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Comparison of Digital Technology Competencies among Mexican and Spanish Secondary Education Students

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Abstract

Information and Communication Technologies (ICT) are tools to be used to support educational processes and students have access to them more and more every day. However this does not assure the appropriate use of these tools. That is why the objective of the present study is to identify the level of competency in the use of ICT of students in secondary schools in Obregon City, Sonora, Mexico, in the opinions of the students themselves and of their teachers and to compare this with the level of digital competencies of students in some regions of Spain, using an investigation carried out earlier. Two questionnaires with 51 questions were used, one for 949 students and the other for 49 teachers. The results show that students claim to have between moderately and very high levels of competence in ICT skills while their teachers say the students have high levels of competence in some technological skills such as producing a written documents with a word processor. In the study in Spain, students and teachers voiced similar averages in the highest level of competencies, but differed in the competencies with the lowest averages.

Keywords: digital competencies, ICT, Secondary school education, digital divide

1. Introduction

Throughout history changes have been notable and in many cases have had an impact on the development of society. There have been countless novelties in the creation of ideas, social structures, work tools and materials, and in the ways we communicate and learn. However, this social-techno fact has not had the same impact at all levels of society. Today, there have been changes in various spheres of society, which have favored or brought on discrimination among the various social groups due to the fact that only some sectors may benefit from these changes. This is precisely what has happened with the “new technologies” (Álvarez, 2005).

It is apparent that, due to the accelerated development of Information and Communication Technologies (ICTs) have had, they play a part in most activities carried out by man, presenting new needs in entertainment and up-dating due to the fact that not everyone has a high enough level of informatics competencies, which differentiates between those who know how to use ICT and those who do not. Gros and Contreras (2006) established that the incorporation of ICTs has made the gap among social groups even larger; we call this phenomenon the digital gap.

The digital divide is seen as a barrier to personal and social development; in order to close this divide citizens need to become literate in technology. About that, Cabero, Marín, and Llorente (2012) note that technological literacy is not intended in the domain of software and hardware, but it is necessary to train people not only as consumers but as citizens who are able to: a) master the technical management of each technology; b) have a set of specific knowledge and skills to search, select, analyze, understand and re-create information that is accessible through new technologies; c) develop a cluster of values and attitudes towards technology so that reject them systematically by consider the technology like "bad", or an attitude of uncritical and submissive acceptance thereof; and d) Use the means and technologies in their daily lives not only as resources leisure and consumption, if not as environments for expression and communication with others persons.

The concept of the digital gap is not only related to access to ICT, but also to the ability to use this technology; that is to say, to the competencies or skills of the individual for the effective use of this technology, be it for

entertainment, communication or education (Matamala, 2014).

Currently the students receive so much information through various means, their skills must be more than simply read and having a regular level of reading comprehension. Therefore the students required the developing of their skills to find, identify, classify, synthesize, organize, discriminate and evaluate the information. The capability to appropriating the information is a necessity, essential, for the human being in this technological era.

ICTs are unprecedented tools due to their use, sometimes indiscriminate, in the formative process. The decade of the 80s (age of the computer), the digital age of the 90s and now the interactive age (from 2000 to date) have directed students to use various electronic devices. Pantoja and Huertas (2010) assert that students even have a good understanding of these resources; however, that is not enough. They should also be competent in integrating ICT into their learning experience.

In this regard, Ritzhaupt, Liu, Dawson, and Barron (2013) states that to be technologically competent, three main aspects must be considered: 1) sufficient infrastructure and technological support within the schools; 2) proper use of technology by students and teachers in the classroom; this means having clear and relevant educational purposes; and 3) that students know clearly how to use ICT for their personal and professional development.

ICTs may help to improve the teaching-learning process of students, assuming that teachers take advantage of the didactic resources they offer. Therefore, it is of utmost importance that students and teachers know how to use these resources (García, Cuevas, & Angulo, 2013).

According to Cabero and Lorente (2008), ICTs are tools which help solve educational problems since they offer a set of possibilities, such as more flexible environments for learning, the elimination of space-time barriers, various alternatives for communicating and greater interaction between student and teacher. They also promote independent and collaborative learning environments in keeping with students' personal traits.

Students of the XXI century require skills and competencies that enable them to adapt to a changing society; the relationship of the individual with the information has changed, so the educational sector raises new ways to bring students to a good development within the Information Society. Vivancos (2008) suggests that students should have knowledge of informatics applications and the ability to search and information processing while maintaining a critical attitude, thoughtful, responsible and ethical.

In this regard, Barrios (2009) explains the need to properly consume ICT. He mentions that young people are not aware of the extent of ICT, so they have ICT as an element of entertainment and sometimes not used as a tool to develop academic activities.

Such is the technological advancement today that Johnson, Adams, and Cummins (2012) mention that there are trends in the use of technology that are increasingly demanding better preparation of students to adapt and to take advantage of the technologies. Therefore, it is necessary that education, at all levels, identify the scope that can be obtained from the interaction of technology in the teaching-learning process and discover how to support students to develop technological skills that allow them to make better use of information in all the ambit in which they unfold.

Thus, the challenge of government is to make an integration between technology and society, based on educational purposes where the main involved, principals, teachers and students value the competencies they have in the use of technology.

In Mexico there have been actions aimed at developing competencies in the use of ICT, such as the Reforma Integral de la Educación Básica (RIEB) (Integral Reform of Basic Education) whose goal is to offer children and young people of Mexico a coherent formative path, growing in depth in accordance with the level of development, educational needs and expectation that Mexican society has for future citizens. This reform arose as a result of the Plan Nacional de Desarrollo 2007-2012 (National Development Plan 2007-2012) and the objectives laid down in the Programa Sectorial de Educación 2007-2012 (PROSEDU) (Sectoral Program of Education 2007-2012), which specifically stresses "promoting the development and utilization of ICTs in the educational system in order to support students' learning, deepen their competencies for life and favor their insertion into the society of knowledge" (Ministry of Public Education, (Secretaría de Educación Pública, 2006, p. 187).

The use of ICT is fundamental in education and that is why students, teachers, principals and society as a whole are constantly innovating and in agreement with the technological changes which are taking place in our country since they are an instrument for improving the quality of education as well as the acquiring of knowledge. In this respect Echevarría (1999, p. 2) mentions "it is no longer enough to know how to get around, speak, write or drive. Getting along in the new electronic media will be an ever-growing demand."

The educational systems have a great responsibility in this respect, since through their plans and programs students should advance in the formation which adequately uses ICT, with the purpose of becoming a society of protagonists in a favorable future in which students are capable of generating their own knowledge and developing their abilities autonomously.

1.1 Approaching the Problem

The increase of the presence of Information and Communication Technology in all scopes of education and everyday life leads us to the conclusion that it is an extraordinary element with great relevance for our society. RIES states that the effects that the use of ICT has brought to the secondary level is one of the most efficient agents of social change, for great transformation in educational, industrial and business spheres. ICT is an educational tool without precedence. Area (2002) defines ICT as a resource and system for elaborating, storing and digitally spreading information based on the use of informatics technology.

Students at the secondary level of education had rarely had so much information available to them, but this does not only mean knowledge, but also the use of ICT; this tool can help improve the exploitation of teaching by students if teachers take advantage of the didactic resources offered. This is why it is vital for students and teachers to know how to use these kinds of resources.

RIES states that the use of ICT applied to teaching at the secondary level benefits the students' learning, favors and increases motivation and raises interest in improving the ability to solve problems and gives learning greater autonomy.

Various studies have been carried out on the use of technology at different levels of education in Spanish-speaking countries. In Spain, for example, there have been studies on the technological domains of ICT for secondary students in various regions of Andalucía, the Basque country and Galicia. From these studies, it has been deduced that students are competent in the handling of technological equipment and the knowledge of various conceptual aspects related to the organization of information derived from them. Students conceive themselves as being moderately competent in the organization of information, searching for it and evaluating the authorship of the same (Cabero & Llorente, 2006).

A study was carried out in Venezuela in order to discover the technological competence of students at the Universidad de Zulia. The results affirm that, in general, university students show a moderate ability to handle with respect to use of the technological network; this determines their present day situation with respect to the existing digital divide (González & Alvarado, 2014).

Research was carried out in the state of Veracruz, Mexico, in order to determine the basic notions that primary students had of ICT. The results showed that students needed to develop skills applicable to the use of Internet, for example, using programs for instant messaging and published contents on the Web, but above all, their basic skill in the use of ICT for creating a text, installing and uninstalling software and making a Power Point presentation (Valencia, Torres, Angulo, & García, 2012).

In southern Sonora studies have been made at the basic education level, but mainly directed at teachers and principals, at primary as well as secondary schools. This research focused on describing the needs for formation and the attitudes of these educational actors on the use of technology (Valdés, Angulo, Urías, García, & Mortis, 2011; Mortis, Valdés, Angulo, García, & Cuevas, 2013; García, Cuevas, Angulo, & Mortis, 2012).

There are various studies on the technological competencies of teachers and principals at the basic level of education in Mexico, but not of secondary school students. It is therefore relevant to learn the level of competence in handling ICT of secondary school students in a city in the southern part of the state of Sonora, Mexico, as a reference for comparison with the level of competencies of secondary students in Spain, research carried out by Cabero and Llorente (2006). This would give us an idea of the general panorama of the competencies that students feel they have in the use of ICT, despite being from different cultural contexts.

1.2 Objectives

Identify the level of technological formation and training of secondary school students in Ciudad Obregón.

Relate the perception that secondary students have about ICT to the perception their professors have of the students' competencies.

Compare the competencies in the use of ICT of secondary school students in Ciudad Obregón, Sonora with students from some regions of Spain.

Identify the factors which favor the level of competencies of the students at secondary schools in southern Sonora.

1.3 Justification

UNESCO (2008) established that in order to live, learn and work successfully in an ever-more complex, information rich society based on knowledge, students and teachers should use digital technology effectively. Within the context of a solid educational context, ICTs may help students acquire the competencies necessary to become competent in the use of information technology and as searchers, analyzers and evaluators of information.

The increase in the presence of information and communication technologies in all scopes of education and life makes it an extraordinary element of great relevance in our society. RIES states that the effects that the use of ICT has brought about at the secondary school level is one of the most efficient agents for effecting social change, due to the huge transformation in educational and industrial markets.

There are now federal programs which provide technological infrastructure to secondary schools which support the learning and teaching process. There are more and more students who have a computer connected to Internet available in their homes; however, this is not enough to ensure that students are using ICT correctly. It is necessary to prepare the student so that he/she understands the culture around him and is able to actively participate in it. That is why it is necessary for secondary school students to understand, use critical thinking and utilize this technology in order to strengthen and develop these attributes.

2. Method

2.1 Participants

For the present study a quantitative approach was used with a non-experimental trans-sectional design with a co-relational-descriptive scope. Two questionnaires were given, one to 949 secondary school students and the other to 49 secondary school teachers in Ciudad Obregón, Sonora. The ages of the students ranged from 12 to 15 years. Of the 949 students who participated, 51.8% were females; 8.6% were in the first year of secondary school, 47.6% were in second year and 43.8% in third year.

2.2 Instruments

The questionnaires used in the present research were adapted from those used by Cabero and Lorente (2006), with the due consent of the authors. These instruments were designed for research carried out to determine the technological dominion of ICT by students in some communities in Spain. The questionnaires used by Cabero and Llorente consisted of 54 questions related to the technological dominion of the students, with a scale of answers from 0 to 10, 0 being not competent at all and 10 being fully competent. Cronbach's alpha internal consistency coefficient was 0.981 and 0.988, on the students' and teachers' questionnaires, respectively.

The adapted questionnaire consisted of 51 questions. Three questions of the type "I know how to design, create and modify databases with an informatics program (Acces, Dbase, My SQL…)" were eliminated from the questionnaire used for teachers and students in Spain since they did not correspond to the competencies of secondary school students in Mexico. They were adequated in the use of regionalized vocabulary, for example, the word "ordenador" was replaced by "computadora" and "fichero" by "archivo." The same scale of answers was used as in the original, from 0-10. Five and three questions which referred to identifying aspects of students and teacher in different variables, respectively were included.

2.3 Procedure

The procedure followed for developing the present study was the following:

a) The databases of public and private secondary schools in Ciudad Obregón, Sonora were obtained from the webpage of SEP (Ministry of Education).

b) The schools and groups of students who would answer the questionnaires were selected.

c) Contact was made with the principals of the schools chosen in order to explain to them the reach of the study and obtain their permission for carrying out the questionnaire process.

d) All groups, both teachers and students, were chosen for filling out the questionnaires. Only those students and teachers who willingly agreed to participate and who gave their authorization were included.

e) The information was captured and analyzed using descriptive statistics and hypothesis tests. Non-parametric statistical tests such as U de Mann-Whitney, using statistic software SPSS were used.

f) The results obtained with the questionnaires given to students in secondary schools in Ciudad Obregón, Sonora were compared to those obtained by Cabero and Llorente (2006) in their study carried out with secondary students in some regions of Spain.

3. Results and Discussion

The data collected in the surveys given to students and teachers at the secondary school level were analyzed and the following results related to the students were found.

Of the 949 students who participated, 84.1% said they had computers at home; 75.8% had access to Internet at home; 76.9% were from public schools and 23.1% from private schools.

The mean value and deviations achieved by the students on each question were obtained. In all questions mean values above 6 were obtained, considering 5 to be interpreted as "moderately competent." This means that students consider themselves to be slightly more than moderately competent. It must be pointed out that there was not a mean value of over 9 for any question, meaning that students did not consider themselves to be completely competent in any aspect.

The questions with the highest mean values and therefore those in which the students in secondary schools in Ciudad Obregón feel most competent are shown in Table 1. The students feel very competent in the use of Office tools, as they do with Word and Excel.

Table 1. Questions with the highest mean values for students in secondary schools in Obregon City, Mexico and the corresponding mean values of students in Andalucía, the Basque country and Galicia, Spain

Question	Values of the mean and standard deviation for students in Obregon City,	Values of the mean and standard deviation for students in Andalucía, the Basque country and Galicia
12. I know how to design, create and modify spreadsheets with some informatics program (excel), for specific aims, using functions such as formatting cells, inserting and hiding lines and making dynamic tables.	8.80; 42.12	5.96; 3.12
8. I can make a written document with a word processor (Word)	8.74; 3.59	8.05; 2.31
9. I can make a written document with a word processor (Word) using advanced techniques: placing a heading, changing the kind and size of letters, using bold print, underlining	8.60; 3.89	8.07; 2.23
28. I can use various search engines on Internet (Google, Yahoo)	8.42; 3.27	8.33; 2.27

The results of the research carried out with students from Spain showed that they feel greater technological command in questions 8, 9 and 28. The average of 8.33 is the highest of any level of command expressed by students of the study in Spain (see Table 1).

The questions with the lowest mean values for students in secondary schools in Ciudad Obregón are shown in Table 2. The results are in keeping with those found by Cabero and Llorente (2006), in which students showed low levels of command for the same questions. The lowest level shown by students in the study in Spain was 4.47. Low values were obtained in typical deviations in all questions, the highest being 42.13 and lowest 2.06; this shows little dispersion of data and therefore little difference in the answers of students in secondary school in Obregon City in Mexico. In fact, the question with the greatest mean value, as a larger typical deviation, Question 1, is the typical lower deviation, "I have basic knowledge of how a computer and its peripheral equipment work," which had a mean value of 8.04.

Table 2. Questions with the lowest mean values for students in Obregon City and the corresponding mean values for students in Spain

Question	Values of the mean and standard deviation for students in Obregon City,	Values of the mean and standard deviation for students in Andalucía, the Basque country and Galicia
4. Solving problems such as configuring an e-mail or anti-virus program, defragmenting the hard drive of the computer and Internet	6.67; 2.93	5.27; 3.19
17. I know how to create an audio clip with an informatics program	6.60; 3.02	5.56; 3.44
24. I know how to design a webpage, using an informatics program, including different links, to the same document or to others	6.53; 4.85	4.47; 3.70
13. I know how to design, create and modify spreadsheets in some informatics program (Excel) for specific uses, using formulas or functions	6.27; 2.94	5.42; 3.20

The students from secondary schools in Obregon City feel somewhat competent in handling computers and peripheral equipment, with scores close to 8, while students in secondary schools in Spain feel moderately competent in the same areas, with scores close to 7 (see Table 3).

Table 3. Questions related to handling peripheral equipment and computers for students from secondary schools in Ciudad Obregón and Spain

Question	Values of the mean and standard deviation for students in Obregon City	Values of the mean and standard deviation for students in Andalucía, the Basque country and Galicia
1. I have basic knowledge of how a computer and its peripheral equipment work	8.04; 2.06	7.06; 2.17
3. I know how to connect audio equipment, video cameras and digital photos to computers	7.95; 2.69	6.78; 3.12
33. I can access, search and recover information using different forms of access and formats (CD-rom, DVD, video)	7.49; 5.96	6.59; 3.07
2. I know how to connect a computer and the usual peripheral equipment (printer, scanner);	7.48; 2.84	7.36; 2.75

In relation to the technical handling of software, students from secondary schools in Obregon City feel somewhat more than moderately competent, while students from secondary schools in Spain said they feel moderately competent in these same aspects (see Table 4).

Students from secondary schools in Obregon City feel competent to very competent in the use of Word, but not in the use of Excel. The level of competence decreases as the level of use of Excel increases. Students feel competent in the use of searchers using various Software such as Google and Yahoo with scores of 8.01. They also feel moderately competent in creating images and graphs using some informatics program with a mean score of 6.95.

Table 4. Questions related to the technical handling of software for students from secondary schools in Obregon City, Mexico and some regions of Spain

Question	Values of the mean and standard deviation for students in Obregon City	Values of the mean and standard deviation for students in Andalucía, the Basque country and Galicia
4. I can install and uninstall informatics programs on a computer	6.94; 3.12	6.93; 3.14
45. I understand the problems of compatibility between informatics hardware and software	6.79; 3.17	5.37; 3.86
1. I solve problems like configuring e-mail, configuring an anti-virus program, defragmenting a hard drive found on a computer or the Internet	6.67; 2.93	5.27; 3.91

The highest mean score for any question is 8.80. This means that students feel very competent; in none of the questions did they say they felt highly competent. The questions with the lowest mean score was 6.25. This means that students feel slightly more than moderately competent and never less than moderately competent. In the study of students in Spain, the highest score was 8.33. This means students see themselves as competent. In none case did they consider themselves very competent. On the other hand, the lowest score was 4.47. In this case students felt slightly competent.

With respect to the results obtained in questionnaires given to teachers, with 49 teachers participating, 49% were females and 51% males; 42.9% had been teaching for between 3 and 5 years; 34.7% for 6 to 10 years, 20.4% for 11 to 20 years and 2% for over 21 years.

There are great similarities between the competencies the students feel they have and the competencies teachers feel the students have with a maximum level of competence of 9.33 and a minimum of 6.27. In some questions, teachers thought that students reached a highly competent level, while students never held that opinion.

The questions with the highest scores from the teachers' point of view in secondary schools in Obregon City are shown in Table 5. This shows that professors see students as being highly competent in the use of Word.

Table 5. Questions with very high mean values as seen by teachers in secondary schools in Obregon City and the corresponding mean values of the teachers' opinions in Spain

Question	Values of the mean and standard deviation for students in Obregon City	Values of the mean and standard deviation for students in Andalucía, the Basque country and Galicia
8. I can make a written document with a word processor (Word)	9.33; 1.35	8.15; 1.84
32. I can have a video-conference with IP (Net-meeting, Messenger, Skype) using the Internet	9.27; 13.15	4.68; 3.51
9. I can make a written document with a word processor (Word) using advanced techniques: placing a heading, changing kinds of type and letter size, using bold type and underlining	8.90; 2.07	7.92; 1.93
51. I know how to use spell-check in Word to edit and check my work	8.84; 1.34	7.37; 2.17

Some of these results coincide with the opinions given by teachers in Spain about their students, with the highest scores being for questions 8 and 9, with scores of 8.15 and 7.92, respectively. The question with the highest score was number 28, "I can use different internet search engines" with a score of 8.21. While this question was not

the one with the highest opinion of teachers in the present study, it received a score of 8.61.

The lowest scores from the point of view of teachers in Ciudad Obregón were for the questions found in Table 6. The teachers think that students are slightly more than moderately competent in designing Web pages. The questions with the lowest scores given by teachers in Spain related to their students were the same questions as those of the present study.

Table 6. Questions with the lowest mean values from the point of view of teachers in secondary schools in Obregon City and the corresponding mean values according to teachers in Spain

Question	Values of the mean and standard deviation for students in Obregon City	Values of the mean and standard deviation for students in Andalucía, the Basque country and Galicia
24. I know how to design web pages, using some informatics program, including different links from the document and from other sources	6.84; 2.79	4.22; 3.24
17. I know how to make audio-clips using some informatics program	6.61; 2.98	4.47; 3.14
23. I know how to design web pages, using some informatics program, including texts and images	6.47; 3.18	4.34; 3.24
31. I know how to send files from one computer to another by Internet using FTP	6.27; 3.07	4.42; 3.23

Hypothesis tests were also carried out in order to test whether the student's opinion of himself/herself is the same as the teacher's with respect to the level of technological command, for each one of the 51 questions and globally for the whole instrument. For this the Mann-Whitney U test was used with a level of significance of 0.05. The results showed that there were significant differences in the opinion of students and teachers in 11 of the 51 questions. These questions were:

2. I know how to connect a computer and its usual periphery equipment: printer, scanner.

4. I solve problems such as configuring e-mail, anti-virus, defragmenting a hard drive on the computer or Internet.

6. I can install and uninstall informatics programs on a computer.

7. I can change the format of files (change files form one kind to another).

8. I can make a written document with a word processor (Word).

11. I know how to design, create and modify spreadsheets with some informatics program (Excel), for specific purposes, using basic functions such as adding, products and means.

12. I know how to design, create and modify spreadsheets with some informatics program (Excel), for specific purposes, using functions such as formatting cells, inserting and hiding rows, making dynamic tables.

13. I know how to design, create and modify spreadsheets with some informatics program (Excel), for specific purposes, using formulas or functions.

21. I browse the Internet with different browsers: Explorer, Netscape, Mozilla, Google Chrome.

33. I can access, search for and find information using different forms of access and formats (CD-rom, DVD, video).

41. I feel competent in knowing when it is wise to make groups of instructions, automate processes of frequent use using frames, control procedures and formulas.

Of the previous questions, only on question 12 did the students see themselves as more competent (8.80) in their own opinion in comparison with the teachers' opinions (8.22). In all other questions, the perception of the teachers surpassed the students' opinions.

There were 40 questions which proved significant upon carrying out the hypothesis test, questions in which teachers and students have the same perception of the level of competence of the latter. The opinion of teachers and students on the level of competence of ICT of the students, coincide in 78.4% of the questions and do not coincide in 21.6%. This shows clear agreement in the opinions of teachers and students on the level of competence in the use of ICT by students. In order to prove the results, the Mann-Whitney U test was performed for the whole instrument and to prove the null hypothesis of whether the opinion on the level of competence is the same between teachers and students. The null hypothesis was accepted with a p value of 0.159.

Comparing these results with the research carried out with students and teachers in Spain, significant differences were found between the opinion of teachers and students in 23 of the 54 questions; that is to say, 42.6% did not coincide. In all of these, the scores on students' opinions were higher than the opinions of teachers.

Hypothesis tests (Mann-Whitney U tests) were carried out in order to test whether the opinion of students was the same between males and females (gender). The same opinion on the level of competence was found in 33 out of 51 questions; that is 64.7% of the questions, among which are:

3. I know how to connect audio equipment, video cameras and digital photos to the computer.

12. I know how to design, create and modify spreadsheets with some informatics program (Excel), for specific purposes, using functions to format cells, insert and hide rows, make dynamic tables.

18. I know how to make a multi-media presentation using some programs, including still images, texts, audio-clips, video-clips or graphs.

21. I browse the Internet using various links and hyperlinks provided by the Web pages I visit.

24. I know how to design Web pages, using some informatics program, including different links, to the document itself and to others.

29. I know how to use advanced web searches ("y"__"o") in different search engines of Internet (Google, Yahoo) to refine information searches.

35. I can organize information, using tools such as databases, spreadsheets or similar programs.

There was no agreement between males and females in 18 out of 51 questions, giving a significant level of 0.05 on the Mann-Whitney U test. Among the questions analyzed were:

2. I know how to connect a computer and its normal peripheral equipment: printer and scanner.

6. I can install and uninstall informatics programs on a computer.

9. I can make a written document with a word processor (Word) using advanced techniques: placing headings, changing type and letter size, using bold face type and underlining.

16. I know how to create images and graphs using some informatics program.

25. I can download from Internet programs, images, audio-clips.

38. I know how to use on-line help manuals.

47. I consider myself competent in being able to discriminate between e-mails with viruses, junk or spam most of the time.

Males feel more competent than females in the following questions: 2, 6, 16, 25, 38 and 47, while females feel more competent than males in question 9. The Mann-Whitney U test was used globally and no significant difference (at the 0.05 level) was found between males and females, in relation to their opinion of their own competencies in the use of ICT.

With respect to the results obtained in the study carried out in Spain, data shows that 4 out of the 54 questions were of the same opinion; that is to say, 7.4% while in the other 50 questions there was a significant difference between the two opinions. For most of the questions male students thought they were more competent than their female counterparts: males have higher scores than females.

With respect to whether students with computers at home had the same opinion of their competence as students who did not, Mann-Whitney U tests were performed for each of the 51 questions, showing a significant difference in 48 out of 51 of the questions. This shows the importance of students' having access to computers. The three questions in which there was no difference were:

11. I know how to design, create and modify spreadsheets with some informatics program (Excel), for specific purposes, using basic functions such as adding, products or media.

12. I know how to design, create and modify spreadsheets with some informatics program (Excel), for specific purposes, using functions such as formatting cells, inserting and hiding rows, making dynamic tables.

27. I can co-ordinate a group activity over Internet, for example an electronic forum.

In the study of students in Spain, the results are more striking since in 54 questions there were significant differences between the opinions of those students who had a computer available to him and those students who did not.

Hypothesis tests were also carried out in order to learn if the opinion is the same for students who had Internet access and those who did not, for each of the 51 questions. The results showed a total of 41 questions with significant differences in only 11 there was not a significant difference. Among those where there was no difference were:

11. I know how to design, create and modify spreadsheets with some informatics program (Excel), for specific purposes, using basic functions such as adding, products or media.

12. I know how to design, create and modify spreadsheets with some informatics program (Excel), for a specific purpose, using functions such as formatting cells, inserting and hiding rows, making dynamic tables.

13. I know how to design, create and modify spreadsheets with some informatics program (Excel), for specific a purpose, using formulas or functions.

29. I can use advanced search options ("y"__"o") on different search engines of Internet (Google, Yahoo) to refine the search for information.

47. I consider myself competent in knowing how to discriminate between e-mails with viruses, junk mail or spam most of the time.

Finally, hypothesis tests were carried out to discover whether there was a difference in opinion among students who studied in public schools and those who studied in private schools. The results show that there is a significant difference in the opinion of students on 45 out of 51 questions. There is a marked difference in favor of students who study in private schools. Among the questions in which opinions were the same on the command of competence were:

23. I know how to design Web pages, using some informatics program, including texts and images.

31. I know how to send files from one computer to another over Internet using FTP.

45. I understand problems of compatibility between informatics hardware and software.

4. Conclusions

After having analyzed the data obtained with respect to the opinion of students on their own level of competencies and teachers' opinions on the level of competencies of students, the following conclusions have been reached:

1) Regarding the technological infrastructure that students have in their homes, in the present study 84.1% reported having a computer and 75.8% have Internet access. These results are very similar to those found by Sigalés and Mominó (2004) in a study realized with students in primary and secondary schools in Catalonia, since most of the students (87%) have a computer at home and 72.5% have Internet access. These show a similarity of conditions of infrastructure among students of the different regions studied.

2) There is a strong disagreement of opinion among the students who did not have a computer at home and students who themselves had it, where 92.2% of the questions had difference, all the high scores were students that had a computer at home. The same forcefulness is shown with respect to the opinion of students who have or not Internet at home. In the case of students in the study of Spain, in all questions, students who have a computer at home scored higher, resulting in all cases a significant difference. Similarly, having internet at home influences the capabilities that students indicate to have, resulting significant in the most questions. Having computer and Internet access at home are two factors that favorably influence the competencies of students.

3) Students of secondary schools in Obregon City, feel very competent in the use of basic Excel, different Internet search engines and Internet browsing with different browsers. These results are consistent with early studies with students from secondary schools in Spain (Ministerio de Educación y Ciencia, Ministerio de Industria, Turismo y Comercio, 2007), which show high levels of competence to use spreadsheets and to use the information available on the Internet. However, in contrast to other research with secondary school students from Spain, made by Cabero and Llorente (2006) and Fernández-Morente, Cebreiro-López, and

Fernández-DeLaIglesia (2010), which show low levels of competence in the use of spreadsheets. These recent evaluations are based on European standards of competencies and skills about ICT that students should acquire.

4) There is a clear consensus of opinion between students and teachers about the level of ICT competence of students, they agree 78.4% of the questions. Similarly, in the study of Spain, there is a consensus of opinion between students and teachers, coinciding more than 50% of the questions. These results are consistent with the perception of competence between students and teachers in another study made by Fernández-Morente, Cebreiro-López, and Fernández-DeLaIglesia (2010), with students from secondary schools in Galicia, Spain. The similar opinion between students and teachers can show some candor in the responses of students about their level of competence in the use of ICT.

5) Students in secondary schools in Obregon City, felt a level more than moderately competent in designing advanced Web pages and producing audio files. Secondary students in Spain opined they are moderately competent in these same aspects. The results of both studies differ from those found in another study with students from Spain, where 34.7% of students in second grade feel competent in designing Web pages and in specific programs to make presentations with sound is high with 83.9 % (Ministerio de Educación y Ciencia, Ministerio de Industria, Turismo y Comercio, 2007).

6) Students from private schools are perceived more competent in ICT that students in public schools, because in 88.2% of the questions had a significant difference, having in all of them the highest scores the private schools students. 20% of students in public schools do not have computers at home, while less than 1% of students in private schools do not have a computer at home. These results agree with those found by Sigalés and Mominó (2004), where there is a marked difference between public and private schools in this aspect, so that students in public schools who do not have a computer at home (17.1%) almost double those of private schools (7.4%).

Finally, due to the results obtained in both studies, it may be pointed out that Mexican and Spanish students in some secondary schools have, in general, similar command in the use of ICT. This is true despite the fact that the students grow up and live in different cultural contexts.

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References

Álvarez, L. (2005). *Alfabetización digital*. VII Congreso Nacional de Organizaciones de Mayores. Retrieved from http://www.ceoma.org/vii_congreso_nacional/ pdfs/proyecto_alfabetizacion_digital.pdf

Area, M. (2002). *Las Nuevas Tecnologías de la Información y Comunicación en la Educación*. Biblioteca virtual del Grupo de Tecnología Educativa de la Universidad de Sevilla. Retrieved from http://tecnologiaedu.us.es/cursos/29/html/bibliovir/pdf/tema6.pdf

Barrios, A. (2009). Los jóvenes y la red: usos y consumos de los nuevos medios en la sociedad de la información y la comunicación. *Signo y Pensamiento, 54*(28), 266-275. Retrieved from http://revistas.javeriana.edu.co/index.php/signoypensamiento/article/view/4537/3499

Cabero, J., & Llorente, M. C. (2008). La alfabetización digital de los alumnos. Competencias digitales para el siglo XXI. *Revista portuguesa de pedagogía, 42*(2), 7-28. http://dx.doi.org/10.14195/1647-8614_42-2_1

Cabero, J., & Llorente, M. del C. (2006). *La rosa de los vientos: Dominios tecnológicos de las TIC's por los estudiantes*. Sevilla, España: Editorial Marquet@.

Cabero, J., Marín, V., & Llorente, M. del C. (2012). *Desarrollar la competencia digital. Educación mediática a lo largo de la vida*. España: Editorial Eduforma.

Echevarría, J. (1999). Nuevas tecnologías, nuevas sociedades. *El Semanal, XXI*, 2, (Informática e Internet para todos). Biblioteca virtual del Grupo de Tecnología Educativa de la Universidad de Sevilla. Retrieved from http://tecnologiaedu.us.es/nweb/

Fernández-Morante, C., Cebreiro-López, B., & Fernández-de la iglesia, J. C. (2010). Análisis de las competencias TIC de los alumnos de educación secundaria y bachillerato de Galicia. *Revista Gallego-Portuguesa de Psicoloxía e E Educación, 18*(2), 1138-1663. Retrieved from http://ruc.udc.es/bitstream/2183/8413/1/RGP%2018_2%202010%20art%2010.pdf

García, I., Cuevas, O., & Angulo, J. (2013). Alfabetización en habilidades digitales: Uso de REA en la práctica docente. En M. S. Ramírez (Editora), *Competencias Docentes y Prácticas Educativas Abiertas en Educación a Distancia* (pp. 10-23). Retrieved from http://catedra.ruv.itesm.mx/bitstream/987654321/745/1/eBook%20Mov%20abierto%20en%20educ%20distancia%20(Ramirez%202013).pdf

García, R. I., Cuevas, O., Angulo, J., & Mortis, S. (2012). *Los directivos de educación secundaria en Cajeme y su relación con las tecnologías de la información y la comunicación*. Informe técnico. ITSON: Cd. Obregón, Son. México

González, O., & Alvarado, Y. (2014). Competencias Tecnológicas en los estudiantes de la Universidad Del Zulia Núcleo Costa Oriental Del Lago. *Revista Electrónica de Humanidades, Electrónica y Educación Social, 18*(9). Retrieved from http://publicaciones.urbe.edu/index.php/REDHECS/article/viewArticle/3663/4687

Gros, B., & Contreras, D. (2006). La alfabetización digital y el desarrollo de competencias ciudadanas. *Revista Iberoamericana de Educación, 42*, 103-125. Retrieved from http://www.rieoei.org/rie42a06.htm

Johnson, L., Adams, S., & Cummins, M. (2012). *NMC Horizon Report: 2012 K-12 Edition*. Texas: The New Media Consortium. Retrieved from http://redarchive.nmc.org/publications/2012-horizonreport-k12

Matamala, C. (2014). Factores predictivos de las competencias TIC en alumnos chilenos de secundaria. *Revista Iberoamericana de Educación, 67*(1), 121-136. Retrieved from http://www.rieoei.org/rie_contenedor.php?numero=6701&titulo=Factores%20predictivos%20de%20las%20competencias%20TIC%20en%20alumnos%20chilenos%20de%20secundaria

Ministerio de Educación y Ciencia, Ministerio de Industria, Turismo y Comercio. (2007). Las TECNOLOGÍAS DE LA INFORMACIÓN Y DE LA COMUNICACIÓN EN LA EDUCACIÓN. *Informe sobre la implantación y el uso de las TIC en los centros docentes de educación primaria y secundaria* (curso 2005-2006). España: Técnicas gráficas forma. Retrieved from http://www.oei.es/tic/TICCD.pdf

Mortis, S., Valdés, A., Angulo, J., García, R. I., & Cuevas, O. (2013). Competencias digitales en docentes de educación secundaria. Municipio de un estado del noroeste de México. *Revista Perspectiva Educacional, 52*(2), 135-153. Retrieved from http://www.perspectivaeducacional.cl/index.php/peducacional/article/view/174/81

Pantoja, A., & Huertas A. (2010). Integración de las TIC en la asignatura de Tecnología de Educación Secundaria. *Revista de Medios y Educación, 37*, 225-237. Retrieved from http://www.sav.us.es/pixelbit/pixelbit/articulos/n37/18.pdfe564

Ritzhaupt, A., Liu, F., Dawson, K., & Barron, A. (2013). Differences in Student Information and Communication Technology Literacy Based on Socio-Economic Status, Ethnicity, and Gender: Evidence of a Digital Divide in Florida Schools. *Journal of Research on Technology in Education, 45*(4), 291-307. http://dx.doi.org/10.1080/15391523.2013.10782607

Secretaría de Educación Pública. (2006). *Informe de rendición de cuentas de la Administración Pública Federal 2006-2012*. Retrieved from http://www.ceoma.org/vii_congreso_nacional/pdfs/proyecto_alfabetizacion_digital.pdf

Sigalés, C., & Mominó, J. M. (2004). *La escuela en la sociedad de la red: Internet en el ámbito educativo no universitario*. Universitat Oberta de Catalunya. Retrieved from http://www.uoc.edu/in3/pic/esp/pdf/PIC_Escoles_esp.pdf

UNESCO. (2008). *Estándares de competencia en TIC para docentes*. Retrieved from http://www.eduteka.org/pdfdir/UNESCOEstandaresDocentes.pdf

Valdés, A., Angulo, J., Urías, M., García, R., & Mortis, S. (2011). Necesidades de capacitación de docentes de educación básica en el uso de las TIC. *Píxel Bit. Revista de Medios y Educación, 2*(39), 211-233. Retrieved from http://www.redalyc.org/articulo.oa?id=36818685016

Valencia, L. A., Torres, C. A., Angulo, J., & García, R. I. (2012). *Nociones básicas en TIC de estudiantes en la educación primaria de Veracruz*. Ponencia presentada en el Sexto Congreso Internacional de Educación.

Instituto Tecnológico de Sonora.

Vivancos, J. (2008). *Tratamiento de la información y competencia digital*. Madrid: Alianza Editorial.