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Perceptions of ICT competencies among e-postgraduate students and faculty

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Abstract

Universities are currently offering many virtual educational programmes that require teachers and faculty to be competent in the use of Information and Communication Technologies (ICT) to be able to achieve significant educational processes. This article examines the differences in the perception of the ICT competencies of students of the virtual postgraduate programme offered by the School of Business Administration and Accounting of the Autonomous University of Chihuahua, among students themselves and among their professors, and in comparison to students' academic works. Method: This case study is based on the use of Likert scale survey questions, interviews, and the content analysis of students' academic assignments. Results and discussion: Data reveal that the evaluation of students' ICT competencies among students and teachers differ in the categories of ethical competencies, application competencies, specialised competencies, and lifelong-learning competencies, and coincide in the evaluation of the categories of basic and collaborative-work competencies.

Keywords

Education; virtual education; ICT competencies; perception.

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1. Introduction

The changes experienced by humanity in recent times have defined new forms of life. It is argued that we are living the third great revolution, this time in the area of computing, which follows the agricultural and industrial revolutions. This is because the incorporation of information and communication technologies (ICT) have irreversibly transformed society and human existence (Velarde, Bernete & Franco, 2015) and permeated all human activities (Bozna, 2017), including education,

“... which derives from the Latin words *educare*, which means “to bring up”, “to nourish”, “to guide”, and *educere*, which can be defined as a “educate” “instruct” through various languages; and it is present in the actions, feelings and attitudes of people” (De Jesús, Andrade & Martínez, 2012, p. 4).

Therefore, it can be said that education “is a social process that is determined by the context and worldviews of its actors, teachers, students and institutions, and that is currently being modified by new socialisation and communication processes” (Guzmán, 2008, p. 22), through the information and communication technologies (ICT), which have become the transforming agent of society, which can in turn use information to create knowledge (Falco, 2017).

In the context of education, one of the effects of technologies is an increase in the of forms of teaching, since face-to-face, semi-present and distance education models have incorporated the online or virtual mode. The latter mode takes place in a new “space and offers a varied range of resources based on ICT. This environment creates an area for work and communication that promotes and facilitates education processes” (Matilla, Sayavedra, Alfonso, 2014, p. 12). In fact, virtual education is defined as:

“the use of new technologies and learning tools as complement of a series of actions and synchronous and asynchronous communication processes whose objective is a type of learning that seeks to develop attitudes that allow individuals to adapt themselves to new situations generated by globalisation and the access to new knowledge and information that can be applied to specific cases” (Guerrero Muñoz, 2008, p. 3).

Thus, it can be said that virtual education requires scientific and technological literacy strategies, to facilitate the effective performance of each person in a society in permanent transformation, where learning is conceived as “the connection, mixture and restructuring of information” (Cabero Almenara & Llorente Cejudo, 2015, p. 191). In this sense “learning occurs when people connect information in a learning community” (Mercado-Varela, Beltrán Villegas Perez, Rivera Vazquez, & Ramírez-Montoya, 2017, p. 144).

Competencies are required to achieve learning that enables people to restructure, mix and find new connections. These competencies can be developed and built based on the internal motivations of each person (González Duéñez, Castillo Elizondo & Hinojosa Rivera, 2017), and are defined as the capacities a person uses to cope, apply, act upon or mobilise a set of cognitive resources, perception and evaluation schemes to solve a complex situation” (Guzmán Ibarra, Marín Uribe & Inciarte González, 2014, p. 25). Competencies involve the domain over a wide collection of strategies in a specific field or area of human activity (Chávez López & Morales Rodríguez, 2016).

Therefore, ICT competencies are conceived as “the abilities, skills, knowledge and attitudes applied to the use of information and communication systems” (Arras Vota, Torres Gastelú, García-Valcárcel 2011, p. 3), through the management and application of technologies, the ability to solve problems, the critical analysis of contents, as well as the ethical construction and socialisation of knowledge.

Based on this definition, ICT competencies can be classified into basic, application, specialised, collaborative-work, lifelong-learning and ethical, which are described below.

Basic competencies

Basic competencies refer to the knowledge required to manage technologies (García-Valcárcel & Arras-Vota, 2011), which involves the use of productivity applications such as Microsoft Word, Excel and PowerPoint, as well as digital tools to obtain information, the production of academic work and its presentation through diagrams and videos.

Application competencies

Application competencies refer to the productive use of applications for information management and professional development through digital resources and networking (UNESCO, 2008). A student who is competent in the use of information is able to determine the nature and level of information he or she needs (Jaramillo, Hennig & Rincón, 2011). Thus, the use of scientific databases to build knowledge and the use of productivity applications such as Word to insert references automatically can be considered as indicators of this category.

Specialised competencies

A person has specialised competencies when he or she is able to solve problems, create original works, plan and organise activities related to a particular project and communicate what he/she learned effectively through digital tools (García-Valcárcel, Arras-Vota, 2011). This construction involves analysis and decision-making in relation to the content of the messages obtained through ICT, which according to Jaramillo, Hennig and Rincón (2011) means the effective use of information to accomplish a specific purpose, such as the construction of evidence-supported knowledge.

Collaborative-work competencies

Collaborative-work competencies involve the individual and social dimensions of education, which includes community learning and being able to interact and collaborate to build knowledge (Cabero Almenara, 2016). This means that there is interaction between “two or more subjects to build learning through discussion, reflection and decision-making on the information resources” (Ruiz Aguirre, Martínez de la Cruz & Galindo González, 2012, p.35), which in virtual education “act as psychological mediators and eliminate space-time barriers; open up the possibility for individualised education in a context of broad social interaction (Ruiz Aguirre, Martínez de la Cruz & Galindo González, 2012, p.35). All of this enables knowledge exchange and construction processes and the development of lifelong-learning competencies through the use of ICT.

Lifelong-learning competencies

A person competent in lifelong learning can assume the generation of his or her own meanings (Novak, 1989), which according to the European Commission (2007) means:

“... the ability to start learning and persist on it, organise it, manage time and information, either individually or in groups... acquire, process and assimilate new knowledge and skills, as well as using past learning and life experiences to apply new knowledge and skills in different contexts” (p.8).

It should be noted that these competencies together with the digital competencies, information management competencies, networking and ethical competencies, are configured as important tools in education (García Revilla, 2017) at all levels.

Ethical competencies

Ethical competencies are configured by actions subjected to moral principles and values that are based on respect, responsibility, honesty, and professional and personal ethics (Hirsch Adler, 2005). In the case of ethical competencies in ICT, it means that a person understands and demonstrates the ethical, legal and responsible use of ICT (UNESCO, 2008). This refers to using information sources properly: recognising copyright and avoiding piracy and plagiarism (Marcial, 2017), i.e., to recognise the authors of the sources of knowledge and, from this, develop new knowledge or support personal ideas. This means that a student competent in ethics always quotes the authors used in his/her works, which reflects respect, honesty and responsibility (Hirsch, 2005), as well as the recognition of copyrights (Marcial, 2017).

Perception

In the case of the evaluation of students' ICT competencies by students themselves and their teachers, it is necessary to take into account the ways in which people experience and interpret reality and learning. Hence the importance of establishing the concept of perception, which “in addition to being a cognitive process, is a way of knowing the world, which is a complex process that depends on the information that the world generates, on physiology, and on the experiences of those who perceive it” (Moreno Tello, Nelly Prado & García Avendaño, 2013, p. 445). In fact, perception always apprehends

significant structures. Human beings see what they expect to see and always make a selection in a way that, somehow, they “construct” the object which they see or observe (Martínez, 2006). In that sense, it can be said that “judgements, which is the basic characteristic of perception, are interactive, psychic-cognitive processes that involve the experiential component” (Villaruel Fuentes, 2015, p. 41), and that it is through reflections that educators shape the interpretation of their own or other people’s training, competence or mastery on an area of knowledge, such as ICT.

1.1. Justification

Since previous studies have detected the importance of establishing the way in which students learn in the digital age and this type of learning is useful to deal with the conditions of the workplace and professional performance, it is necessary to determine the areas in which students are not fully competent, even if they think otherwise, because it has been demonstrated that students do not acquire the skills required for the current context of digital transformation in their academic life (Álvarez-Flores, Núñez-Gómez & Rodríguez Crespo, 2017). Thus, it becomes necessary to identify the areas of opportunity in meaningful learning through which students build knowledge in community.

1.2. Research objectives

Compare the perceptions that teachers and students of the virtual postgraduate programme have of students’ ICT competencies.

1.3. Research question

Is there a difference in the perception of students’ ICT competencies among students themselves and their teachers?

1.4. Research hypotheses

- H.1 There are differences between the ICT competencies students claim to have and the ICT competencies students actually have (Jaramillo et 2011).
- H.2 There are differences in the perceptions of students’ ICT competencies among students themselves and their teachers, due to a lack of knowledge to solve conceptual problems and contribute to the creation of knowledge among students (Álvarez-Flores, Núñez-Gómez & Rodríguez Crespo, 2017; Jaramillo, Hennig and Rincón, 2011)
- H.3 Students’ academic work did not reflect students’ ethical or specialised competencies (Jaramillo, Hennig and Rincón, 2011).

2. Methods

This research was carried out based on the case study method, “which contributes to the widening and deepening of the knowledge about individuals and groups, as well as organisations and related phenomena” (Yin, 2003, p. 4). The analytical-synthetic and theoretical-deductive methods were used

for this study. The research adopts a mixed approach, which involves applied and descriptive qualitative and quantitative techniques as well as field activities and literary reviews.

2.1. Research techniques

The data collection techniques that were used in this study are bibliographic analysis, surveys, interviews, analysis of students' assignments and statistics.

- Bibliographic techniques were used to collect information for the construction of the theoretical framework and to carry out the discussion of results.
- The survey questionnaire was composed of Likert-scale items relating to the perception of students and teachers on the development of indicators in ICT competencies, where: 1 is Strongly Disagree; 2. Disagree; 3. Neutral; 4. Agree; and 5 Strongly Agree. Below are examples of the items that formed the scale applied to virtual postgraduate students.

ICT competencies

With the objective of assessing students' perception of their competencies in Information and Communication Technologies (ICT), they were asked to mark with an X the answer that best fits their appreciation.

Meaning of values: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, and (5) strongly agree.

Competencies	1	2	3	4	5
I effectively manage Word, Excel, Power Point and other productivity applications.					
I do scholarly works as part of a team by using a variety of digital resources.					
I use ICT to learn on a permanent basis.					
I always quote the authors that I use in my work.					

- Interviews were conducted with 15 professors who were asked about the materials they used in the online platform of the postgraduate programme, the way in which they organised the course, the conditions of teaching in terms of availability of computer resources, the quality of the virtual space and the commitment to students. They were also asked about the development of ICT competencies by students and about the competencies they believed students had actually developed, among other issues.
- The textual content of 5 assignments handed in by students were analysed and placed in the Google search engine in order to identify plagiarism and compare students' responses of perception about their competencies and the competencies they actually manifested in their academic work.
- A complementary survey was carried out among virtual postgraduate professors, based on the adaptation of the scale applied to students, in order to compare responses with the perception of

teachers regarding students' ICT competencies. The wording of the questionnaire for teachers varied in the presentation of the items:

“Dear professors, we are collecting information that will allow us to assess the ICT competencies of the students of the virtual postgraduate programme, from the perspective of their teachers. Thus, please answer this questionnaire, in accordance with the following values:
(1) strongly disagree, (2) disagree, (3) neutral, (4) agree, and (5) strongly agree.

Competencies	1	2	3	4	5
1. Students are proficient in the use of scientific databases in search for answers to the questions arising in the course I teach.					
2. Students always quote the authors they use in their papers.					
3. Students have the ability to solve problems using ICT.					
4. Students are proficient in the use of Word, Excel, Power Point and other productivity applications.					

- This survey was conducted via e-mail, WhatsApp and Facebook, and was responded interactively through the electronic device selected by the respondent.
- The statistical analysis of the data was performed with the Statistical Package for the Social Sciences (SPSS version 20.0), which is an application for predictive analytics (IBM, 2016).

2.2. Universe of study

The research was conducted at the School of Business Administration and Accounting of the Autonomous University of Chihuahua (UACH). This institution was founded on 8 December 1954 (Universidad Autónoma de Chihuahua, 2008), while the School of Business Administration and Accounting was founded on 18 December 1958 (Facultad de Contaduría y Administración, 2013). This School offers its services to students in nine municipalities of the State of Chihuahua and offers online academic programmes for people who have access to ICT in every corner of the planet.

The actors that formed the universe of study were 198 students and 46 teachers from the online postgraduate programme in 2016. The sample of students was 64.67, which was rounded to 65. Meanwhile, the sample of teachers was 31.10 of the universe and it was rounded to 31 (Table 1), resulting in 46 teachers. Meanwhile the sample of teachers who participated in the structured interview was 23.

The following formula was used to calculate the samples:

$$n = \frac{z^2 pqN}{E^2 N + z^2 pq}$$

n = sample

z = 1.96

Error (E) = .1

p = 0.5, which is equivalent to the probability of success of the variable

q = 0.5, which is equivalent to the probability of failure

N = population size

Table 1. Sample sizes

Year	Sample of students	Sample of teachers
2016	65	31

2.3. Instrument reliability

One of the tests most currently used to measure the degree of reliability of a scale is Cronbach's alpha coefficient (Landeró & González, 2006, p. 156). The use of this test provided the value of 0.950, which indicates that the results are reliable, since 0.7 is acceptable, 0.8 is good and 0.9 is excellent (2014 Frías-Navarro, 2014). (See table).

Table 2. Statistical reliability of the instrument

Cronbach's alpha	Number of items in the questionnaire
0.950	19

3. Results and discussion

Basic competencies

The basic competencies section is composed of three items related to the management of technologies, productivity applications and students' presentations that use these resources.

Table 3. Basic competencies of virtual postgraduate students in 2016

	Students	Teachers	ANOVA
1. Students manage effectively Word, Excel, Power Point and other productivity applications	4.43	4.5	0.703
2. Students include schemes in their presentations	4.27	4.5	0.174
3. Students use videos in their presentations	3.1	3.36	0.216

Students of the virtual postgraduate programme consider themselves to be quite competent in the use of productivity applications and digital tools, which is an evaluation that is consistent with the educational model they are taking and the assessment carried out by teachers in this category, i.e., there were no significant differences between the evaluations made by both groups in any of the items. We can say that the perception by both groups coincides in that: learners are competent in the management of productivity applications and the use of schemes in their presentations. With regards to students' use of videos in their presentations, both teachers and students valued it practically in a neutral manner, which is consistent with the results presented by Jaramillo, Henning & Rincón (2011), who found that students do not enrich their presentations with images or videos.

Application competencies

The application competencies section consists of four items that reflect students' use of scientific databases and Word-specific applications for their academic works.

Table 4. Application competencies of virtual postgraduate students in 2016

	Students	Teachers	ANOVA
1. Students are proficient in the use of scientific databases in search for answers to the questions arising in the course I teach.	4.16	2.89	0.000
2. Students perform information searches in the scientific databases available in the UACH to support their academic papers.	4.18	2.64	0.000
3. Students perform information searches in Google Scholar to support their academic papers	4.21	3.53	0.001
4. Students are competent to insert bibliographic references automatically in Word	4.01	2.86	0.000

In terms of application competencies, we analysed the items related to the use of technologies to explore and acquire information, as well as their productive use in the academic documents students present. The results reflect, on average, a positive evaluation by students, although it is important to note the need to use academic search engines more frequently and the need to receive comprehensive

training in the use of Word to incorporate bibliographic references and bibliography in the format requested by the teacher.

In fact, the comparison of all the evaluations made by students and teachers on implementation competencies present a significant difference in the ANOVA, ranging from 0.001 to 0.000, which reflects a gap between the perception of students and their teachers, which can be supported with evidence taken from the academic work presented by students of the virtual postgraduate programme under study.

Here are two fragments of students' works with information obtained from non-scientific databases, such as the case of *promonegocios.net* (Thompson, 2007), from where a student took the following quote but did not mention its precise origin nor used Word automatically for this task, and neither included personal contributions about the cited work:

“The issues that have to do with ethics are often ambiguous. There are and there will be situations in which some might consider that the activities are inappropriate or lack ethics, while others will consider it acceptable. It could even be the case that the same activity may be considered ethical at a given time and unethical at another. Therefore, it is recommended for firms to implement codes of ethics...” (Student 1 of 2016).

Another student also included information from a web page (*Tiendas Mascotas*, no date) but included no reference about its origin and author, as if it were his own knowledge. Here is the text that was part of an assignment:

“The trout is a popular name used to refer to several species that are related to the salmon family. They are cold water fish that usually inhabit rivers and lakes distributed throughout North America, Asia and Europe...” (Student 2, 2016).

This finding shows that not all the virtual postgraduate students are proficient in information management through ICT and that it is necessary to work more on aspects of implementation to perform searches in documents included in scientific databases that facilitate the generation of original knowledge.

These results indicate that students perceive themselves to be more competent in comparison with the qualifications that teachers give and that this discrepancy can be exemplified with fragments of the papers presented by students. This comparative result shows how the humans make a selection that, in a way and to some extent, “builds” the object that they see or observe (Martínez, 2006), in this case in a way which favours them. However, it is important to note that one of the aspects to improve, by students, is the reading of more scientific articles and texts that will enable them to expand their knowledge in a certain area, in order to support knowledge with reliable sources and optimise the use of Word.

Specialised competencies

These competencies were examined through seven items that include the capacity to perform analysis, synthesis, questioning and construction of knowledge.

Table 5. Specialised competencies of virtual postgraduate students in 2016

	Students	Teachers	ANOVA
1. Students read at least five scientific articles, using ICTs, to perform an assignment.	3.857	2.194	0.000
2. Students break down the elements of the article and make relevant comments that enrich their academic work	4.1	2.528	0.000
3. Students create original works using ICT as a means of personal expression.	4.145	3	0.000
4. Students have the ability to solve problems through the use of ICT.	4.217	3.444	0.000
5. Students have the capacity to build their own concepts based on the definitions of other authors.	4.214	3.222	0.000
6. Students have the skills and knowledge that allow them to carry out a research project using ICT.	4.348	3.361	0.000
7. Students have the competencies to generate key questions and problems, formulating them clearly and precisely.	4.114	3.028	0.000

The differences between teachers and students about specialised competencies are significant, with an ANOVA of 0.000 in all items. This indicates a gap between students' self-perception and the way teachers evaluate students' competencies. It should be noted that the standard indicates that the competent learner must know that existing information can be combined with their own ideas to produce new information and achieve the connective learning, from which information can be found, mixed and restructured (Cabero, 2015). However, there are authors who highlight the lack of knowledge on young people in the use of digital media and technologies to solve conceptual problems and contribute to the creation of knowledge by participating with others in creative and innovative actions (Álvarez-Flores, Núñez-Gómez & Rodríguez Crespo (2017). The findings of these authors are consistent with the results presented by Jaramillo, Hennig and Rincón (2011), who found that students showed no specialised competencies and, in this case, students themselves gave a low rank to their reading of scientific articles for an assignment and the analysis of the elements of the article.

Collaborative-work competencies

These competencies were evaluated through an item that establishes whether this type of work is carried out by virtual postgraduate students.

Table 6. Collaborative-work competencies of virtual postgraduate students in 2016

	Students	Teachers	ANOVA
Students produce scholarly works as a part of a team by means of variety of digital resources.	3.61	3.36	0.288

With regards to competencies in collaborative work, students expressed that they scarcely participate in such activities. This response is consistent with the responses expressed by their teachers, of whom 83%, in the structured interview, responded that they organise the course mainly through study guides and independent study and that the means they use to socialise or raise questions about the course is through online forums. Only the remaining 17% of teachers highlighted the importance of collaborative work in the subject taught in the virtual mode. These results coincide with those of Calderón Canales et al. (2016), who propose that most of the teachers simply transfer their practice to the virtual mode, which prevents achieving communities of connective learning.

Thus, as an area of opportunity, teachers can consider the incorporation of processes to promote the participatory construction of knowledge, since they are responsible for the promotion of such activities to assure learners can connect information within a community (Mercado-Varela, Beltrán, Villegas Perez, Rivera Vázquez, Ramírez-Montoya, 2017) and, in doing so, they can learn more (Islas Torres, Delgadillo Franco, 2016), which according to Calderón Canales *et al.* (2016) requires long and continuous processes in the transformation of teaching and the commitment of students.

Lifelong-learning competencies

These competencies are examined through the incorporation of two items directly linked with these capabilities.

Table 7. Lifelong learning competencies of virtual postgraduate students in 2016

	Students	Teachers	ANOVA
1. Students use ICT to learn on a permanent basis.	4.114	3.028	0.000
2. Students are open to different ways of thinking that will enrich their learning.	4.348	3.389	0.000

In terms of the lifelong learning competencies, there is a significant difference of 0.000 in both items, between their perception among students and teachers. The former value these competencies more favourably than the latter and it is important to note that this type of competencies needs to be strengthened to start learning and persist in it, organise it, manage time and information, either individually or in groups (European Commission, 2007), given that throughout our lives learning is configured as a valuable tool in education (García Revilla, 2017), which requires ethical, application and specialised competencies, in order to have clarity on the sources and their responsible use.

Ethical competencies

Ethical competencies were evaluated through two items that ask respondents whether students respect and recognise the work of others, and involve notions of copyright.

Table 8. Ethical competence of virtual postgraduate students in 2016

	Students	Teachers	ANOVA
1. Students always cite the authors whose work they use in their papers.	4.286	3.194	0.000
2. Students use ICT to learn from others and recognise their work through citation and references.	4.174	3.194	0.000

Results indicate that there are significant differences of 0.000 among the group of teachers and students in both items about ethical competencies and that teachers give neutral answers to the questions that evaluate these competencies, while students evaluate these competencies positively. Thus, it can be said that students perceive their ethical competencies more positively than teachers do and that the perception of the latter is consistent with the analysis of extracts of students' assignments, like the following:

An example is the following text, which was copied, without a reference to its origin, from monografías.com (Cortés Fiscal, 2011), a data base that is not considered scientific:

“... work motivation arises as an alternative to conflicts such as: the lack of understanding between people, discouragement, low productivity and lack of interest towards work, to mention but a few; thus achieving mediation between employers' interests and the workers' needs and expectations, where the problem is not work per se, but it is human relations and personal attitudes what influence the working environment” (Student 3, 2016).

The same thing happens with the following quote, which was copied from a blog by a young man (Salvador, 2012) to use a paper for the research methods course.

“Technology, as a result of scientific progress, is what has given the world its current form, and it is almost like its oxygen. Eliminating all the advances would be a setback too difficult to take. It is difficult for human beings to do without the comforts provided by technology even for a few hours.” (Student 4, 2016)

Another example is taken from a research paper presented by a student of the virtual postgraduate programme. He uses Bachelor's degree thesis written by Sanchez (2011), but does not recognise it anywhere in the paper. The following fragment is presented as evidence of plagiarism.

“All of us hear and use the word stress and other related terms, such as fear, anxiety, anguish, fatigue or depression, but it is difficult, even for the scientists and researchers, to define clearly what we mean and the meaning, scope and consequences of these concepts. Thus, the terms

stress, anxiety and fear mingle in everyday language and even in scientific language, so that their definition is difficult. They are polysemic concepts that describe different yet interconnected situations and psychological states.” (Student 5, 2016)

Based on the previous, we can point out that even when students think it is important to quote authors and recognise their work they do not always do so. Moreover, although we cannot generalise, these cases are evidence of the absence of search activity in scientific data bases, which coincides with the study conducted by Jaramillo, Hennig and Rincón (2011), who detected that only 2 of 471 students searched for information for their academic work in research databases or journals, while the study conducted by Álvarez et al. pointed out that university students in Mexico and Spain valued their understanding and application of copyright as basic or intermediate.

On the other hand, Flores and Roig-Vila (2017) found that the variable “Knowledge on ethical and legal aspects regarding the use of ICT” only reaches an average of 3.04, which coincides with the teachers’ evaluation of students in this competence, 3.19, but differs with the global average of 4.2 posed by students about this competence.

4. Conclusions

The question that guided this research work is: Is there a difference in the perception of students’ ICT competencies among students themselves and their teachers?

This questioning was provisionally resolved with the following hypotheses:

- There are differences between the ICT competencies students claim to have and the ICT competencies students actually have (Jaramillo et 2011).
- There are differences in the perceptions of students’ ICT competencies among students themselves and their teachers, due to a lack of knowledge to solve conceptual problems and contribute to the creation of knowledge among students (Álvarez-Flores, Núñez-Gómez & Rodríguez Crespo, 2017; Jaramillo, Hennig and Rincón, 2011)
- Students’ academic work did not reflect students’ ethical or specialised competencies (Jaramillo, Hennig and Rincón, 2011).

One hypothesis was partially validated since, in the virtual postgraduate programme of the School of Business Administration and Accounting of the Autonomous University of Chihuahua, there are differences in the perceptions of students’ ICT competencies among students themselves and their teachers, in the areas of ethical, specialised, application, and lifelong-learning capacities. On the other hand, there were coincidences in the perception of students’ ICT competencies among students themselves and their teachers, in the areas of basic and collaborative-work competencies.

In addition, some works made by students reflect the lack of application, specialised, lifelong-learning and ethical competencies in the management of information, which coincides with the absence demonstrated by university students with regards to the ability to articulate and apply criteria to evaluate information and its sources (Jaramillo, Hennig, Rincón, 2011). Thus, there is a performance

gap between the ICT competencies learners considered to possess and the way in which they manifest it through their work and the teachers' evaluation of these competencies.

Considering that ICTs are facilitators (Castaño, Jenaro, Flores, 2017) and instruments that allow to achieve significant learning processes, and that in order to achieve connective learning educators must be committed and guided by the principles of their profession and must promote teamwork among students. Hence the need for the actors involved in the academic process to stay up to date with the technologies that allow them to achieve learning communities (Mercado-Varela, Beltrán, Villegas Perez, Rivera Vázquez, Ramírez-Montoya, 2017) which in turn enable individuals to learn more (Islas Torres, Delgadillo Franco, 2016).

This is why in the tetrahedron formed by teachers, students, materials and technologies in virtual learning environments that incorporate new teaching models, teachers need to serve as leaders to draw ideas, theories and collaborative methods, to improve the teaching-learning process, in which the student becomes the creator of his/her knowledge through the search, analysis and evaluation of the information that enables him/her to support his/her decisions with creativity and responsibility (Manzanilla-Granados, Dorantes-González, Cordero López, 2017). Hence the need to delve into the incorporation of ICT to the andragogy practices of the daily academic activities and the degree of articulation and relevance of these tools in the teaching-learning process.

Hence the need to implement the continuous evaluation of the development of ICT competencies by higher education institutions and to design training strategies for prospect students prior to the admission to any of the study programmes offered in virtual mode, so that they are capable of assimilating and widening their ICT competencies. This will provide education capable of generating competent graduate with capabilities to build and connect knowledge. Likewise, there is a need for the continuous training of the actors who are part of the virtual postgraduate programme according to the needs for competencies in digital information management, teamwork and lifelong learning (García Revilla, 2017), which are required by globalisation.

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