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Diagnosis of the attitudes towards ICT of education students according to gender and educational modality

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Diagnóstico de las actitudes hacia las TIC de estudiantes de educación acorde al género y modalidad educativa

Francisco David Guillén-Gámez* | Sonia Janeth Romero Martínez** | Xavier Giovanni Ordóñez Camacho***

ABSTRACT

Attitudes towards technology are ideas, conceptions and thoughts that guide actions and, in the case of students, can influence the learning process and academic performance. The aim of this research is to know if there are significant differences between face-to-face and completely distance learning students in relation to their attitude towards technology and according to gender. To meet this objective a non-experimental mixed research was carried out with a sample of 180 Early Childhood and Elementary Education students. Attitudes were measured and scores were compared using both parametric and non-parametric statistics. Following this methodology, the study found statistically significant differences in the average attitude towards technology depending on the educational modality and gender; specifically, men and distance learning students show more favorable attitudes in the affective dimension while face-to-face students exhibit more favorable scores in cognitive and behavioral attitudes. The conclusions derived from this study may help to develop educational interventions focused in the improvement of unfavorable attitudes.

Resumen

Las actitudes hacia la tecnología son ideas, concepciones y pensamientos que guían las acciones y, en su caso de los estudiantes, pueden influir en el proceso de aprendizaje y en su rendimiento académico. El objetivo de esta investigación es saber si existen diferencias significativas entre los estudiantes que cursan una modalidad presencial y otra a distancia en relación con su actitud hacia la tecnología, así como según el género. Para cumplir este objetivo, se realizó una investigación mixta no experimental con una muestra de 180 estudiantes de educación infantil y primaria. Las actitudes se midieron y las puntuaciones se compararon utilizando estadísticas paramétricas y no paramétricas. Al seguir esta metodología, el estudio encontró diferencias estadísticamente significativas en la actitud promedio hacia la tecnología dependiendo de la modalidad educativa y el género; específicamente, el sexo masculino y los estudiantes a distancia muestran actitudes más favorables en la dimensión afectiva, mientras que los estudiantes presenciales poseen puntuaciones más favorables en actitudes cognitivas y de comportamiento. Las conclusiones derivadas de este estudio pueden ayudar a desarrollar intervenciones educativas centradas en la mejora de actitudes desfavorables.

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INTRODUCTION

All changes that are currently happening in the information and communication society caused by Information and Communication Technology (ICT) are playing a big part in every area -political, economic, social and others- where education represents a fundamental pillar, because the profile of the students is changing fast (Agrawal & Mittal, 2018; Chan *et al.*, 2017; Martin *et al.*, 2011).

Thanks to the great advances that ICT are causing, the use of virtual learning platforms has spread with great acceleration in last decade (Guillén-Gámez *et al.*, 2020). However, this implementation has not only occurred in distance education contexts, where the virtual platform is a technological axis, but also in those educational contexts that are carried out face-to-face as support systems for teaching.

From this perspective, Digital Competence (DC) aims to prepare students to develop autonomously in a globalized and increasingly connected by technological devices society. The amount of information is increasing exponentially; therefore, the student will have to learn digital strategies to manage this information (Røkenes & Krumsvik, 2016).

In this sense, Valtonen *et al.* (2011) state that students' DC should focus on the development of skills, attitudes and knowledge of technologies in many contexts. Moreover, as Tondeur *et al.* (2016a) affirm, this is also necessary the pre-service teachers and future teachers, since they should have the adequate skills, knowledge and attitudes to put them into practice efficiently in educational contexts.

Although most of the current university students can be considered as "net generation" or "digital natives" (Thompson, 2013; Bowe & Wohn, 2015), it does not guarantee they have acquired the DC and, if they have acquired it, it is interesting to analyze the level of competence they have. Some authors (Sentance & Humphreys, 2015; Jaggars, 2014; Garcia, Escofet & Gros, 2013; Al-Doub, Goodwin & Al-Hunaiyyan, 2008) have found differences in DC when comparing different study modalities (face-to-face, distance or blended).

Others have found differences in the development and acquisition of DC according to the gender (Tondeur *et al.,* 2016b; Aesaert & Van Braak; Ardies *et al.*, 2015; Cai, Fan & Du, 2017; Stošić & Fadiya, 2017). The questions that guide the present investigation are: a) Are there differences between students of face-to-face modality and students who study completely at a distance in the attitudinal dimension of the DC? And, b) are there differences between men and women in the attitudinal dimension of the DC?

In order to answer these questions, the objective of this study is to compare a component of the DC (attitudes towards technologies) in university students of face-to-face modality with distance students. A second objective is to analyze differences in attitudes towards ICT according to gen-

der. Below is a theoretical approach to the concept of DC in general and to attitudes towards ICT in particular; secondly, a brief summary of previous studies on the comparison of the DC according to gender and modalities of study.

Approximation to the concepts of digital competence and attitude towards ICT

Digital competence is defined as the safe and critical use of ICT for work, leisure and communication. In addition, possession of basic skills with computers to retrieve, evaluate, store, produce, present and exchange information as well as to communicate and participate in collaborative networks (Van Deursen & Van Dijk, 2014; Aesaert *et al.*, 2014; Sefton -Green *et al.*, 2016).

Authors as Binkley *et al.* (2012), Incantalupo, Treagust & Koul (2013), Kandasamy & Shah (2013), Wilson, Scalise & Gochyye (2015), Aesaert *et al.* (2015) and Kihoza *et al.* (2016) affirm that these competences are composed by different dimensions: cognitive knowledge, attitudes and procedural skills.

Greenwald (2014) states that attitudes are part of the DC and are composed of thoughts, ideas and opinions of people on an attitudinal object and condition the behavior of people towards that object (in this case, the ICT). Attitudes are made of elements that guide the behavior of individual according to the intensity of feelings and thoughts (Semerci & Aydın, 2018).

In the context of DC, Yang and Kwok (2017) affirm that the attitudes towards ICT influence the learning process. Therefore, if teachers want to use technology successfully in their classes, they should have a positive attitude towards the use of technology (Khan *et al.,* 2012). In the same way, Afshari *et al.* (2009) conclude that students develop this attitude when teachers feel comfortable enough with technology and know its use.

On the other hand, the students' attitudes towards ICT condition their learning, self-regulation and academic performance becoming a key

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driving force behind learning behavior (Liu, Lin & Zhang, 2017; Aydin & Semerci, 2017; Keser & Çetinkaya, 2013). In addition, the attitude of the students (positive or negative) can be modified by previous experiences or stimuli and, therefore, learned and developed (Binder & Niederle, 2006; Prior *et al.,* 2016).

Comparison according to study modalities

There have been several studies that compare educational variables according to study modality without reaching conclusive results. The most studied variables are academic performance, dropout and satisfaction; in contrast, attitudes have not been studied as much.

Regarding academic performance, some studies have found a higher performance in students who attend online classes compared to students in face-to-face modality (Amry, 2014; Sharp & Sharp, 2017). On the contrary, some studies identify a lower performance in distance compared to face-to-face students (Jaggars, Edgecombe & Stacey, 2013; Xu & Jaggars, 2013).

However, most studies find that there is no difference in learning outcomes between modalities of instruction (McCutcheon *et al.*, 2015; Al-Qahtani & Higgins, 2013; Amro, Mundy & Kupczynski, 2015; Jahng, Krug & Zhang, 2007; Szeto, 2014; Yen *et al.,* 2018). In addition, other studies have also found gender is a moderating variable in the academic performance of students when they are compared according to modality (distance *versus* face-to-face) (Figlio, Rush & Yin, 2013; Xu & Jaggars, 2013).

On the other hand, student satisfaction has also been analyzed in terms of different educational modalities (Salimi & Kornelus, 2018; Dunn, 2013; Allen *et al.*, 2002). For example, Zhan and Mei (2013) analyzed the satisfaction of the face-to-face and distance students in a sample of 257 students, concluding that virtual students often feel isolated due to the distance of their teachers and rest of the students. These authors

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conclude that face-to-face students are more satisfied than distance students. In the same line, Jaggars (2014), Bambara *et al.* (2009) or Young & Duncan (2014) determined that distance students might have lower satisfaction due to less interaction with the faculty. However, some other researches have determined opposite results (Bowers & Kumar, 2015).

Regarding to DC, Suriá (2010) determined that distance students did not reach the levels of learning of the 2.0 tools of face-to-face students, because this group did not receive the same training for their use. Opposite results were found by Vota, Arras & Tejedor (2014), Moreno & Delgado (2013) and Garcia, Escofet & Gros (2013), who conclude that distance students present higher levels of DC than face-to-face students. In regards to the type of university, Meerza & Beauchamp (2017) analyzed the attitudes toward ICT of a sample of 717 university students from a public and a private university, finding statistically significant differences.

Comparison according to a gender perspective

The relationship of gender and attitudes towards ICT has been more studied in the scientific literature than the modality of study, despite being an important topic in education. However, little research has been found that address the study from a gender perspective, understanding gender as an analytical category that explains the inequalities between men and women, emphasizing

the notion of multiple identities and taking into account that the feminine and the masculine are formed from a mutual, cultural and historical relationship (De Barbieri, 1992).

Several authors address the issue of the existence of a possible "digital gap" from a gender perspective, having into account that the inequality relationships between genders have effects in the production and re-production of discrimination. For example, authors such as Tondeur *et al.* (2016b) and Sáinz & López-Sáez (2010) determined that women have less favorable attitudes towards technology in a general way. Kubiatko *et al.* (2011) found similar results: men showed more positive attitudes. These results can be explained because there are numerous inequalities between women and men in terms of access, participation, use and control of resources, goods and services linked to ICT (Anguita & Alario, 2006).

In addition, is important to consider attitudes are mediated by previous experiences and it is essential for the development of positive attitudes that technological education and access to tools be as equal as possible. Gender gap is meditated and interacts with other variables such as age, rural or urban environment (or migratory origin) and educational and socioeconomic status (Arenas, 2011).

In contrast with the ideas presented above other studies have found that women have more favorable attitudes towards ICT (González-Sanmamed, Sangrà, & Muñoz-Carril, 2017). In a recent meta-analysis extracted from 23 empirical studies, Siddiq and Scherer (2019) found gender differences in performance of ICT tasks, favoring women. However, other studies did not find gender differences regarding the behavior towards ICT (Semerci & Aydın, 2018; Dauda, Ayanda & Jibrin, 2018; Teo, Milutinović & Zhou, 2016; Sáinz *et al.*, 2016).

Despite the existence of researches and studies that do not find differences in the attitude towards technology between men and women, it cannot be denied that in recent decades there is a wide academic concern about the digital gender gap in the technological field. Likewise, it becomes increasingly clear that the digital gender gap will not continue to grow around the greater or lesser use of technology, or even the ability to use it, but depends on the attitude and interest of women in getting involved in the technological world (Booth, Goodman & Kirkup, 2010; Brynin, 2006).

Many researchers consider the digital gender gap as a problem of greater importance than the simple access and use of ICT or the development of basic computer skills (Adya & Kaiser, 2005; Ahuja, 2002; Beise, Myers, VanBrackle & Chevli-Saroq, 2003).

For this reason the comparative study of attitudes towards ICT in men and women, such as the present study, is essential to understand the future evolution of the digital gender gap in the technological field; specially having into account that the study of the digital gender gap has been gradually focusing on the study of explanatory factors of such underrepresentation of women in the world of ICT, with special emphasis the study of attitudes towards technology in young women (as the sample used in the present research) and on the factors involved in the rejection of careers in the field of ICT.

Attitudes in pre-service teachers

Although the attitudes of teachers and pre-service teachers play an important role in the incorporation of ICT in their classes, few studies examine attitudes in affective, cognitive and behavioral dimensions. Different sub-dimensions of attitudes, such as attitudes towards the general use of ICT (Hernández-Ramos *et al.*, 2014, Blackwell, Lauricella & Wartella, 2014), attitudes towards the educational use of ICT (Baş, Kubiatko & Sünbül, 2016) and attitudes towards the ease of use of ICT have been investigated (Scherer *et al.*, 2018, Teo, Huang & Hoi, 2018).

However, attitudes towards ICT in its components (affective, cognitive and behavioral)

haven been scarcely analyzed. This is the reason why the main objective of this research is to analyze in depth the attitudes towards ICT in pre-service-teachers, having into account affective, cognitive and behavioral dimensions. The secondary objectives of the present research are: a) to analyze the differences in attitude according to study modality (face-to-face *versus* distance); and b) to analyze differences in attitude according to gender. To do so, we formulate the following hypothesis, based in the review of the scientific literature:

1) There are differences between distance and face-to-face students in one or more components of the attitude towards ICT.
2) There are differences between men and women in one or more components of the attitude towards ICT.

METHOD AND MATERIALS

Design

This research was non-experimental and transversal, with a mixed approach (quantitative-qualitative) in which no treatment has been applied to any of the variables. The information has been selected, observed and collected. Descriptive and inferential analyses have been carried out in order to identify the differences between the groups of interest.

Participants

The sample is non-probabilistic: 180 students of Early Childhood and Elementary Education compose the sample. Fifty percent of the sample pertain to a face-to-face program of the Complutense University of Madrid (UCM), and the other 50% of the students belong to a completely distance program of the Madrid Open University (MOU). Most of the participants -around 80.56%- are women. This mirrors the student population in Early Childhood and Elementary Education. In regards to age, there are notable differences between modalities: the mean of age of the students in distance education (MOU) is 33.77 (sd = 8.27), and in face-to-face program (UCM) is 19.74 (sd = 2.42). This distribution indicates more dispersion of ages and a higher mean of age in distance education.

Procedure

A test for measuring the attitudes towards ICT was applied to the students of Early Childhood and Elementary Education in the Faculty of Education of both universities, during the first semester of the course 2016/2017. At MOU the test was applied through a survey platform and in UCM it was applied in paper-pencil format during an hour of class. In both cases, the consent for participation was requested to the participants informing them of the voluntary nature of their participation and guaranteeing them anonymity in the treatment of information. The information collected through the instrument has been complemented with an unstructured interview conducted with a subgroup of four women and four men (two from UCM and two from MOU), to complement the study with a qualitative approach.

Instrument

1) Attitudes towards ICT were measured by means of the Scale of Attitudes Towards ICT (SATICT), an instrument designed to measure attitudes towards the incorporation of ICT in the teaching-learning process that has been proposed by Ordoñez & Romero (2016).

The SATICT is composed of 20 Likert type questions, of five points each, in which students must respond according to their degree of agreement with the proposed statement (from "completely disagree" to "completely agree"). Four of the items were scored in reverse. The test is composed by three factors: Cognitive Factor (CF), which includes seven items on thoughts, beliefs and attitudes related to the influence of ICT in cognitive aspects of learning (for example: "ICT favor my learning"). Affective Factor (AF) composed of eight items, consisting of value judgments of an affective nature on the inclusion of ICT in the educational process (for example: "I feel comfortable using ICT in my university stud-

ies"). And the Behavioral Factor (BF) composed by five items, including questions about the impact of the ICT in behaviors related to learning (for example: "ICT make the study of subjects easier"). The total score of the SATICT is 100 points.

Ordoñez and Romero (2016) present evidence of reliability and validity of the SATICT scores. Regarding reliability (internal consistency), the values reported by the authors are: the total test α = .903 and for each factor, α = .74 (CF), α = .80 (AF), and α = .77 (BF). The composite reliabilities are: .86, .78 and .87, respectively. Regarding evidence of content validity, the authors present item-objective concordance made by five expert evaluators, indicating concordance between 45% and 83%.

With respect to the evidence of construct validity, the authors perform a confirmatory factor analysis finding a good fit of the three-dimensional model (χ^2_{SB} = 693.83 (p <.001); CFI = .97; NNFI = .97; SRMR = .041 and RMSEA = .054). Similarly, the authors present evidence of convergent validity (20 items have statistically significant factor loads).

NON-STRUCTURED INTERVIEW

A non-structured interview was used to deepen in the topic of digital gender gap, using the same categories of the quantitative instrument: affective, cognitive and behavioral attitudes. The interviews had an average duration of 20 minutes, in function of the complexity of each of the sequences.

RESULTS

Differences in attitudes according to modality (face-to-face versus completely online students)

Table 1 shows the descriptive statistics for the total scores and for each factor. The table includes mean (*m*), standard deviation (*sd*), skewness (g_1),

kurtosis (g_2) and mean rank. Also, the Shapiro-Wilk (SW) normality test was included. This table shows there are differences in the mean of scores of the attitude between both groups: these differences indicate higher affective scores in distance students and higher cognitive and behavioral scores in students of face-to-face modality.

On the other hand, the values of the SW, g_1 and g_2 statistics show that the assumption of normality is not met in the group of distance students, so it was decided to use non-parametric statistics to make the comparison between groups. In particular, the Mann-Whitney U test was used to compare the ranks of the two distributions.

Table 2 shows significant differences between the students of both modalities in the ranks of all the factors and in the total score. The trends observed in the descriptive section are confirmed, indicating more favorable attitudes of the face-to-face students in cognitive and behavioral components; and better scores of distance students in the affective component. The table also exhibits

the effect size through the r test. In the behavioral factor the effect size is high, but it is moderate in cognitive and affective factors.

Differences in attitudes according to gender

Table 3 shows descriptive statistics for the total scores and for each factor according to gender. Table includes mean (m), standard deviation (sd), skewness (g_1), kurtosis (g_2) and mean rank. Also, the Shapiro-Wilk (S-W) normality test was included:

As presented in this table, men have higher scores of attitudes. On the other hand, the values of the S-W, g_1 and g_2 statistics show that the assumption of normality is met, so, Student's t parametric test may be used. This test confirms these differences are significant in the case of affective factor [$t = 2.162$; $df = 51.07$; $p = .035$; $d = 0.46$], and also in the total score of the test [$t = 2.009$; $df = 54.93$; $p = .047$; $d = 0.35$]; however effect size (Cohen's d) is moderate.

Table 1. Descriptive statistic and normality test according to modality

FACTOR	MODALITY	M	SD	G$_1$	G$_2$	RANK	SW	DF	P (SW)
AF	Distance	28.34	4.72	-0.70	0.56	92.54	0.995	80	.007
	Face-to-face	27.10	3.85	-0.17	-0.11	76.15	0.980	84	.210
CF	Distance	25.11	2.81	-0.60	0.40	53.84	0.956	80	.008
	Face-to-face	29.09	2.84	0.61	0.01	111.73	0.942	84	.001
BF	Distance	17.73	3.12	-0.69	0.75	76.44	0.935	80	.001
	Face-to-face	19.00	2.50	0.13	0.01	93.56	0.975	84	.100
Total	Distance	71.18	9.48	-0.66	-0.08	74.16	0.950	80	.004
	Face-to-face	75.31	8.10	-0.52	-0.12	90.44	0.973	84	.073

Note: AF = Affective Factor, CF = Cognitive Factor, BF = Behavioral Factor.
Source: own elaboration.

Table 2. Statistical significance of the differences according to the study modality

FACTOR	MANN-WHITNEY	WILCOXON	Z	SIG.	R
AF	2797.00	6625.00	-2.194	0.028	0.163
CF	2875.00	6115.00	-2.280	0.023	0.169
BF	1067.50	4307.50	-7.780	0.000	0.579
Total	2693.00	5933.00	-2.196	0.028	0.165

Note: AF = Affective Factor, CF = Cognitive Factor, BF = Behavioral Factor.
Source: own elaboration.

Table 3. Descriptive statistic and normality test according to gender

FACTOR	GENDER	M	SD	G₁	G₂	SW	DF	P (SW)
AF	Male	29.22	4.09	0.28	-1.17	0.949	32	.132
	Female	27.38	4.34	-0.34	0.35	0.984	132	.137
CF	Male	27.56	3.08	0.10	0.23	0.980	32	.057
	Female	27.02	3.53	0.41	0.01	0.978	132	.020
BF	Male	19.06	2.68	0.14	0.46	0.936	32	.810
	Female	18.07	2.94	-0.44	0.80	0.966	132	.029
Total	Male	75.84	7.68	0.70	-0.54	0.980	32	.798
	Female	72.67	9.23	-0.33	0.42	0.987	132	.269

Note: AF = Affective Factor, CF = Cognitive Factor, BF = Behavioral Factor.
Source: own elaboration.

INTERVIEWS ANALYSIS

The discourse analysis confirms and expands the results obtained in the other parts of the research (Yang & Kwok, 2017; Liu, Ling & Zhang, 2017). In this sense, a series of factors that influence the positive attitudes were extracted:

- Previous experiences with the use and access to ICT influence attitudes, especially in women.
- Family interests and work influence attitudes. The family, the expectations of the parents and aspects of parenting, have a greater influence in the case of women and work in the case of men.
- The usefulness of the ICT that participants perceive is fundamental in the development of favorable attitudes. Students who perceive that ICT are useful for their future professional performance exhibit more positive attitudes.

All students interviewed agree that ICT are a fundamental support in the teaching-learning process and have great potential for the integration of students with special educational needs in the classroom:

At present it is necessary that future teachers not only know how to use various technological tools, but also know how to convey to students the taste for technology (interviewee Nº 4-Woman).

Thanks to our technologies our future work as teachers will be more useful and effective. In my case, I already use them a lot as a student (Interviewee Nº 6-Man).

The content analysis shows the most prominent factors that influence the attitudes of the women are the potential of ICT as communication tools, and in the case of men its potential for stimulate learning or knowledge acquisition by use the ICT in classroom:

I believe that ICT are a fundamental tool for working with young children, because of their enormous communicative potential through play (Interviewee Nº 1-Woman).

ICT are important for better student training (Interviewee Nº 3-Man).

DISCUSSION

This work has analyzed the attitudes towards ICT of pre-service-teachers to become teachers, taking into consideration the modality of the study and gender. With this in mind, two samples of face-to-face and distance students of Early Childhood and Elementary Education were used.

The analysis of the results has shown empirical evidence to support the first hypothesis in the introduction, since there are statistically significant differences in the average range of attitudes towards ICT of the pre-service teachers, depending on the educational modality. Such differences have occurred in all three factors, as well as the total SATICT score.

In particular, in the present study, it has been found distance students show more favorable attitudes towards the affective dimension, while the face-to-face students have more favorable attitudes in cognitive and behavioral aspects, as well as the total test; thus corroborating the conclusions provided by Suriá (2010), as well as the results found by Zhan & Mei (2013), Jaggars (2014) and Young & Duncan (2014). All these authors affirm that the affection is very important for distance students, because they lack the presence of classmates and teachers, which can result in isolation and less satisfaction in their learning.

In this study, there is supporting evidence for the second hypothesis as well, since it has been found that there are differences in attitude between men and women. Specifically, it has been found that men have more positive beliefs than women in the affective dimension and in the total of the test. These results are consistent with the investigations carried out by Tondeur *et al.* (2016b), and Sáinz & López-Sáez (2010), who affirm that females have less favorable attitudes towards the incorporation of ICT in the educational process than males. These results can be explained by the fact that technologies are socially and culturally defined as masculine and technological competences, they are understood as competences of the masculine gender (Hayes, 2008).

In the introduction section we expressed the need to address the issue of attitudes toward ICT in order to reach a better understanding the digital gender gap. The results of the present research allow designing interventions focused on the attitudinal aspects, which are essential for future

teachers such as the usefulness of technology in the classroom and for people with special educational needs. The present research coincides with other studies (Hayes, 2008; Margolis & Fisher, 2003) in pointing out the importance of informal experience with technologies as a critical factor in the development of attitudes, especially the family and work influences.

Limitations and Further Research

Due to the social changes that have occurred in function to the fast-paced development of ICT, the training of pre-service-teachers in terms of DC should be one of the objectives of current education. However, today there are still gaps in the attitudes towards ICT of this group.

In this work, it has been possible to verify there are significant differences in an important component of the DC, as well as the attitudes towards ICT among students of early childhood and primary education, who are studying in the face-to-face modality compared to distance students. Distance students also have more favorable attitudes in the affective, cognitive, behavioral and main dimensions in comparison to face-to-face students.

In addition, it has been proven that gender affects attitudes towards ICT and differences

It has been found distance students show more favorable attitudes towards the affective dimension, while the face-to-face students have more favorable attitudes in cognitive and behavioral aspects

have been found that indicate women have a more unfavorable attitude towards the incorporation of ICT in the educational process. Thus, it can be concluded that by using the SATICT test to assess the attitudes of students towards ICT through different indicators, significant differences have been found when comparing face-to-face education with distance education. In particular, the use of ICT for the teaching and assessment of students, as well as technological infrastructures are quite different between groups, particularly given that distance education is fully supported by technological tools.

This study has provided the tools for a better understanding of the variables that influence the development of a more favorable attitude among children in early childhood and elementary education, which play such an important role in the incorporation of ICT in their classes. In this sense, universities should develop more incentives to improve the attitudes towards ICT of teachers in training since such attitudes are directly related to the DC, and together with knowledge and skills in digital tools, they have a positive influence on the quality of education.

The results of this study will allow universities to design improvement plans according to the profiles of students who need it most (in this case, women and distance students in cognitive and behavioral aspects), and whose attitudinal levels are the lowest compared to others. The present research also has some weaknesses, which may constitute future research lines. One of them is its generalizability, since the sample is not probabilistic. However, the study could be replicated in other universities in all geographical regions of Spain, and even internationally.

Finally, analyzing and comparing the knowledge and technological skills of students in both educational modalities in order to complement the results of this study according to the attitude, could expand this research and, therefore, in the words of Arrufat, Sánchez & Santiuste (2010) triangulation of the definition of DC would be carried out.

In addition, it would be interesting to delve deeper into the relationships that may exist between the attitudes of students towards ICT compared to the satisfaction and motivation they have in their studies and the university to which they belong. Additionally, if this study could be applied in other modalities of study, such as in *B-Learning*, one could compare in which modality students have more developed or favorable attitudes towards the incorporation of ICT in education.

> It has been proven that gender affects attitudes towards ICT and differences have been found that indicate women have a more unfavorable attitude towards the incorporation of ICT in the educational process

CONCLUSIONS

- Existence of general positive attitudes towards ICT in Early Childhood and Elementary Education students.
- Distance students have more favorable attitudes towards ICT compared to face-to-face students.
- Men have more positive attitudes towards ICT than women in the affective dimension and in the total of the test.
- Previous experiences with the use and access to ICT influence attitudes, especially in woman.
- Family expectations and work influence attitudes towards ICT.

- Perceived usefulness of the ICT is fundamental in the development of favorable attitudes, both, in men and women.

LIST OF ABBREVIATIONS

ICT: Information and Communication Technologies
DC: Digital Competence
UCM: Complutense University of Madrid
MOU: Madrid Open University
SATICT: Scale of Attitudes Towards Information and
Communication Technology
SW: Shapiro-Wilk
AF: Affective Factor
CF: Cognitive Factor
BF: Behavioral Factor

DECLARATIONS

1) Availability of data and materials
   The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.
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