



# Assessment of Information Technology Use Competence for Teachers: Identifying and Applying the Information Technology Competence Framework in Online Teaching

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**Abstract:** This paper proposes a theoretical framework as a foundation for building information technology competence framework and the requirements for using information technology competence of teachers in online teaching at training institutions. The parameters in this paper survey was conducted on sample space (n = 342) and 42 expert opinions to identify information technology competence framework with criteria and skill sets necessities to successfully organize online teaching. This paper discusses on teaching developing information technology competence to change minds and develop teachers' competency to meet the online teaching trend of the digitalization today. So, building information technology competence framework in online teaching has many meanings in training process contribute to improving the learning capacity of students.

**Keywords:** Information technology in education, information technology competence, assessment competence, digital literacy, online teaching

## 1. Introduction

Technical and Vocational Education and Training (TVET) has an important role to play in technology diffusion through the transfer of knowledge and skills. Rapid technological progress has had and continues to have significant implications for TVET. Understanding and anticipating changes have become crucial for designing responsive TVET systems, and more broadly, effective skills policies. The flexibility to adapt the supply of skills to the rapidly, and in some cases radically, changing needs in sectors such as information technology and the green economy has become a central feature of TVET systems.

UNESCO has defined TVET as comprising of education and training and skills development relating to a wide range of occupational fields, production, services and livelihood. TVET as part of lifelong learning can take place at secondary, post-secondary, tertiary and includes work-based learning and continuing training and professional development that may lead to a qualification. It needs to consider literacy, numeracy skill, transversal skills and citizen skills which form an integral part of TVET (UNESCO, 2015). The summary of TVET can be clustered into three main attributes which are (1) Inclusive of education and training processes; (2) Comprehensive shaping of talent; and (3) Crossing all occupational fields (Ismail, et al., 2018).

TVET courses have been created to respond to the diverse information communication technology (ICT) needs of learners, whether these are related to work, education or citizenship. New courses have been introduced to address

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occupational changes in the ICT job market, while many TVET providers have shifted provision towards a blended approach, with significantly more self-directed and/or distance learning. Skills for economic development include a mix of technical and soft skills. Empirical evidence and TVET policy reviews conducted by UNESCO suggest that TVET systems may not as yet sufficiently support the development of the so-called soft competencies (UNESCO, 2013b), (UNESCO, 2013c). Many countries have, however, adopted competency-based approaches as measures for reforming TVET curricula.

In today digital world, in addition to the basic applying information technology (IT) in teaching, the identification of criteria and the demand for using IT competence in online teaching are the indispensable trend in education. Many research results show that the integration of technology has many benefits for both teachers and students in the teaching process. By studying the impact of applying IT competence in teaching through analyzing and compiling information from many related scientific publications conducted in different countries, the authors give that IT application enhances cognitive ability, self-learning ability of students (Koehler, Mishra, Kereluik, Shin, & Graham, 2014), (Almerich, Orellana, Suárez-Rodríguez, & Díaz-García, 2016), (Hsu, 2017). Therefore, the teachers needing the IT competence to improve the quality of teaching activities of themselves can shape and develop IT competence for students through training.

The research was developed and distributed to experienced online teachers to assess the importance of online teaching tasks with a 7-point Likert measuring tool (Bigatel, Ragan, Kennan, May, & Redmond, 2010). Effective online course development depends on; 1) course content is well designed the interaction between teachers and learners is good, and the teachers are well prepared and fully supported; 2) creating a sense of online learning community; and 3) the rapid advancement of technology (Sun & Chen, 2016), which demonstrates the impact of technology bringing fundamental success in online teaching, and it is essential in organizing and implementing courses.

This study aims to identify the IT competence framework to propose the requirements and procedures for useful tools and resources from IT competence to communicate, organize, store, administer and assess in online teaching by inheriting and developing the IT competence frameworks and skills standards of organizations such as UNESCO, ISTE, TPACK. The scale can support the measurement and assessment of IT competencies in the context of the digital age in teaching, and it provides the right direction in fostering and developing this competence for teachers in online teaching. The research process was carried out by generalizing experiences, investigating education and seeking expert opinions to establish research results. The research's results will contribute to the theoretical and practical pedagogy of technology in education.

## 2. Related Works

By analyzing the concepts of competence, we can define competence into following categories: Activity category (competence is the mobilization of knowledge, skills and other personal attributes excitement, belief, will ... to perform a certain type of work in a given context (Education and Training Ministry, 2015)); Category of individual attributes (competence is the characteristic of an individual who demonstrates the level of proficiency-ie, which can be practiced successfully and certainly-one or several types of activity (Institute of Linguistics, 2010)).

The term IT is defined as a set of modern scientific, technological and technical tools for the production, transmission, collection, processing, storage and retrieval of information, and exchange of digital information (National Assembly of Vietnam, 2006). IT competence is defined as a diverse set of tools and technology resources, used to exchange, create, disseminate, store and manage information. The concept of IT competence in teaching is understood as storage, processing, and communication of information by electronic means, and through such means to communicate, and communicate information between many people or group together effectively in the teaching process.

According to UNESCO: In 2018, the United Nations Educational Scientific and Cultural Organization (UNESCO) set up an ICT Competence Framework for Teachers version 3.0, in which the competence framework covers 6 dimensions (UNESCO, 2018) developed from UNESCO version 2.0 in 2011. In teaching, the teachers include:(1) Understanding ICT in Education, (2) Curriculum and Assessment, (3) Pedagogy, (4) Application of Digital Skills, (5) Organization and Administration, (6) Teacher Professional Learning.Each aspect consists of 3 levels of continuity in the development of teacher competencies:1-Knowledge, 2-Knowledge Deepening, 3-Knowledge Creation.

The ICT competence framework proposed by UNESCO in 6 dimensions is very diverse, not only in terms of tool use but also in theoretical knowledge, and in activities specific of the teacher. In addition, the demand for IT competence in teaching for teachers is not limited in the proficient and effective use of what is available, but also encourages innovation, creating new ones based on the practice requirements of the teaching process. Helping teachers to develop technological knowledge and skills in how to use new ICT to teach is a critical component of teacher preparation in the digital age. The results of the study confirmed that the professional development of teachers in the use of new ICT in the digital age should be an ongoing effort in all educational institutions, and is imperative to train teachers in an innovative method of teaching with ICT resources (Adegbenro & Olugbara, 2018).

In 2012, the TPACK-XL framework was Milad Saad, et al., built which redefining ICT-TPCK knowledge bases. "The potential of TPACK-XL framework might seem useful to serve as an advanced lens of ICT-TPCK for educators

and researchers to open the discussion about the strategies leading to building preservice teachers' knowledge and the corresponding teacher education programs content that appreciate the pedagogically wise negotiation to fit the capacities of ICTs in education" (Saad, Barbar, & Abourjeili, 2012).

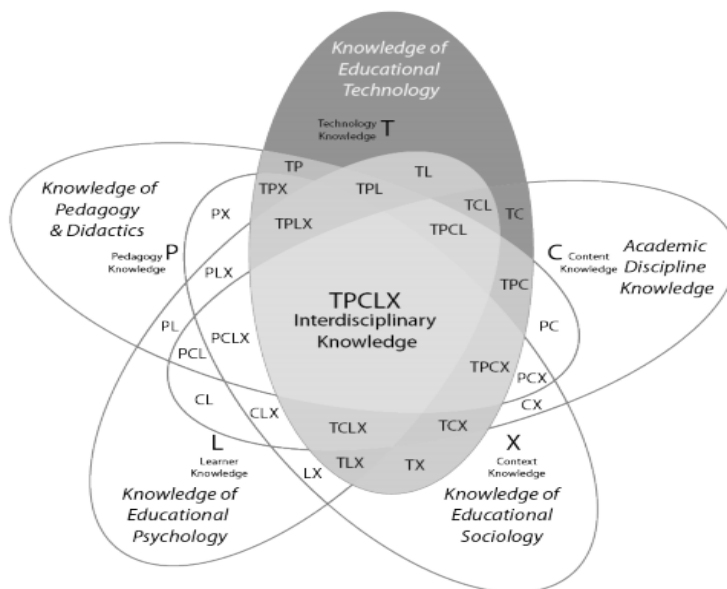


Fig. 1 - Educational Technology in TPACK-XL (Saad, et al, 2012)

ISTE's technology skills standard for teachers and education: In 2008, the ISTE (International Society for Technology in Education) published a set of standards for technology skills for teachers, and in 2018, which development the set of standards for technology skills for education leaders (ISTE, 2018) including 5 standards: (1)-Equity and Citizenship Advocate, (2)-Visionary Planner, (3)-Empowering Leader, (4)-Systems Designer, (5)-Connected Learner. This standard defines the skills and pedagogical ideas that educators need in the digital age.

The uniqueness of this scale is that the application of IT is not limited to the skill level of using technology in different fields, but it also emphasizes theoretical, practical and critical understanding. It also mentions the positive attitude, correctness, and leadership when using digital tools and resources in schools. There are some researches on competence framework, IT skills standards, or IT competence assessment in teaching (Hsu, 2017), (Mosa, Mahrin, & Ibrahim, 2016), (Lacey & Murray, 2015), (Koehler, Mishra, Kereluik, Shin, & Graham, 2014), (Wang, Chen, & Anderson, 2014), (Prineas & Cini, 2011), (Geçer & Dağ, 2010). However, the results of this research show that they are only applying traditional teaching methods or interactive results, learners' competence evaluation to organize an online basis, but they have not solved the problem in setting up the tools of evaluation criteria for using IT in teaching and online teaching. The author's research direction is to propose the process of building a set of criteria for assessing the competence to use IT in association with the IT competence framework in online teaching.

### 3. Methodology

This study used a combination of qualitative and quantitative methods. This would be best equipped to provide the depth of description needed to clarify how the essential needs of using IT competence in online teaching. Based on teacher interviews and review of relevant studies, teaching tasks were identified and included survey instruments. In this study section, we used investigation results for data collection, analysis methods, and get an expert opinion.

All interviews were recorded with the permission of the participants and subsequently translated from Vietnamese into English. The database was initially constructed for each case. Then, each case's data would be organized, classified, edited and analyzed according to the research objectives.

The methods were used in this study, through the study process, empirical analysis and get of the specialist's view, and the analysis has generated reliable factors. These methods based on the ICT competence framework of UNESCO, ISTE, TPACK, and which were based on obtaining the process of survey data by SPSS version 20, and MS Excel 2016 software.

#### 3.1 Sample

The research covers all the teachers and undergraduates who study and learn at Education Universities in Vietnam from the 2017 – 2018 academic years. The sample group was chosen randomly at 342 among teachers and undergraduates, and 42 expert opinions.

## 3.2 Procedure

We conduct research methods. The data was collected through the survey of using IT in the teachers and undergraduates. The survey with sample space ( $n = 342$ ) was administered to 342 teachers and undergraduates, and 42 expert opinions at Education Universities. In the research, validity was defined according to the specialist's views. The reliability of the competence framework scale was calculated by using Cronbach's Alpha, and expert opinions. The experimental results from the Cronbach's Alpha demonstrated that the competencies in the experimental questionnaire were reliable. An overall alpha score for the pilot data was found at 0.791 (Table 2), which indicated high reliability of the instrument. Each variable in the one-way analysis were applied with SPSS statistical software, and an optimal scaling technic was also used to reach detail information related to one of the research questions.

## 3.3 Descriptive Statistics of Data

The results were analyzed from the investigation and survey data, with which we assess the needs of applying IT competence and demand has an IT competence framework in online teaching; the core aim of this study is identifying 6 steps building IT competence framework, the structure of IT competence framework (Fig. 2), and propose the criteria framework of identifying the using IT competence in the online teaching of teachers with of 10 component competence groups and 33 indices of corresponding expression (Table 1); experiment and analysis with t-Test for the applying of IT competence framework (Table 1) in online teaching as results in Table 5 and Table 8.

## 4. Results

### 4.1 Current Situation of IT Applying in Online Teaching

In recent years, computer technology has been increasingly utilized for educational settings. Undergraduates are substantially involved in technology indoors and outdoors in the classrooms. Within the environmental conditions that the speed and substructure of internet networks, and digital technologies rapidly change and improve, technology cannot be considered separately from education (Semiz & Ince, 2012). Most schools have been built according to computer technology needs and equipped with necessary hardware, software and network infrastructure for internet access.

Practical survey: Surveyed on 342 teachers and undergraduates at colleges and education universities in Vietnam. Survey forms: questionnaires, live interviews and online surveys (via google docs forms, zalo, viber and other media). Survey results the levels apply IT of the teacher in online teaching achieved: average rate 85% ability to use internet services in online teaching, 89% ability to integrate new technology with pedagogy, 87% extend of application and development of IT competence in online teaching.

Through the analysis of survey results, it can be seen that the number of teachers applying technology to teach and communicate with colleagues and students is pretty good. The need of using IT competence framework in online teaching: The issues were investigated include: (1) the urgency of the introduction of using IT competence framework for teachers, (2) Self-assessment of proficiency in using the IT in teaching, (3) Assessment of coherence between teaching methods and the use of IT in teaching, (4) Assessment the level of applying IT in teaching, from data storage, communication to the exploitation of online resources.

Survey results demand the IT competence framework of teachers in online teaching: The results show that the majority of teachers (80%) determine the necessary and very necessary for the IT competence framework used in teaching towards developing the IT competence of teachers necessary in online teaching.

*Assessment:* Most teachers are aware of the importance of applying IT in online teaching with the trend of the digital age; There should be a standard framework for assessing using IT competence for teachers. Besides, instructors need to know the combination of teaching methods and the use of IT in online teaching; Teachers need to know how to use IT to store, communicate with colleagues, and use IT resources to improve their teaching effectiveness.

### 4.2 Identifying the Using IT Competence Framework in Online Teaching

#### 4.2.1 Principles of Identifying Competence in Online Teaching

Several studies show that teaching methods are effective in online learning environments with organizational manners and competence requirements for online courses. Online teaching, online education, online tutorials and online courses are used interchangeably in the online teaching methodology (Sun & Chen, 2016).

Researched in technology and teaching methods that focus on core skills in online teaching organization, including (Gascoigne & Parnell, 2014): (1) technology, (2) pedagogy, and (3) administrative competence.

- Technology and social communication skills: Technological skills are fundamental, and although social communication skills are not essential, it enhances the ability to connect with the instructor's students. Skills include: basic computer skills, proficiency in software applications, software installation/updating, internet search capabilities, proficiency with features, communication platforms and functions in the learning management system.

- Management and organizational skills: Skills such as time management, providing constructive feedback on students' assignments, proficiency in the content of the course and the ability to submit grades upon request, in accordance with track academic integrity issues.
- Pedagogical skills and teaching methods: Centralized learning models, content-guided instruction and learning guides do not provide content, providing feedback on building, establishing and maintaining online presence.

A study has identified the potential for success in online teaching, which 7-point rule of effective teaching with online teaching success (Bigatel, Ragan, Kennan, May, & Redmond, 2010): 1). Encourage contact between students and faculty, 2). Develop reciprocity and cooperation among students, 3). Encourage active learning, 4). Give prompt feedback, 5). Emphasize time on task, 6). Communicate high expectations, 7). Respect diverse talents and ways of learning. The teacher needs competence: In the knowledge, creation approach will be able to design learning based on IT resources and environment; use IT to support the development of knowledge creation and critical thinking skills of students; assists students continuously, effectively learning and creating knowledge communities for students and colleagues.

#### 4.2.2 Proposing the Criteria of Identifying IT Competence Framework in Online Teaching

One of the implications of the growth in the practice of telecommunication is its inclusion in teacher education programs, particularly CMC teacher education approaches based on social constructivist views of teacher education in developing teaching competence (Dooly, 2010); (Guichon & Hauck, 2011). This kind of experience has been found to foster the development of multimodal communicative competence, multiliteracies, autonomy, and the teacher competencies required for teaching with multimodal technologies (Fuchs, Hauck, & Müller-Hartmann, 2012).

The growth of competency-based education in an online environment requires the development and measurement of quality competency-based courses, and the background for a proposed rubric to measure quality in competency-based online courses (Krause, Dias, & Schedler, 2015). The IT competency model identifies the knowledge, skills, and abilities deemed necessary for workers to perform successfully in the field of IT. This work was one of many sources that provided a foundation for teaching curricular guidance (U.S. Department of Labor, 2012).

According to (Keengwe & Kidd, 2010), the course design process has 5 stages: (1) content design; (2) content development; (3) content implementation; (4) course assessment; (5) modify the content. Research on materials related to the using of IT competence framework in teaching and the criteria in assessing the use of IT in online teaching. In order to build the IT competence framework in line with online education and to approach the international trend, we will base on the following principal bases:

- a) ICT competence framework for teachers by UNESCO
- b) TPACK model theoretical framework
- c) Standards technology skill of ISTE organization
- d) Developed the framework with IT competence of ETS organization
- e) IT Law
- f) IT competence building program of MoIC
- g) Regulations on the application of IT in teaching by MoET
- h) Output standard of students in the training program pedagogical universities
- i) Characteristics of online learning model
- j) Technology and IT factors in online teaching
- k) Some typical researches on frameworks, sets of competence criteria using IT in teaching

The bases are the main basis for evaluating the competence using IT in teaching and defining the IT competence framework for teachers in online teaching. Through research, practical assessment of the application of IT in teaching and the need of using IT competence in teaching and online teaching, we propose a process for identify the IT competence framework for teachers in online teaching including 6 steps: *(1)-Identify bases for competence building, (2)-Build a competence framework with component competences, (3)- Build expressions for each component competences, (4)-Describe criteria corresponding to each expression in the competence framework, (5)-Get expert advice, (6)-Complete the competence framework.*

Identification of the IT competence framework including indicators and criteria developed on the basis of research, analysis survey data, assessment, control, and ask for experts who are educational researchers and knowledgeable teachers about the field of applying IT in general teaching and online teaching in particular, along with some teachers have experience teaching in universities. After receiving feedback from the experts, the IT competence framework was revised and further submitted for comments (repeat steps (2) <-> (5) of 6 steps on above). This process is repeated until there is high consensus from the experts.

The proposed framework for the use of IT competence in online teaching is reviewed on the assumptions set out in the selection of criteria, measurement values and assessment results. How to define criteria, measure the value of criteria, and evaluate effectiveness when applying the IT literacy framework in online teaching needs to be clarified;

The identification of competence framework should cover common competence, professional competence and managerial capacities in order to address the elements of mission objectives, criteria and competence requirements in online training promote effectiveness in teaching methodology for competence development.

Determining the core content of the IT competence framework for teachers in online teaching is a system of component competencies that describe in detail the expressions of (1) knowledge, (2) skills, and (3) attitudes at each level in assessing teachers' IT competence according to 3 levels.

Based on the study of national and foreign scientific resources and materials, combined with the context of the education and training sector, the results of gathering opinions from 42 experts on the criteria system of the IT competence framework in teaching, and evaluation carefully in line with the reality and trends approach international education; we propose a structure of IT competence framework for teachers in online teaching (Fig. 2).

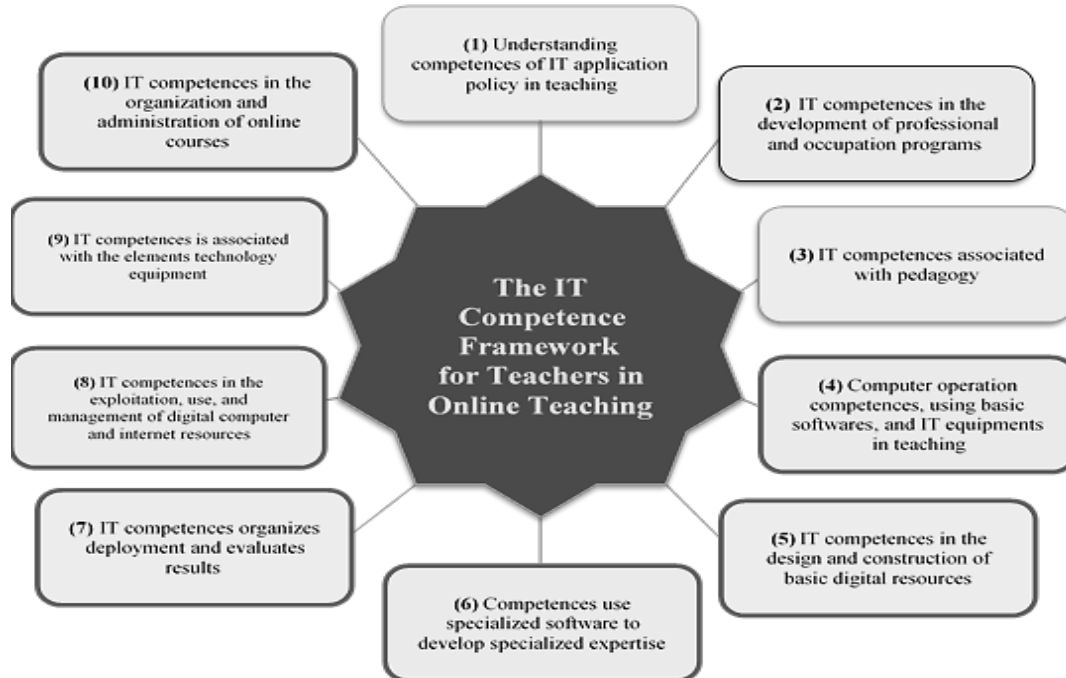


Fig. 2 - The Structure of IT Competence Framework for Teachers in Online Teaching

With the IT competence framework in online teaching (Fig. 2), we built a set of criteria to evaluate IT use competency for 10 component competence groups with 33 criteria indicators (Table 1).

Table 1 - The IT Competence Framework Of Teacher In Online Teaching

Competency Group	Index Criteria
1-Understanding competences of IT application policy in teaching	<ol style="list-style-type: none"> <li>1. Analyze, assessment issues of using IT in teaching.</li> <li>2. Update and analyze trends and policies applying IT in teaching according to IT law.</li> <li>3. Proposing alternatives for applying IT in the teaching process in accordance with objective and subjective conditions.</li> </ol>
2-IT competences in the development of professional and occupation programs	<ol style="list-style-type: none"> <li>1. Factors applying IT in professional and occupation programs.</li> <li>2. Assessment the impact of IT factors on training disciplines.</li> <li>3. Demand for IT application in the development of professional and occupation programs.</li> </ol>
3-IT competences associated with pedagogy	<ol style="list-style-type: none"> <li>1. Identify IT competence factor in the teaching methodology.</li> <li>2. Apply IT competence in teaching to develop career of yourself.</li> <li>3. Competence of using IT in professional training and professional pedagogy of teachers.</li> <li>4. Combine the application of IT with positive teaching methods and the specific teaching method of each specialty.</li> </ol>
4-Computer operation competences, using basic softwares, and IT equipments in teaching	<ol style="list-style-type: none"> <li>1. Basic computer use and operation skills.</li> <li>2. Ability to set up and use softwares, basic applications on the computer.</li> <li>3. Skills to use the basic IT application softwares in teaching.</li> <li>4. Use peripherals and conventional IT tools in teaching.</li> </ol>

Competency Group	Index Criteria
5-IT competences in the design and construction of basic digital resources	<ol style="list-style-type: none"> <li>1. Use the basic IT softwares and applications in designing, building digital resources.</li> <li>2. Use tools to search, exploit, update, edit and export documents for teaching.</li> <li>3. Use utility software, IT support tools to exploit and manage digital resources in teaching.</li> </ol>
6-Competences use specialized software to develop specialized expertise	<ol style="list-style-type: none"> <li>1. Ability to use specialized IT application softwares according to professional and industry characteristics.</li> <li>2. Ability to integrate and embed IT application products in teaching.</li> <li>3. Effectively manipulate products created from specialized softwares.</li> </ol>
7-IT competences organizes deployment and assessment results	<ol style="list-style-type: none"> <li>1. Use software to assist in the development, design, and management of test bank in digitized form.</li> <li>2. Use a variety of forms of examination, assessment through tools, softwares to provide assessment information, feedback on teaching and learning.</li> <li>3. Promoting the competence for IT application in the interactions of the process of organizing the examination, assessment and feedback for students in the technology application environment.</li> </ol>
8-IT competences in the exploitation, use, and management of digital computer and internet resources	<ol style="list-style-type: none"> <li>1. Use tools to manage time, organize digital databases, and manage resources online.</li> <li>2. Use tools to monitor, manage, communicate, and support students during the participation of the course.</li> <li>3. Use proficient systems, external data storage devices, and online storage.</li> </ol>
9-IT competences is associated with the elements technology equipment	<ol style="list-style-type: none"> <li>1. Use technology equipments and peripherals attached to computer systems and IT application systems.</li> <li>2. Applying elements of technology equipments in multi-dimensional interactive learning environment support design.</li> <li>3. Capacity to use new technology equipments in teaching.</li> </ol>
10-IT competences in the organization and administration of online courses	<ol style="list-style-type: none"> <li>1. Ability to use and operate the course online.</li> <li>2. Maximize the ability to administer and organize course in an online environment.</li> <li>3. The ability to analyze and access digital resources in the online environment.</li> <li>4. Online work skills.</li> </ol>

Determining competence blocks for (1) knowledge, (2) skills, and (3) attitudes according to 3 levels corresponding to each expression of the IT competence framework for teachers in online teaching to achieve, including:

- Level 1. Teacher has a low level of competence (basic level: there is comparison in applying).
- Level 2. Teachers have energy at average level (quite proficient level: there is an evaluation in application).
- Level 3. Teachers have high level of competence (proficiency level: analysis and evaluation, criticism and creativity, can share and re-instruct).

The set of criteria for the use of IT by teachers' IT framework is assessed according to these 3 levels and is a measure of teachers' IT use in online teaching.

### 4.3 Assessment the Criteria Scale of IT Competence Framework

After build the set of criteria to evaluate IT use competence (Table1), we surveyed on 342 research objects, and process processing and data statistics, the Cronbach's Alpha parsing to rating the trust and value of the between observed variables in scale and EFA factor to evaluate the convergence value and the discriminant value of the observed variables for the elements of the scale. The main manifestations are the observed variables for the 10 component competence groups of the IT competence scale.

The  $j^{th}$  criteria expression of the  $i^{th}$  competence will be assigned variable  $NLi\_TCj$  ( $i = 1->10, j = 1->4$ ).

With 3 levels of 33 criteria expressions for 10 component competences, we assign level 3: = 3; Level 2: = 2; Level 1: = 1.

The analysis results are as follows:

i) Cronbach's Alpha coefficient analysis

Cronbach's Alpha coefficients were analyzed for each of the factorial capacities with their observable variables, we have confidence coefficients of 0.6 and above with a variable-sum correlation greater than 0.4.

With 10 component competence groups with 33 observation variables, we have the following results:

**Table 2- Reliability Cronbach's Alpha of the IT Competence Framework**

Reliability Statistics	
Cronbach's Alpha	N of Items
.791	33

Example: With component competences of 3 competence group with 4 observation variables assigned: NL3\_TC1, NL3\_TC2, NL3\_TC3, NL3\_TC4, we have the following results:

**Table 3 - Cronbach's Alpha of 3 Competence Group**

Reliability Statistics	
Cronbach's Alpha	N of Items
.871	4

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
NL3_TC1	8.000	9.500	.947	.866
NL3_TC2	7.600	8.300	.868	.723
NL3_TC3	7.500	8.200	.866	.721
NL3_TC4	7.600	8.300	.868	.723

ii) Analyzing the EFA Factor

When analyzing the exploratory factor for each component competence, we have the observed variables converge on an element, which has a relatively high Factor of load and is greater than 0.5. The KMO (Kaiser-Meyer-Olkin) coefficient is in the range of  $0.5 \leq KMO \leq 1$  and has the Bartlett Sig.  $< 0.05$ .

For example, with 3 component competence group, we have the following result:

**Table 4 - KMO Factor of 3 Competence Group**

KMO and Bartlett's Test	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.794
Approx. Chi-Square	521.832
Bartlett's Test of Sphericity	df 8
	Sig. .000

The above results show that the scale for each component competence is quite high.

iii) Analysis of the Pearson correlation coefficient between the observed variables in the components

When analyzing the Pearson correlation coefficient between the observed variables in each factor, we have a relatively high correlation coefficient. With the results of the scale analysis above and expert's opinions, it is possible to confirm that the IT competence framework in Table 1 is feasible and right with reality.

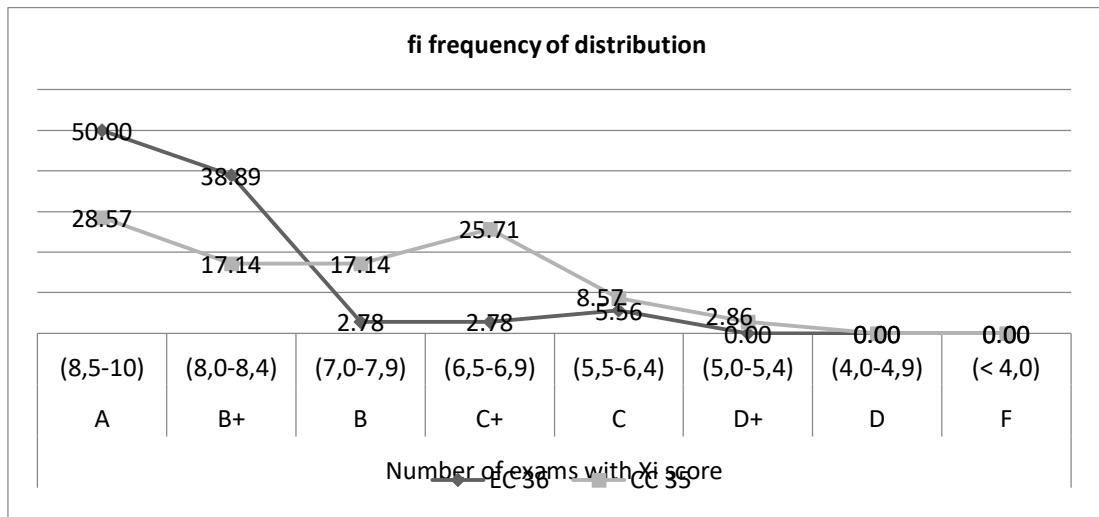
**4.4 Assessment of Experimental Results Applied IT Competence Framework**

Conduct empirical evaluation through the organization of teaching on two object classes including: experimental classes that apply to teach the approach of developing IT and control classes with traditional teaching methods. "Experimental Class" denoted as EC, and "Control Class" denoted as CC. Through statistics, results of  $F_1$  distribution table (number of students achieving  $X_i$  score),  $f_i(\%)$  frequency table, and  $f_{a\downarrow}$  frequency of backward convergence learning results, as follows:



**Table 5 - Table  $f_i$  Scores and  $f_i$  (%) Frequency for Assessment Learning Results**

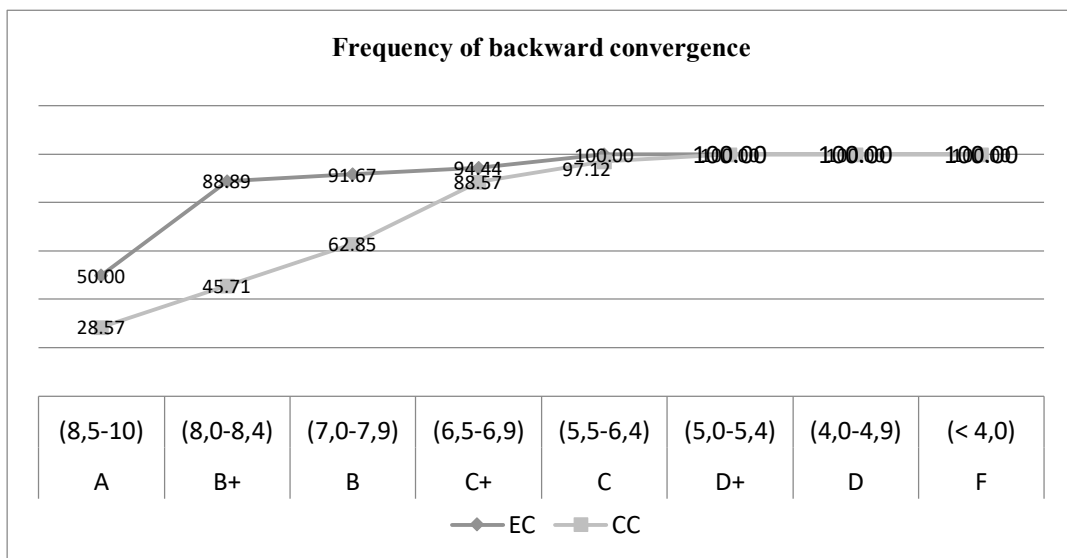
Class	Total students	Number of exams with $X_i$ score							
		A (8,5-10)	B <sup>+</sup> (8,0-8,4)	B (7,0-7,9)	C <sup>+</sup> (6,5-6,9)	C (5,5-6,4)	D <sup>+</sup> (5,0-5,4)	D (4,0-4,9)	F ( $< 4,0$ )
EC	36	18	14	1	1	2	0	0	0
		50,00	38,89	2,78	2,78	5,56	0,00	0,00	0,00
CC	35	10	6	6	9	3	1	0	0
		28,57	17,14	17,14	25,71	8,57	2,86	0,00	0,00



**Fig. 3 -  $f_i$  Frequency of Learning Results**

**Table 6 - Table frequency of backward convergence ( $f_{a\downarrow}$ ) learning results**

Class	Total students	Number of exams with $X_i$ score							
		A (8,5-10)	B <sup>+</sup> (8,0-8,4)	B (7,0-7,9)	C <sup>+</sup> (6,5-6,9)	C (5,5-6,4)	D <sup>+</sup> (5,0-5,4)	D (4,0-4,9)	F ( $< 4,0$ )
EC	36	9,25	8,2	7,45	6,7	5,95	5,2	4,45	2,0
		50,00	88,89	91,67	94,44	100	100	100	100
CC	35	28,57	45,71	62,85	88,57	97,12	100	100	100



**Fig. 4 -  $f_{a\downarrow}$  frequency of backward convergence of learning results**

Table of analysis results (Table 6) shows that the percentage of students achieving good and excellent grades in the EC class (reaching 91.67%) is higher than that of the CC class (reaching 62.86%). From the graph of the backward convergence frequency (Fig. 4), the value of the line shows the frequency of backward convergence of EC class upper layer compared to the control layer of CC class, showing that the results of the overall scores of the EC class is higher than CC class.

#### 4.4.1 Analysis of Statistical Characteristic Parameters

From the results of the EC classes and the CC class (Table 5), the analysis results with t-Test Data Analysis tool in MS Excel are as follows:

**Table 7 - Analysis t-Test of Statistical Characteristic Parameters**

Parameter	EC	CC
Mean	8,00	7,78
Standard Error	0,159995	0,120074
Median	7	6,7
Mode	7	6
Standard Deviation	0,647998	0,366022
Sample Variance	0,5575	0,417,94
Kurtosis	0,543341	0,495145
Skewness	0,714003	0,630475
Range	36	35
Minimum	0	0
Maximum	36	35
Sum	72	70
Count	9	9
Largest(1)	36	35
Smallest(1)	0	0
Confidence Level(95,0%)	9,592965	8,347906

From the results of Table 7, the average parameters, median, standard deviation, sample variance of the test scores of the EC class are higher than the CC class. Therefore, that can be determined that there has been progress and increase in scores in assessing learning outcomes when applying teaching models that apply the IT competence framework in teaching online.

$$ES = \frac{Mean_{post} - Mean_{pre}}{Standard\ Deviation_{pre}} = \frac{X_{EC} - X_{CC}}{S_{CC}} = 0,6$$

The value  $ES = 0,6$  reaches the average influence level (the ES value is about 0,5 to 0,79). The average value (expected) the score distribution table is calculated:

$$\bar{X} = \frac{1}{n} \sum_{i=1}^n n_i \cdot x_i$$

+ With the EC class:

$$\bar{X} = \frac{1}{36} (18 \times 9,25 + 14 \times 8,2 + 1 \times 7,45 + 1 \times 6,7 + 2 \times 5,95) = 8,54$$

+ With the CC class:

$$\bar{X} = \frac{1}{35} (10 \times 9,25 + 6 \times 8,2 + 6 \times 7,45 + 9 \times 6,7 + 3 \times 5,95 + 1 \times 5,2) = 7,71$$

Table of data on the impact level of the score results of students:

**Table 8 - The impact level of the score results**

Class	Average value	Standard deviation	Variance	ES index
EC	8,54	0,65	0,56	0,6
CC	7,71	0,37	0,42	

#### 4.4.2 Evaluation of Experimental Results

Through the data analysis tables and Table 8, the final evaluation results of the module were conducted, showing that the average score of the EC classes (using the IT competence framework in online teaching) is 8,54 higher than the CC classes is 7,71. Based on the chart of spectral scores in the graph of the distribution of scores, as in the graph of frequency distribution, that can be seen clearly: The students achieving good and excellent scores (from B score or higher) in the EC class is higher CC class; on the contrary, the students achieving a C/C+ score was lower in the CC class is higher EC class.

Experimental assessment results confirmed the feasibility and effectiveness of teaching according to the approach of IT development. It can be concluded that students' learning efficiency has increased, the quality of teaching and learning of classes has been improved in the teaching process. This proves that the organization of teaching applying the IT competence framework for teachers with an online learning model in the direction of teaching and developing skills has had a positive impact, contributing to improving the efficiency and quality of training for pedagogical students.

## 5. Findings and Discussions

The identifying the structure of using IT competence framework of the teacher in online teaching is designed to exploit the application of IT in online teaching to meet the trend of education period with the public digitization, which is the core of IT and communication, addressing the main objectives of teaching in general and in online teaching in particular in the direction of competence development, including; Knowledge and skills to use basic IT suitable for career objectives; Integrate pedagogical knowledge and skills with technology to improve teaching and learning; Apply technology to handle, store, respond and assessment learning outcomes; Use technology to improve communication, collaboration and effectiveness in teaching; Effectively exploit the application of IT in teaching in accordance with the period of digital technology.

In the process identifying the criteria of IT competence framework in online teaching, the following points should be discussed and clarified so that the use of the competence framework is highly effective: It is necessary to develop appropriate teaching and learning activities so that learners can express their behaviors or create learning products, which is a testament of ability of learners through online school; A teaching content can not develop all the elemental competences so the teacher can select some appropriate elemental competence for assessment corresponding to the learning content; The assessment of the development of competence is very elaborate and time-consuming, effort of teachers. Therefore, teachers can encourage self-assessment and peer assessment. At the same time, teachers can use some software to synthesize, manage and process the most effective assessment results in the process of organizing online teaching; It is also important to consider the value of competencies as indicated by participants in the online expert survey, but not the explicit competencies required for online teaching success.

For the best learning outcomes, online learning environments need to have features that facilitate interaction and collaboration among learners so that they can create a good learning environment. Teachers need to be trained continuously, have sufficient time to prepare and participate in online courses, appropriate class sizes and a well-deserved salary (Colwell & Jenks, 2004), the timelines need to be clearly defined so that learners can organize (Shi, S. et al.'s, 2006), the relationship between undergraduates' classes and computer competency results showed that there is a significant difference (Zorba, 2011), the identify barriers in teaching, new role of teacher in the online learning environment to stimulate the reflection of effective strategies to enhance the success of teachers in the transition from the pedagogical platform online learning (Keengwe & Kidd, 2010) with IT in teaching makes up the success factor of online teaching.

Online education is an alternative to student learning to focus on critical and creative thinking (Wang Y. D., 2014). However, online courses are usually driven by technology (Callaway, 2012) and are more designed for the convenience of online systems and technology (Cole, Shelley, & Swartz, 2014). To foster intellectual rigor and develop personal and informative perspectives, further research should explore how to use technology and software to engage students in repeated and ongoing conversations in many different online formats.

The online teaching model using IT is a useful trend in the digital age today. The ability to set up and interact with the IT application platform for online courses will be a milestone considering the effectiveness of the teaching process. With this model, a factor of criteria in assessing the competence to use IT is necessary; It not only acts as a toolkit in applying IT to the teaching process, but also a measure of the teacher's IT competence; This allows the teacher itself to know the inherent competence and the need to cultivate the necessary criteria to achieve IT knowledge, skills and competencies used in online teaching.

## 6. Conclusions

The parameters in this paper represent a phase of a multi-stage study aimed at addressing the need for IT competence framework in online teaching with the criteria and skills required to organize successfully teaching online. The results of this study provide the framework for accessing methods and content in the form of IT competence needed to be included in the curriculum for professional development. The methodology and results presented in this study may prove useful to educational institutions that determine IT competence to target professional development programs. The survey instrument used may serve as the basis of a rating tool that can be given to teachers for the purposes of assessing their unique educational needs in the online environment.

Through the process of surveying, analyzing, evaluating and proposing to identify the framework of IT competence in online teaching includes 10 component competence groups with 33 criteria indicators according to 3 levels corresponding to each expression of the IT competence framework for teachers in online teaching to achieve, which the research objectives set. The basic ability to apply IT in online teaching, identify the criteria of using IT to help teachers identify the goals set for students in each module, from which to build content teaching and selection of teaching methods more appropriate. At the same time creating opportunities for students to participate and evaluate the process helps students recognize what to do and need to improve to achieve the best results. With the advancement of technology, the main factor is IT, the application of the role of many technological tools to promoting better social interaction and the growth of a learning community should be enhanced. social media and virtual reality environments. This approach is perfectly suited to the requirements of teaching-oriented learners.

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