

# Assessment of Learning Results on the Development of Competency to Use Information Technology in Teaching

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**Abstract**— Competence and assessment of competence based on modern teaching model is one of the trends of applying innovation in teaching methods towards the development of learners' competence. The process of organizing teaching in association with technological factors and the assessment of learning outcomes towards the approach of teaching and developing the information technology competence plays an important role to decide the success of the target create learners to be the center and teach students to develop the comprehensive skills of learners. The paper concentrating on researching the results of teaching and applying technological factors is determined according to the principles and the criteria values of evaluation of information technology competence tested experimentally for classes specific learning.

**Keywords**— Competence, assessment according to competence, information technology competence, competence development teaching.

## I. INTRODUCTION

The 21st century is pushing for a rapid change in technology. Recent developments in the field of technology that are part of information technology (IT) have opened many opportunities and challenges for people in many fields, including educational activities. In today's classroom, not only are face-to-face classes, but also "virtual space" classes, "open learning spaces" classes, ...

Information technology is not a deliberately launched initiative on an existing system to bring about improvement, but a great disturbance has established the current order and resulted in a large number of changes are not predictable (Somekh, 2007). With the development of IT leads to a consequence in teaching in order to improve the position of learners while training the generation of people who are self-reliant, responsible, professional and social, have creative spirit. In order to accompany the civilized world, the trend of modern teaching approaches the development of technology, digital teaching and learning through online environment is increasingly exist.

The assessment of learning outcomes of learners has changed according to learners' outcomes including skills, knowledge and learner expertise; Focusing on creativity,

critical thinking, communication and collaboration skills are essential for future learners.



Fig. 1. Learning framework of the 21st century

There have been many research projects on the assessment of learning outcomes in the direction of assessing the use of IT in teaching at home and abroad, such as: mentioned the problem of assessing the orientation of competence and detailing some issues about the level of assessment and the degree of mastery in practical work of learners (Matthew, et al., 2014); Shirley Fletcher (1995), has identified a number of basic principles, suggestions on methods as well as the benefits of assessment techniques based on competence; provides some guidance for training workers towards job-based assessment. 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 (Bennett, J., et al., 2006)

The research was developed and distributed to experienced teachers to assess the importance of teaching tasks, effective technology application 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 learning community; and 3) the rapid advancement of technology (Sun, A., & Chen, X., 2016), which demonstrates the impact of technology bringing fundamental success in technology

application teaching, and it is essential in organizing and implementing courses.

There are some researches on competence framework, IT skills standards, or IT competence assessment in teaching (Aaron Lacey, et al., 2015; Matthew J., et al., 2014; Mosa Ali, et al., 2016; Zhijun Wang, et al., 2014; Geçer Kolburan A., et al., 2010). Especially the IT competence framework used in implementing and evaluating the teaching activities of organizations (UNESCO, 2011; ISTE, 2008), a standard set of IT competence for pedagogical students (based on UNESCO's IT competence standards for teachers) was consulted at the "UNESCO ICT Program" workshop with 6 component competencies and 3 levels of development (VVOB, 2011).

Assessment learning outcomes in the direction of developing IT competencies to orient and build motivation for learning in technology skills training for students and as a basis for building teaching content, choosing methods teaching methods, tools to assess suitable competence for learners of teachers. If the competence framework is combined with more specific criteria, that will be the scale used in assessing the effectiveness of teaching according to the approach of IT in a modern teaching environment, the importance an occupational competence of learners is needed in today's digital technology era.

## II. MATERIALS AND METHODS

### A. Study are

#### *Definition of Competence*

The origin of Latin: competence is "competentia" which means meeting, in English is "competence", is the result of a linguistic activity. After that, teaching language theorists widely use this term to refer to a certain skill in the process of acquiring target language.

It can be seen that the core common point of the above understanding of the concept of energy is the ability to apply knowledge, skills and attitudes to solve a real situation in life. Competence is something that exists both in potential form and as an ability to be revealed through the process of solving real-life situations in life. The practical aspect of competence is what the school can organize and evaluate learners.

#### *Definition of IT competence in teaching*

By analyzing the concepts of competence, we can defined 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); 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)).

Although there are differences in the use of terminology, the commonality of these concepts is that the two characteristics of the competence are the competence that is expressed through action and ensures effective operation, good results.

The term of 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). The IT competence is defined as a diverse set of tools and technology resources, used to exchange, create, disseminate, store and manage information (Craig Blurton, 2002).

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.

#### *Assessment according to competence in teaching*

According to the research group of the Vietnam Institute of Educational Sciences, each of the 3 psychological structures mentioned above are separated into specialized forms of competence: there is a type of energy in the form of knowledge (cognitive competence), there is a type of energy in the form of skills (working skills), and there is a type of energy in emotional and expressive form (emotional energy). When combining all 3 things, it is still competence, but more complete and generalized.

Identifying from the concepts of energy and assessing according to competence, competence of using IT in teaching, the author draws and gives out the factors to be achieved in terms of assessing the competence of using IT in teaching, expressed according to 03 weak the main factor is: (1) assessing competence, (2) IT application competence and (3) teaching environment.

### B. Method

This study used the 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 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 and analysis methods.

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. Through the study process, empirical analysis and getting of the specialist's view, and the analysis has generated reliable factors. These methods based on obtaining the process of survey data by SPSS version 22 and Microsoft Excel 2016 software.

(1) *Sample*: The research covers all the teachers and undergraduates who study and learn at Education Universities in Vietnam in 2018 year. The sample group was chosen randomly at 96 among teachers and undergraduates.

(2) *Procedure*: In the research both quantitative and qualitative methods were used. The survey was administered to 96 teachers and undergraduates at Education Universities. In the research, validity was defined according to specialist's views. The reliability of the competence scale was calculated by using Cronbach's Alpha. 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, which indicated a high reliability of the instrument from (Thanh P.C, Thanh N.T, 2019).

(3) *Descriptive statistics of data:* The results were analyzed from the investigation, survey data, and experiment (Table 1), with which we assess the needs of applying IT competence in teaching, determine the value of the scale and verify, assessment the learning outcomes of the IT development approach (Fig 3, 4).

### III. RESULTS AND DISCUSSION

#### A. Principles for assessing competence in teaching

Based on the theoretical studies of the assessment as well as the practical implementation of the process of assessing the learning outcomes of the competence assessment, we summarize the following four principles of assessing the competence in teaching as follows:

*Transparency:* Transparency assessment is public and clear to the assessor and the candidate on all relevant issues. The audiences need to know which method they will be evaluated by (direct observation or video recording, testing of products or services to be done, and when, in what context, by criteria), or will you get feedback on how much your performance is and what needs to be improved. If the evaluation criteria are accepted, understandable, practical and meaningful, and the methods and plans of good evaluation, the roles and responsibilities of the parties (assessors, audience object) the easier it is to control.

*Validity:* The value related to evaluation in competence based systems includes skills, knowledge and integrating them with practical applications. Recommendations for determining competence must be based on evidence collected in some contexts or situations. The value refers to the methods and assessment tools that allow to obtain the required evidence information, which measures the measure of the level of achievement of the evaluation objective. An assessment is well planned when auditors and candidates know exactly what will be assessed and based on which evidence. First of all, the auditor or the designer of the assessment process must think about the objective of the assessment, ask myself what evidence he needs about the performance of the candidate and which assessment method will provide evidence.

*Reliability:* Reliable evaluation means always consistently measuring what you intend to measure. An assessment with only real value if the auditor gives the same evidence and provides the same evidence must go to the same conclusion about the competitor's competence. Reliability is a necessary condition for the value of the assessment. Trust also means that assessment practices should be regularly monitored and reviewed to ensure that there is consistency in interpreting the collected evidence. In order to ensure the reliability of the method, the auditor must make a judgment about the candidate with the same evidence in different locations. At the same time, if the two assessors return: there is competence to assessment the criteria of employees; there is competence in

the evaluation standards themselves; and detailed understanding of the standards and use them as references in the context and culture of the workplace or the field of careers. *Flexibility:* Flexibility expressed in the way of organization and process of evaluation and evidence collection. For example, for the purpose of assessing the ability to handle situations, it is possible to use a question or answer question or a hypothetical/simulated situation instead of a real situation. For the process of performing work that requires a lot of time, it is possible to use pre-selected intermediate products to save time and consumable resources. Flexibility in assessing according to competence in general is also reflected in the process of accrediting employees, and therefore, both methods of assessment are not interested in where and how that competence is achieved.

#### B. Requirements of assessment according to competence in teaching

*Evidence of energy efficiency must ensure both quality and quantity - value, authenticity, current and complete*

The value of evidence is critical in the assessment. In determining the value, the auditor must make sure that the evidence is consistent with the assessment objective? The evidence is broad and to what extent is the complexity of knowledge, skills, and attitudes to help make appropriate decisions? The evidence should consistently show the quality of the person's work - long enough and in some circumstances, different working conditions.

The authenticity refers to the certainty of evidence, answering the question: is this evidence actually collected from the activities of the person who is being evaluated? candidates perform alone or in groups? These questions are particularly relevant when the evaluation of historical evidence is being stored. In order to ensure the authenticity, evidence must be directly related to the assessor that needs to be evaluated as well as directly related to the candidate's employment. Evidence should reflect every aspect of competence associated with actual employment.

Calculate the timing of indicator evidence up to the time of evaluation. In order to ensure topicality, evidence must prove that candidates are currently applying the knowledge and skills necessary to express their work competence. This requirement is often difficult to achieve when it comes to the evidence of the school's out-of-school performance results, especially those who have gone through the work process. Does it accurately reflect their competence at the time of assessment, requiring the assessor to consider and compare with the current update competence standards. In some cases, with skills, the competitor's ability to achieve before may follow the outdated competence standards compared to the time of evaluation and recognition.

Adequacy to ensure objectivity, science, assessment records must gather sufficient evidence of standard implementation.

Full evidence means that there is enough basis to conclude that competitor has competence. In order to ensure completeness, evidence must cover all requirements for the performance of standards-based work. For complex,

sometimes dangerous jobs, impossible, not or difficult to implement right at the time of evaluation, it is necessary to use different types of evidence in order to ultimately prove competence of people rated according to standards.

*Assessment methods and tools must measure a wide range of skills*

Assessment methods and tools will be designed to assessment a variety of skills according to the requirements of the job, be it: thinking skills and problem solving (shown in the process and conclusion). situation handling results); partner skills (job delivery, team work, service and customer care); job management skills (recording, arranging work places, preserving equipment, tools, supplies, industrial hygiene).

*Assessment conditions must be adequate and consistent with the assessment objectives*

Achieving competence to meet the requirements of job standards can only be carried out in the same context as the practice practice, and therefore, the conditions for assessing the competence need to reflect the best practices. that of students joining the working environment. Teachers should ensure that they have adequate equipment, tools and supplies necessary for the performance of the candidate's work and are arranged in accordance with the test, ensuring that observations can be made easy and clear. Concerning the conditions of implementation, evaluation tools may also be designed to determine whether the competitor correctly prepares or selects the right equipment, tools, materials and equipment. necessary labor or not.

Briefly, assess how, according to which method and tool, according to which specific process depends on the following key factors: 1) Assessment what (assessment objective); 2) Assessment according to which standard (assessment criteria); 3) Assessment under what conditions and circumstances (scope of activity); 4) Staff of teachers/assessors.

In order to assess learning results according to the competence that requires vocational teachers at the same time as an auditor to have: 1) Knowledge and understanding of occupational criteria; 2) Competence to meet the standards set for tasks and tasks related to the subjects/training modules that teachers are teaching; 3) Knowledge and understanding of assessment, including: objectives, objectives, context, assessment process, assessment methods and tools; 4) Skills of observing, collecting evidence, analyzing, interpreting, behaving and giving positive feedback, making decisions about learners' competence ...

*C. Assessment the reliability of scale competence*

The process of setting up and building a scale to assess IT competencies in teaching is carried out and verified through two factors of qualitative research and quantitative research, and with this method, the process of building the scale is described in the following diagram (Fig 2).

Stemming from the IT competence structure with corresponding criteria for each component of the component is further cited from the study in (Thanh P.C, Thanh N.T, 2019), conducting surveys on 96 subjects who are specialized teachers IT and teachers have experience in using IT in

teaching, conduct processing and analyzing data collected by using SPSS 20 software to verify indicators of reliability of scale including: Cronbach's Alpha, to assess the reliability and range of values between observed variables and EFA coefficients, to assessment convergent values and discriminant values of observed variables for scale factors.

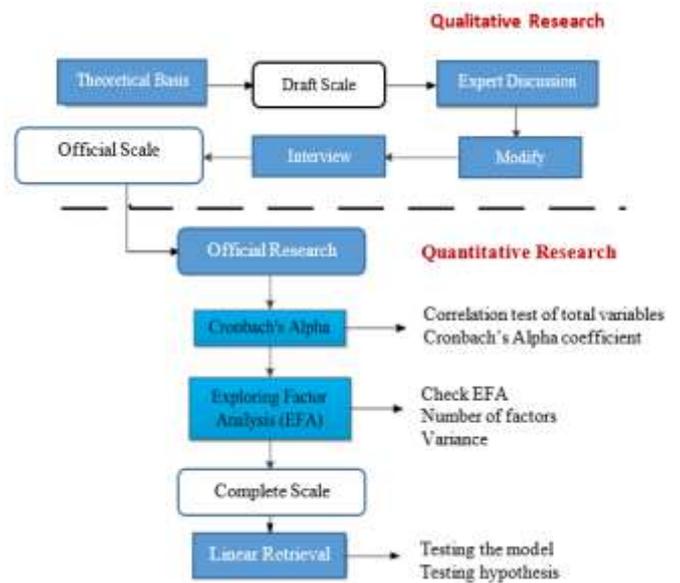


Fig. 2. Diagram of evaluation process of IT competency scale in teaching

TABLE 1. The IT competence framework in teaching

Competence 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>
5- IT competences in the design and construction	<ol style="list-style-type: none"> <li>1. Use the basic IT softwares and applications in designing, building digital resources.</li> </ol>

of basic digital resources	2. Use tools to search, exploit, update, edit and export documents for teaching. 3. Use utility software, IT support tools to exploit and manage digital resources in teaching.
6- Competences use specialized software to develop specialized expertise	1. Ability to use specialized IT application softwares according to professional and industry characteristics. 2. Ability to integrate and embed IT application products in teaching. 3. Effectively manipulate products created from specialized softwares.
7- IT competences organizes deployment and assessment results	1. Use software to assist in the development, design, and management of test bank in digitized form. 2. Use a variety of forms of examination, assessment through tools, softwares to provide assessment information, feedback on teaching and learning. 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.
8- IT competences in the exploitation, use, and management of digital computer and internet resources	1. Use tools to manage time, organize digital databases, and manage resources online. 2. Use tools to monitor, manage, communicate, and support students during the participation of the course. 3. Use proficient systems, external data storage devices, and online storage.
9- IT competences is associated with the elements technology equipment	1. Use technology equipments and peripherals attached to computer systems and IT application systems. 2. Applying elements of technology equipments in multi-dimensional interactive learning environment support design. 3. Capacity to use new technology equipments in teaching.
10- IT competences in the organization and administration of online courses	1. Ability to use and operate the course online. 2. Maximize the ability to administer and organize course in an online environment. 3. The ability to analyze and access digital resources in the online environment. 4. Online work skills.

*Process of determining the scale value*

The survey results of lecturers and students, we assess the reliability of the scale of the framework criteria and use the Cronbach's Alpha parsing to rating the trust and intervalence the price of the between observations variable in scale and EFA factor to assessment the convergence value and the discriminant value of the observed variables for the elements of the scale (Table 1).

The analysis results are as follows:

*- 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.

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

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:

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

Demonstrate that the manifestations are factual and have a high intrinsic correlation in component competences.

*- 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:

KMO and Bartlett's Test									
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.								.794	
Bartlett's Test of Sphericity								Approx. Chi-Square	521.832
								df	8
								Sig.	.000
Total Variance Explained									
Comp onent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Var	Cumulative %	Total	% of Var	Cumulative %	Total	% of Var	Cumulative %
1	4.154	73.074	63.074	3.154	73.074	73.074	3.138	72.755	72.755
2	2.336	66.728	69.802	2.336	66.728	69.802	2.352	67.047	67.047
3	.861	17.220	87.022						
4	.521	10.420	97.441						
Extraction Method: Principal Component Analysis.									
Component Matrix <sup>a</sup>									
		Component							
		1	2						
NL3_TC1		.800	.795						
NL3_TC2		.742	.712						
NL3_TC3		.896	.808						
NL3_TC4		.603	.784						
Extraction Method: Principal Component Analysis.									
a. 2 components extracted.									

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

*- 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 empirical analysis above, it is possible to confirm that the IT competence framework and scale with the component competence groups and mentioned indicators are feasible and reasonable with the reality.

D. Assessment experimental results

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  $F_i$  distribution table (number of students achieving  $X_i$  score),  $f_i$  frequency table (%) learning results, as follows:

TABLE 2. Table of  $F_i$  scores for assessment of learning outcomes

Class	Total students	Number of exams with $X_i$ score					$\bar{X}$
		A (8,5-10)	B (7,0-8,4)	C (5,5-6,9)	D (4,0-5,4)	F (0-3,9)	
EC	38	18	16	3	1	0	7,0
CC	37	10	12	12	3	0	6,4

TABLE 3. Table of  $f_i$  frequency (%) learning results

Class	Total students	Frequency of the number of exams with $X_i$ score				
		A (8,5-10)	B (7,0-8,4)	C (5,5-6,9)	D (4,0-5,4)	F (0-3,9)
EC	38	47,36	42,11	7,89	2,63	0,00
CC	37	27,03	32,43	32,43	8,11	0,00

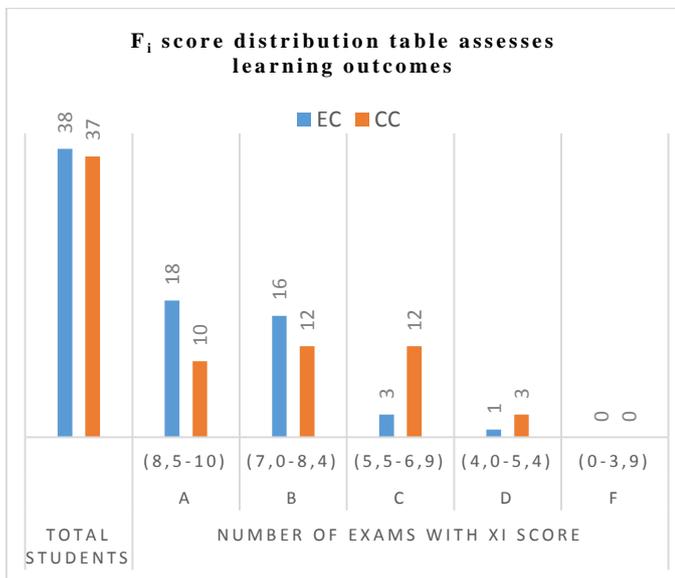


Fig. 3.  $F_i$  score distribution table assesses learning outcomes

The end of the course of the experimental class is higher than that of the pilot class (the average difference is 0.6 scores).

Experimental evaluation 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.

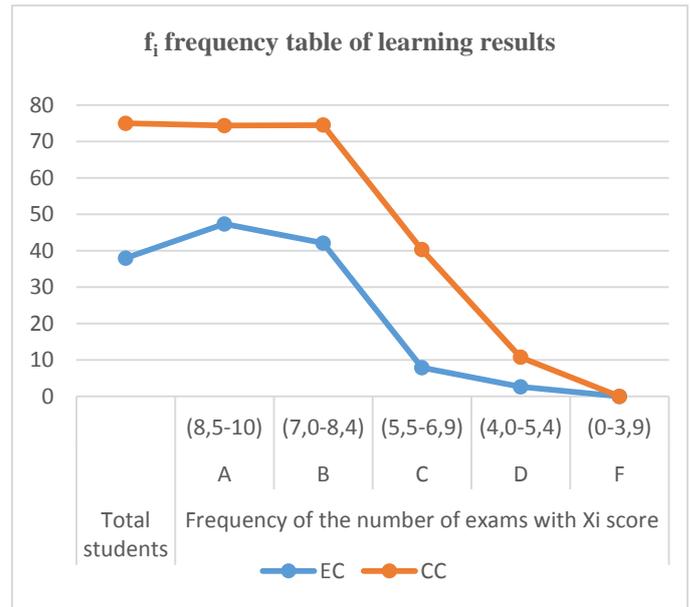


Fig. 4.  $f_i$  frequency table of learning results

For the best learning outcomes, 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 courses, appropriate class sizes and a well-deserved salary (Colwell, J. L. and Jenks, C. F., 2004). The relationship between undergraduates' classes and computer competency results showed that there is a significant difference (Erdal Zorba, 2011).

Education is an alternative to student learning to focus on critical and creative thinking (Wang, Y. D., 2014). However, courses are usually driven by technology (Callaway, S. K., 2012) and are more designed for the convenience of systems and technology (Cole, M. T., et al., 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. 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.

IV. CONCLUSIONS

Through the process of surveying, analyzing, evaluating experimental teaching, we had gained some positive results with the research objectives set. The basic ability of applying IT in based-technology 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. This approach is perfectly suited to the requirements of teaching oriented learners.

Assessment learning outcomes in the direction of developing IT competencies to orient and build motivation for learning in technology skills training for students and as a basis for building teaching content, choosing methods teaching methods, tools to assess the competition for teachers' learners, and determine the professional capacity of learners in today's digital age.

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