.1 Functional Competency

Functional competency is a component which helps specify details of academic personnels competency development based on international professional qualification standards in the field of computing. Specifically, the model consists of five modules which are the objective, the qualities of academic personnel, trainers, content (curriculum), and training environment. These are the basic framework for identifying contents and environments of the training system. The details of these 5 sub-components are the following.

(1) Objective: This sub-component is to identify the goal of developing academic personnel competency based on international professional qualification standards in computing field. For example, the goal could be to develop competency of academic personnel in computer network.

(2) Academic Personnel: This sub-component is to identify the basic requirements for the personnel who could enter the training system. That is, the trainee must 1) hold Bachelor's degree or higher in computing field, 2) have 2-year experiences or more as a trainer in TQF-certified curriculum in the field of computing field, and 3) have basic knowledge and skills in ICT.

(3) Trainers: The trainers must hold the international certificates for the courses they are responsible for. For example, the trainers for CCNA certificates must hold before the CCNA course starts.

(4) Content: The certificates must be complied with the international professional qualification standards in computing field which consist of 1) 4 basic-level certificates (a. CompTIA Strata, b. TIPE Level 1 (IP), c. ECDL/ICDL (L1-L7) and d. IC3), 2) 6 specialist-level (a. CompTIA A+, b. MOS, c. ITPE- Level 2 (FE), d. ECDL/ICDL (L7-13), e. CompTIA CTT+ and f. Computer Language (HTML 5, C#, Java)), and 3) 8 professional-level certificates (a. Network+, b. Security+, c. Linux+, d. Server+, e. Storage+, f. Project+, g. ECDL/ICDL (Advance), and h. Certificate Product (IBM, SUN, Microsoft, CCNA, Oracle)).

(5) Training plan: This component is to identify the training modules (Face to Face and e-Video and e-web cop) to be integrated into the blended training system according to the training objective. For example, the training modules for CCNA course might include Face to Face and e-web cop.

3.2 Blended Training System

Blended Training System is designed to help academic personels achieve their training goal while minimizing interruptions on their ordinal work. The key feature of the proposed blended training system is to assess the effectiveness of development of functional competency of academic personnel based on international professional qualification standards in computing field using pre-test and post-test exams that would take place before and after the training, respectively. In addition, the system utilizes e-Video system working in conjunction with e-Web collaboration as an online supportive instrument during the training phrase. The following are the details of 6 sub-components:

(1) Pre-test: This is the knowledge assessment before entering the blended training in order to infer functional competency of individuals based on international professional qualification standards in computing field. This is the step that every personnel must take before entering the training session.

(2) Face-to-face training: This module is divided into 2 stages. The first stage is an introduction about the content and description regarding curriculum content of each certificate. This is the guideline for self-learning for the learners toward the online system based on the content specified by the system. The second stage is a practical training specified by the curriculum and the conclusion of related content in the curriculum of each

certificate before entering the post-test system. In the face-to-face training, trainers must hold the certificates of the courses they are responsible for.

(3) e-Video lecture: This module is self-learning system for learners via internet in the form of e-Video. The learners can then study any time they want based on their competency and do not have to attend a fixed-time theory session.

(4) e-Web collaboration: E-Web collaboration between specific computer networks is the additional system for learners to exchange and discuss with trainers and also the fellow learners who join the same trainings for each certificate about knowledge and content related to the curriculum.

(5) Post-test: This is an assessment system after the training. Then, the system would be used to assess the competency of individuals or their readiness to take the examination for each certificate at International Standard Examination Centers.

(6) Feedback: This module is designed to re-train the learners when their post-test scores are lower than 80%. That is, those learners need to re-take the training system in Article 2.2-2.5. The function of such mechanism is to enhance the competencies of those learners before taking the actual certificate tests whereby reducing the failure rate and institution's spending on examination fee reimbursement.

3.3 Computing Field Certification Exam

Certification exam that are consistent with international professional qualification standards in computing field is another key component for validating the competency of academic personnel. Once the learners have passed the certification exam, they would receive the respective international certificate. These certificates are typically divided into 3 following levels.

(1) 4 basic-level certificates that all academic personnel must have as a basis for instructor in computing field based on TQF.

(2) 6 specialist-level certificates based on TQF that all academic personnel who teach the core subjects in computing field must have.

(3) 8 professional-level certificates based on TQF that all academic personnel who teach special professional subjects in computing field must have.

The details of examinations for each certificate are consistent with Article 1.4 in which the examinations must be held at International Standards Examination Centers only. These exams could be used to infer the competencies of academic personnel based on international professional qualification standards's criteria.

4. Assessment of the Proposed Model

The assessment result of appropriateness of the functional competency development model for academic personnel based on international professional qualification standards in computing field determined by 9 selected experts are reported in Table 1 and 2. According to the results, the academic personnel competency development model based on international professional qualification standards in computing field are rated as the highly appropriate ($\bar{x}$ = 4.78). When considering the individual key componentswhich are 1) the competency of academic personnel, 2) blended training, and 3) international professional qualification standards in computing field, we found that all of them are rated as the highly appropriate ($\bar{x}$ = 4.89, $\bar{x}$ = 4.67, $\bar{x}$ = 4.78, respectively). For the assessment result of sub-components under the three key components of the functional competency development model for academic personnel based on international professional qualification standards in computing field, details are the following.

(1) Overall, the functional competency development model component is rated as highly appropriate ($\bar{x}$ = 4.82). When considering the 5 sub-components of the competency of academic personnel which are 1) objective, 2) the qualities of academic personnel, 3) trainers, 4) content (curriculum), and 5) training environment, all of them are rated as highly appropriate ($\bar{x}$ = 4.89, $\bar{x}$ = 4.78, $\bar{x}$ = 4.89, $\bar{x}$ = 4.89, $\bar{x}$ = 4.67, respectively).

(2) The blended training system for developing academic personnel competency based on international professional qualification standards in computing field is rated as highly appropriate in overall ($\bar{x}$ = 4.83). When considering the 5 sub-components of the blended training which are 1) Pre-test, 2) Face to Face training, 3) E-Video lecture, 4) E-Web Cob knowledge exchange networking, 5) Post-test, and 6) Feedback, all of them are rated as highly appropriate ($\bar{x}$ = 4.89, $\bar{x}$ = 4.89, $\bar{x}$ = 4.67, $\bar{x}$ = 4.78, $\bar{x}$ = 4.89, $\bar{x}$ = 4.89, respectively).

(3) Computing field certification exam is rated as highly appropriate ($\bar{x}$ = 4.78). When considering each level of the certificates which are basic level consisted of 4 certificates, specialist level consisted of 6 certificates, and

professional level consisted of 8 certificates at International Standards Examination Centers, all of them are rated as highly appropriate ($\bar{x}$ = 4.78).

Table 1. Assessment result of the appropriateness of the three main components of functional competency development model for academic personnel base on international professional qualification standards in computing field

Assessment Topics	$\bar{x}$	SD	Assessment result
Section 1. Key components of the functional competency development model for academic personnel base on international professional qualification standards in computing field	4.78	.37	Highly appropriate
(1) Competency of academic personnel	4.89	.33	Highly appropriate
(2) Blended training system for academic personnel competency development	4.67	.50	Highly appropriate
(3) Examination for certificate of international professional qualification standards in computing field	4.78	.44	Highly appropriate

Table 2. Assessment result of the appropriateness of sub-components of the three main components of functional competency development model for academic personnel base on international professional qualification standards in computing field

Assessment Topics	$\bar{x}$	SD	Assessment result
(1) Competency of academic personnel (average from all sub-components)	4.82	.34	Highly appropriate
(1.1) Objective: to develop academic personnel competency based on international professional qualification standards in computer science	4.89	.33	Highly appropriate
(1.2) Qualifications of Academic Personnel: the personnel must hold: 1) Bachelor's degree in Computer Science or higher, 2) 2-year experiences as a trainer in TQF-certified curriculum in the field of Computer Science or more, 3) basic knowledge and skills in ICT	4.78	.44	Highly appropriate
(1.3) Trainers: The trainers must hold the international certificates for the courses they are responsible for	4.89	.33	Highly appropriate
(1.4) Content: The certificates must be complied with the international professional qualification standards in computing field	4.89	.33	Highly appropriate
(1.5) Training plan: Integrated training (Face to Face and e-Video and e-web cop)	4.67	.50	Highly appropriate
(2) Blended training system for academic personnel competency development (average from all sub-components)	4.83	.41	Highly appropriate
(2.1) Pre-test	4.89	.33	Highly appropriate
(2.2) Face to Face training	4.89	.33	Highly appropriate
(2.3) E-Video lecture	4.67	.71	Highly appropriate
(2.4) E-Web Cob knowledge exchange networking	4.78	.44	Highly appropriate
(2.5) Post-test	4.89	.33	Highly appropriate
(2.6) Feedback	4.89	.33	Highly appropriate
(3) Examination for international computing field	4.78	.44	Highly appropriate
(3.1) 4 basic-level certificates certified by International Standards Examination Centers: 1) CompTIA Strata, 2) TIPE-Level 1 (IP), 3) ECDL/ICDL (L1-L7) 4) IC3	4.78	.44	Highly appropriate
(3.2) 6 specialist-level certificates certified by International Standards Examination Centers: 1) CompTIA A+, 2) MOS, 3) ITPE- Level 2 (FE), 4)	4.78	.44	Highly appropriate

ECDL/ICDL (L7-13), 5) CompTIA CTT+, 6) Computer Language (HTML 5, C#, Java)			
(3.3) 8 professional-level certificates certified by international standards examination centers: 1) Network+, 2) Security+, 3) Linux+, 4) Server+, 5) Storage+, 6) Project+, 7) ECDL/ICDL, 8) Certificate Product (IBM, SUN, Microsoft , CCNA, Oracle)	4.78	.44	Highly appropriate

5. Discussion of Results

The proposed model is assessed as appropriated by the experts. Specifically, the appropriateness of the functional competency development model for academic personnel base on international professional qualification standards in computing field is considered in two levels. First, each of the individual key components of the model as well as the model itself are rated as the highly appropriate ($\bar{x}$ > 4.50).

Secondly, all sub-components of each model's components are rated as the highly appropriate ($\bar{x}$ > 4.50). Even though the assessment determined by the experts shows that a sub-component of blended training system for developing the competency of academic personnel based on international professional qualifications standards which is Article 2.3 e-Video lecture is rated lower than other components ($\bar{x}$ = 4.67), it is still rated as highly appropriate ($\bar{x}$ > 4.50). Particularly, the experts have raised a concern that the issues of internet speed and strength of wireless signal in Thailand might affect the efficacy of the training system which consists of online learning tools, e.g., e-Video and e-Web components. However, as such technology has constantly become more popular, it is expected that the issues would be resolved in the near future. Also, the experts suggested that the training objective must be carefully choosen so that, at the end, the knowledge and skills the trainees obtained from the course can benefit to students.

All these results have confirmed the potential of the proposed training model to develop functional competency of academic personnels, based on experts' opinions. This model could also be appiled to other scienfic deciplines which each of them also consists of different emerging branches to constantly maintain and enhance the qualification of academic personnel while providing flexibility in training process. In the next step, this system would be deployed in educational institutes in Thailand and the effectiveness of the proposed model will be reported.

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