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The Technological Challenge Facing Higher Education Professors: Perceptions of ICT Tools for Developing 21st Century Skills

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Abstract: To consider that some quality teaching-learning processes in the Higher Education is practically unthinkable without the use of technology, especially because of its impact in developing the necessary skills and abilities for the 21st century. (1) Background: One of the initial steps to successfully approach this challenge is to analyze how university professors consider that ICTs can contribute to developing skills and abilities in their students. In this regard, their perceptions are one of the factors that will limit the use they make of these tools. (2) Method: For this reason, a quantitative research has been designed in which 345 university professors have participated for different branches of knowledge of one Spanish university. (3) Results: Among the most relevant results, we can highlight that the professors recognize the potentials of the ICTs and consider they have a positive effect on learning and development of 21st century skills in their students. These benefits are seen in different fields like communication, collaboration, and critical thinking, among others. Likewise, the importance of the technology culture teaching role is outstanding. (4) Conclusions: Finally, the need for integration of ICTs in a pedagogical model in which professor training in digital skills acquires relevance is shown.

Keywords: Higher Education; ICT; 21st century skills; technology; university professors

1. Introduction

The irruption of Information and Communication Technologies (herein, ICTs) in current society has given way to a transformation of the same in many ways. One of the fields in which this has had greater effect concerns educational context. Specifically, the Higher Education field has progressively been impregnated by educational activities based on these ICT supports. In fact, this has propitiated the start of a transformation process of the conventional university to the digital university through new pedagogical models, new learning environments and the action of professors capable of providing the students with the knowledge, skills and abilities necessary for life [1]. That way, all these transformations have developed into a more sustainable model of education [2,3].

However, recently several authors [4,5] have stated that the expectations created around the impact of ICTs in the educational context have not been satisfactorily fulfilled. Despite their great potential, the degree of use of the same is not resulting so effective as expected [6]. The literature available until now coincides in attributing with greater frequency the cause of this effect to a superficial method of integrating ICTs in the teaching-learning process. Added to all that, on several occasions the responsibility of this deficient use of ICTs has fallen on the professors and on their attitudinal response toward the integration process of these tools into their academical practice [7]. Likewise, professors

of different educational stages claim a lack of training in that respect. Because of that, evidently the digital skill of professors will become a new challenge they must assume so they can respond to the demands required by this society of knowledge.

Considering the integration of ICTs, several studies [8] have coincided in that, frequently, their incorporation into the classroom has been done under an instrumental use of the same and, therefore, maintaining a conventional type of educational culture. However, the potential offered by ICTs is not only instrumental and, from a practical point viewpoint, this must be seen in the acquisition of skills that consolidate significant learning that in turn allows inclusion of science, innovation and technology into education. This phenomenon becomes a real possibility through the application of active methodologies including the use of ICTs adopted in the real context of university classrooms [9].

The response capacity to these current and future challenges and opportunities of the 21st century society responds to an imperative need for education. In this regard, an effective use of ICTs requires the possibility of opting for an initial and permanent training during the development of the teaching task to adapt to the versatility of the technological field in education. As well, it requires importance the use of methodologies aimed at students who are successful at professors who respond to the diversity of needs present in students [10].As explained in the most recent research [11], the training of professors is necessary to achieve the most optimal development possible of digital skills, which include capabilities, knowledge, strategies and attitudes that must be activated [12].

The importance of the teaching role as a key factor to introduce ICTs in their educational practices has been extensively highlighted in previous literature [13,14]. Some authors [8] mention the need for a change in the profile of the Higher Education professor. These are required to integrate ICTs effectively and efficiently into the academic process. To do that, Crisol [15] proposes a methodological renewal in which the professor adopts a guide role in the teaching-learning process, putting into practice the well-known active methodologies, which focus on the students, increase their participation, favor collaborative work, promote autonomy in their learning, as well as encouraging the acquisition of competences and skills, so they can develop themselves in the face of 21st century demands [16,17]. In addition, Valtonen et al. [18] consider ICTs as fundamental tools for developing and managing all the 21st century skills in the students.

Undoubtedly some of us are immerse in the constant and rapid changes in which the technological boom has created unprecedented complexity of the systems. In the educational systems of those technologically advanced nations, students are faced with situations in which their learning is permanently connected to technological and digital routines that already form an inherent part of their daily routines [19]. In this regard, Higher Education institutions are in a transformation process of their teaching-learning processes, with a fundamental objective of providing the students with enough skills and abilities to develop themselves in a society characterized by complexity and uncertainty. Literature has denominated these abilities as "21st century skills" [20].

Abilities for the 21st century skills are, in line with that explained by Ananiadou and Claro [21] (p. 7), the capacity of students to "apply knowledge and abilities in important areas of interest and effectively analyze, reason and communicate while resolving and interpreting problems in a variety of situations". The definition of 21st century skills can vary according to the proposals by different authors, as an example, the study carried out by Makrakis and Kostoula-Makrakis [22] where they take as a starting point the basic skills known as the "4 C's". However, they even propose up to 10 transversal skills to respond to the demands required by 21st century society, although on this occasion reference is taken from those proposed by Fullan and Langworthy [23] (p. 24), known as "the 6 Cs". This approach was defined because the need to unify the meaning of pedagogy, technology and the construction of change was considered. These skills are linked to obtaining in-depth learning from new pedagogy that allows creating knowledge in the students related to the world using the potential offered by ICTs in the educational field. This way, the authors [23] (p. 24) propose that in-depth learning can be developed through these six elements: "Character education", "Citizenship", "Communication", "Critical Thinking", "Collaboration" and "Creativity and Imagination". The development of the

mentioned abilities will allow preparing the students for the 21st century society through in-depth learning that allows its use in daily life [24]. However, a methodological transformation is required to acquire these skills in the teaching-learning process, as well as a change of role, both for the professor as facilitator and guide in the academic process, and for the students as an active part of their own learning.

Over the last years, an important amount of empiric evidence [25–27] has revealed the importance of using the ICTs not only at academic level, but also from a global viewpoint. All that, with the intention of promoting through the same a more sustainable education. Based on the Sustainable Development Goals proposed by the United Nations Organization for Education, Science and Culture [28], these digital tools directly contribute to one of the aims responding to the guarantee of offering inclusive and equative education promoting learning opportunities for all persons. Likewise, the use of ICTs is also related to other Sustainable Development Goals that contribute to reducing social and economic inequalities and to guarantee, in this way, the well-being of all people. In other words, digital tools are valuable as response to the needs demanded by current society.

From a holistic viewpoint of ICTs, their acceptance has become generalized in society. However, this requires promoting different actions with the intention of obtaining as much benefit as possible from the several advantages and applications they offer [4]. The results shown by several studies [5,8,29] establish that the perceptions of the ICTs by professors are, generally, positive. In fact, the majority consider them as tools that favor active and interactive learning and that achieve respect for individual learning rhythms. Even so, a more significant learning is valued in association to their use in the academic process [30]. However, the results of other studies [12] reveal that the most reluctant professors to the incorporation of ICTs in their professional task, indicate several limitations associated to the everyday use of these technological tools. Among these, we highlight lack of technological knowledge, traditional training and the economic investment required by the implementation of these tools. For this reason, the knowledge, attitude and beliefs that university professors adopt when faced with the integration and use of ICTs in their academic practice, will be considered as key factors for academic and, even, professional success of their students [31,32].

Until now, studies have shown that the innovative use of ICTs in the academic process aimed at obtaining educational objectives, favoring positive results in Higher Education students [8,33]. At the same time, these tools have the potential of improving quality in education at all levels: academic, personal, and social. However, greater support from educational institutions is required to improve positive impact of ICTs in the teaching-learning process. At the same time, adequate professor training and updating of content and methodologies are required to allow developing an optimal level of the same, that way achieving 21st century quality education [4,16].

Taking all this into account, this study pretends offering an approximation to the perception of university professors about how ICTS contribute to development of abilities and skills for the 21st century in their students. More specifically, six skill dimensions and the possible differences existing between these perceptions attending to the gender of the professors, to the professor figure they develop and to the years of experience in university teaching are analyzed. In addition, we pretend studying how the contribution of ICTs to these skill dimensions are pre-defined by gender, age of the professors, their experience, and the university course in which more hours are taught. In short, this study answers a set of questions that define the objectives of the study: To what extent do university professors consider that the use of ICT can improve the 21st century skills of their students? Is there greater agreement among professors on the most positive benefits that ICTs have on the development of some of these skills? Are there differences in professors' perceptions based on sociodemographic variables? To what extent can some of these variables predict the most favorable perceptions of 21st century skills development benefits?

2. Materials and Methods

A quantitative study is presented with a descriptive survey and non-experimental character based on a questionnaire. In this sense, this approximates the objective under study without introducing

modifications of the variables with the aim of exploring it and describing it [34]. This type of design allows an objective and comparable systematic description of characteristics and facts of a population [35]. Therefore, this is a valuable source of information to analyze the perceptions of university professors.

2.1. Participants

The sampling of this study consists of 345 professors from Higher Education fields with different contract profiles. As seen in Table 1, practically half of the participants (49%) are permanent professors (University Professors and University Tenured Professors), 23.5% are interim professors (Contracted, Assistants Interim and Researchers) and, finally, 27.5% of Associate professors. Regarding the branches of knowledge of these professors, we highlight with a greater percentage that linked to legal and Social Sciences (35.1%). The rest of branches have similar percentages (15.4% of Arts and Humanities; 16.5% of Sciences; 15.9% of Health Sciences; 17.1% of Engineering and Architecture). 55.97% of the sample are men, while 44.3% are women. Regarding age, 36.1% are between 24 and 45, 33.7% between 46 and 54 and a similar percentage (30.2%) are professors between 55 and 73. On the other hand, and distributed in three levels, 33.7% of the professors have from 0 to 10 years' experience, 37.8% have from 11 to 25 years' experience and, lastly, 28.4% report having from 26 to 49 years' experience in university teaching. Regarding the courses in which professors spent more hours teaching, there appears a greater percentage in the first course (26.1%) and less percentage in the later levels of Master or Doctorate (10.1%). We must highlight that the sampling applied responds to a convenience type [36]. Consequently, the sample is formed by those professors who voluntarily accepted to participate in the research.

Table 1. Sociodemographic characteristics of the sample.

Variable	n	% of the Sample
Professional profile		
Permanent Teaching Staff (Professor and Associate Professor)	169	49
Non-official teaching staff (Assistant Professor and Graduate Teaching Assistant)	81	23.5
Adjunct Professor	95	27.5
Knowledge area		
Arts and Humanities (A&H)	53	15.4
Sciences (S)	57	16.5
Health Sciences (HS)	55	15.9
Social and Legal Sciences (C&LS)	121	35.1
Engineering and Architecture (E&A)	59	17.1
Years teaching experience (M = 17.96, SD = 11.79)		
0-10 years	115	33.7
11-25 years	129	37.8
26-49 years	97	28.4
Gender		
Men	192	55.7
Women	153	44.3
Age (M = 48.75, SD = 10.17)		
24-45 years	122	36.1
46-54 years	114	33.7
55-73 years	102	30.2
Course in which more hours are taught		
1º	90	26.1
2º	81	23.5
3º	75	21.7
4º	64	18.6
Master/Doctorate	35	10.1
Total	345	100

2.2. Instrument

A quantitative study is presented with a descriptive survey and non-experimental character based on a questionnaire. In this sense, this approximates the objective under study without introducing modifications of the variables with the aim of exploring it and describing it [34]. This type of design allows an objective and comparable systematic description of characteristics and facts of a population [35]. Therefore, this is a valuable source of information to analyze the perceptions of university professors.

A questionnaire already validated from the Martin and Touron [37] study was used to obtain the data about perception of the ICTs influence on the development of 21st century skills in university students. Specifically, a Likert type scale from 0-10 points was used. The instrument consists of 18 items organized in six sections that each allude to a different skill dimension: character, collaboration, communication, citizens, critical thinking, and creativity. We decided to evaluate the reliability of the instrument once again, calculated by means of the Cronbach Alfa test that show acceptable degrees of internal consistency (α character = 0.87; α collaboration = 0.90; α communication = 0.70; α citizenship = 0.81; α critical thinking = 0.87; α creativity = 0.84). At the beginning of the questionnaire a series of social demographic variables were introduced that facilitated the initial description of the university professors: gender, age, years of teaching experience, teaching role, branch of knowledge to which they belong and, finally, the course in which they give most hours of teaching.

2.3. Research Procedure and Data Analysis

The university professors were contacted by e-mail, sent from the administration bodies of the participating university. By means of the same, they were informed of the study objectives and they were asked to participate voluntarily and anonymously. In addition, a website link was attached that would take them to the online platform supporting the questionnaire. After compilation, the data was refined and introduced into a database.

The data was analyzed using the SPSS statistics packet version 22.0. Descriptive and inferential type analyses were applied. Firstly, a check was made to ensure all cases were fulfilled to allow applying the pertinent statistical tests. Descriptive analyses were made for typical averages and deviations. Then, bivariate contrasts were applied by means of average differences (t-Student) for independent samples and variance analysis (ANOVA). To specifically detect where these statistically significant differences were located, post-hoc comparisons were applied using the Tukey test. On the other hand, the Pearson correlation coefficient was used to establish lineal relations between skill dimensions. Lastly, six multiple lineal regression analyses were made considering, as dependent variables, each of the skills measured in the study.

3. Results

Firstly, Table 2 represents a summary of the descriptive statistics of each indicator forming the six skill dimensions. There we can also see the total averages and typical deviations of each dimension. In the skill linked to the character, the indicator that has obtained most points refers to the highlighted function of the ICTs to allow a differentiated learning rhythm in the university students (M = 7.20, SD = 2.34). In turn, that with the least interest has arisen refers to the perception that the ICTs mean tools for stimulating diversions and learning (M = 7.20, SD = 2.34). Regarding the collaboration skill indicators, the average points from both are situated at a slightly higher level than the average (M = 6.92 SD = 2.45, M = 6.49 SD = 2.64). This fact reflects the perceptions that the sample professors do not support evident contribution of the ICTs to the collaboration attitudes among the students. The communication skill dimension shows a disparity of results. Although the professors consider that technology facilitates access to the material and to the earning content (M = 8.48 SD = 1.84), the development of oral and written expression is positioned with an average score much lower (M = 4.26 SD = 2.95).

Table 2. Descriptive statistics.

	M	Sd	M. Total	Sd
Character (0 - 40) (CHA)				
Relax the materials that best adapt to the learning.	6.98	2.32	27.48	8.44
Allow students to work at their own rhythm.	7.20	2.34		
Facilitate diversion and learning.	6.62	2.62		
Increase student motivation.	6.66	2.64		
Collaboration (0 - 20) (COLL)				
Allow students to collaborate with their classmates.	6.92	2.45	13.41	4.85
Allow students to learn from/with their classmates.	6.49	2.64		
Communication (0 - 20) (COMM)				
Facilitate that students can access the learning material and content.	8.48	1.84	20.06	5.79
Develop oral and written expression of the students.	4.26	2.95		
Allow the students to learn with the use of digital technology.	7.31	2.41		
Citizenship (0 - 20) (CIT)				
Consider the strong points, weaknesses, and interests of the students.	5.69	2.66	12.19	4.81
Propose a facilitating climate for learning.	6.49	2.58		
Critical thinking (0 - 40) (CRI)				
Allow them to participate in taking decisions.	6.05	2.69	25.05	8.92
Allow the students to participate in resolving problems.	6.40	2.56		
Develop critical thinking (give my opinion, create proposals. . .)	5.56	2.80		
Self-evaluate their learning progress.	6.89	2.53		
Creativity (0 - 30) (CRE)				
Foster autonomy in their learning	7.15	2.35	19.60	6.62
Improve their learning processes.	6.73	2.38		
Increase creativity of the students.	5.70	2.84		

Generally, the contribution of ICTs to citizenship skill has been perceived as average, both for the indicator referring to the consideration of the strong points and student interests (M = 5.49 SD = 2.66), and for that related to the disposition of a climate facilitating learning (M = 6.49; DT = 2.58). The contribution of ICTs stands out in that regarding critical thinking, for the self-evaluation of progress in learning of the student (M = 6.89 SD = 2.53) while, for the development of critical thinking, it has obtained an average lower score (M = 5.56 SD = 2.80). Lastly, these professors have evaluated that the ICTs are tools that facilitate development of student creativity, although with slight variations among the indicators (fostering of autonomy: M = 7.15 SD = 2.35; improvement of learning processes: M = 6.73 SD = 2.38; increase of creativity: M = 5.70 SD = 2.84).

Then, the inferential analysis of differences was made taking, as a starting point, the six skills to which the ICTs contributed. Therefore, the t-Student tests and ANOVA were applied, which results are shown in Tables 3 and 4. In the Levene test for equality of variances, the equality of variances is assumed as ($p > 0.05$) in all items. Firstly, and regarding the gender variable, it seems that, compared with that of men, female professors give greater importance in all the skill dimensions. In all of them, the differences are highly significant ($p < 0.000$).

Table 3. T-student for contrasting means.

	GENDER			
	M	W		
	M (Sd)	M (Sd)	t	*p*
CHA	25.56 (8.96)	29.87 (7.07)	4.69	0.000
COLL	12.55 (4.84)	14.50 (4.66)	3.67	0.000
COMM	18.89 (5.79)	21.52 (5.48)	4.14	0.000
CIT	11.02 (5.07)	13.66 (4.01)	5.07	0.000
CRI	23.25 (8.83)	27.26 (8.55)	4.00	0.000
CRE	18.22 (6.63)	21.31 (6.23)	4.19	0.000

Table 4. ANOVA test for contrasting means.

	PROFESSIONAL PROFILE					YEARS TEACHING EXPERIENCE				
	Permanent	**Non-Official**	**Adjunct**			**0–10**	**11–25**	**26–49**		
	M (Sd)	**M (Sd)**	**M (Sd)**	**F**	***p***	**M (Sd)**	**M (Sd)**	**M (Sd)**	**F**	***p***
CHA	25.27 (8.82)	28.96 (7.53)	30.16 (7.44)	11.79	0.000	29.90 (6.34)	27.90 (8.28)	24.47 (9.34)	11.32	0.000
COLL	12.11 (5.23)	14.43 (4.20)	14.84 (4.06)	12.03	0.000	14.82 (3.81)	13.63 (4.92)	11.58 (5.16)	11.92	0.000
COMM	18.77 (5.99)	20.53 (5.51)	21.93 (5.13)	9.16	0.000	21.64 (4.87)	19.92 (5.44)	18.44 (6.87)	7.79	0.000
CIT	11.04 (5.05)	13.01 (4.43)	13.50 (4.20)	9.28	0.000	13.50 (3.89)	12.60 (4.51)	10.30 (5.36)	12.27	0.000
CRI	22.56 (9.27)	26.76 (7.93)	27.85 (7.97)	11.95	0.000	27.96 (7.36)	25.65 (8.44)	20.94 (9.39)	16.34	0.000
CRE	17.51 (6.93)	20.93 (5.89)	22.08 (5.49)	16.39	0.000	21.54 (5.51)	20.30 (6.21)	16.45 (7.28)	16.30	0.000

In that referring to the teaching profile, also differences in all skill dimensions were detected. Specifically, and in comparison with the professors with a temporary contractual figure and that of associate that of the permanent professors (University Professors and Heads of Departments) grant less relevance to the ICTs for development of these 21st century skills in their students ($p < 0.000$). These results maintain a close relationship with the statistically significant differences that are seen among the categories of the variable corresponding to age of the professors. This way, when they are compared with the perceptions of the professors with less quantity of years of teaching experience, those professors with longer trajectories have attributed less core to the ICTs a tools that favor the 21st century skills ($p < 0.000$).

A Pearson correlation analysis was used to examine the relationships among the 21st century skills that are developed under the action of ICTs in the Higher Education field. Table 5 shows the high and positive correlations that are established among these abilities. The highest correlation is seen between the skill related to critical thinking and the creativity skill (0.80, $p < 0.01$). In turn, the lowest correlation index (although no less efficient) is located between the collaboration skill and that of citizenship (0.63, $p < 0.01$). These results translate into some more favorable perceptions toward the action of ICTs on one of these skills, it also includes favorable positioning of the others.

Table 5. Correlations.

	CAR	**COL**	**COM**	**CIU**	**PCR**	**CRE**
CAR	1					
COL	0.68 **	1				
COM	0.75 **	0.65 **	1			
CIU	0.70 **	0.63 **	0.68 **	1		
PCR	0.70 **	0.73 **	0.73 **	0.76**	1	
CRE	0.79 **	0.68 **	0.78 **	0.75 **	0.80 **	1

The relationship is significant at the 0.05 level. ** The relationship is significant at the 0.01 level.

Lastly, a series of multiple regression analyses were made to define if the skills could be predicted based on the gender of the professors, their years of experience in university teaching, their age and the academic course in which they give a greater quantity of teaching hours. The results, shown in Table 6, reveal that only the gender and years of experience significantly predict the perception that ICT contribute to developing the 21st century skills in the students. For the case of teaching trajectory, the prediction is established in a negative sense in the six skills.

Table 6. Hierarchical regression analysis to predict skills.

	Competence: Character				
	Non-standardized Coefficients		**Standardized Coefficients**		
Variable	**B**	**Standard Error**	**B**	**t**	***p***
(Constant)	29.544	2.639		11.194	0.000
SEX	3.368	0.893	0.204	3.773	**0.000**
EXPER	−0.169	0.058	−0.243	−2.898	**0.004**
AGE	−0.007	0.067	−0.008	−0.100	0.920
COURSE	0.008	0.339	0.001	0.023	0.981
$R = 0.345$, $R^2 = 0.119$, $F = 10.435$, $p < 0.000$					
	Competence: Collaboration				
	Non-standardized coefficients		Standardized coefficients		
Variable	B	Standard error	B	t	*p*
(Constant)	13.999	1.558		8.986	0.000
SEX	1.434	0.528	0.149	2.715	**0.007**
EXPER	−0.109	0.035	−0.268	−3.154	**0.002**
AGE	0.021	0.040	0.045	0.525	0.600
COURSE	−0.068	0.200	−0.019	−0.343	0.732
$R = 0.299$, $R^2 = 0.089$, $F = 7.597$, $p < 0.000$					
	Competence: Communication				
	Non-standardized coefficients		Standardized coefficients		
Variable	B	Standard error	B	t	*p*
(Constant)	19.622	1.883		10.423	0.000
SEX	2.189	0.636	0.189	3.443	**0.001**
EXPER	−0.135	0.042	−0.276	−3.245	**0.001**
AGE	0.043	0.048	0.075	0.882	0.379
COURSE	−0.037	0.241	−0.008	−0.153	0.879
$R = 0.314$, $R^2 = 0.099$, $F = 8.440$, $p < 0.000$					
	Competence: Citizenship				
	Non-standarized coefficients		Standarized coefficients		
Variable	B	Standard error	B	t	*p*
(Constant)	13.923	1.512		9.210	0.000
SEX	2.070	0.512	0.219	4.046	**0.000**
EXPER	−0.086	0.033	−0.215	−2.568	**0.011**
AGE	−0.020	0.039	−0.042	−0.503	0.615
COURSE	−0.018	0.194	−0.005	−0.091	0.928
$R = 0.357$, $R^2 = 0.128$, $F = 11.241$, $p < 0.000$					
	Competence: Critical Thinking				
	Non-standardized coefficients		Standardized coefficients		
Variable	B	Standard error	B	t	*p*
(Constant)	30.509	2.886		10.573	0.000
SEX	2.851	0.969	0.163	2.942	**0.004**
EXPER	−0.191	0.064	−0.256	−2.973	**0.003**
AGE	−0.050	0.074	−0.059	−0.678	0.499
COURSE	−0.266	0.372	−0.040	−0.714	0.476
$R = 0.367$, $R^2 = 0.135$, $F = 11.257$, $p < 0.000$					
	Competence: Creativity				
	Non-standardized coefficients		Standardized coefficients		
Variable	B	Standard error	B	t	*p*
(Constant)	22.465	2.144		10.476	0.000
SEX	2.281	0.724	0.173	3.150	**0.002**
EXPER	−0.159	0.047	−0.287	−3.371	**0.001**
AGE	−0.007	0.055	−0.010	−0.122	0.903
COURSE	−0.222	0.274	−0.045	−0.809	0.419
$R = 0.367$, $R^2 = 0.135$, $F = 11.463$, $p < 0.000$					

4. Discussion

One of the most relevant findings derived from this study alludes to the possibility offered by the ICTs, from the Higher Education professors' point of view, for development of 21st century skills in their students. Their use inside the university classroom has the potential of stimulating collaborative and cooperative dynamics among the students, versatile and interpersonal communication, creation of teaching-learning communities, and the design of active teaching models in which the students have the possibility of sharing information and listening for their own interests. In turn, the results of this work reinforce the transcendency of analyzing perceptions of the professors about the contribution of ICTs to skill development. That way, according to the positioning they show, their predisposition to the use and implementation of university education practices founded on mediation with these tools could be different.

Regarding the prediction of the perceptions of these professors, the results are situated in a line like those reported by Alshammari, Reyes and Parkes [38], and Guillén-Gámez and Mayorga-Fernández [39]. Therein, gender and years of teaching experience (in addition to the participation in certain projects and the type of face-to-face or online teaching they gave) could also predict the perceptions and attitudes of a large sample of Higher Education professors toward ICTs. Regarding the differences found herein according to the variables such as gender or years of teaching experience, in previous research [40] with samples of professors of the Secondary Education stage, the existence of statistically significant differences could not be define attending to the mentioned social demographic characteristics. Likewise, Onasanya, Shehu, Oduwaiye and Shehu [41] did not show any differences according to gender in professors' perceptions about the integration of ICTs in the learning of their students. However, attending to their employment experience, differences were seen that can translate in that those professors with less experience showed a more positive attitudinal positioning toward the benefits of ICTs.

In a certain sense, that found in this work is situated in the line of that recently concluded by authors like Suleimen [42]. ICTs have a significantly positive effect on the learning by students and, consequently, their use in classrooms is fully justified. From the point of view of the participating professors, these tools allow the continuous interchange of ideas, independent research processes, development of critical thinking and creativity and, also, self-evaluation of their learning [43].

The accumulated empiric evidence [44,45] has highlighted the importance of establishing a clear difference between those skills desired for designing in the classroom a rich learning atmosphere, and those other skills of the students to which ICTs contribute for their development. Taking this second approach as a reference, the relevance that these professors have attributed to, for example, some skills such as communication and collaboration, are supported by studies like that of Sá and Serpa [46]. This study affirms that "development of communication and collaboration skills using ICTs favors the learning and group work reflecting, analyzing and resolving problems" [46] (p. 141). Extending these findings to the practical field, reconsidering the role of Higher Education Professors is a fundamentally important aspect. This way, the creation of collaboration networks with other professors and the interchange of practices an knowledge can lead, as indicated by Spiteri and Chang-Runfgren [47], to a more efficient use of technology in the university classroom and the facing up to greater challenges in the teaching-learning process.

The relevant technology function as a resource placed at the service of educational field and the teaching-learning processes has also been highlighted in other recent research works [48,49]. That way, and coinciding with hat established by this study, all the other studies have described the power perceived of technological resources during educational activities. Among other questions, the potential to create knowledge networks, providing solutions to problems arising in the learning environments and improving performance and optimizing learning strategies stand out. In other words, technologies have an integral role in the learning process throughout the whole life [50], an aspect that is positioned as intimately linked to the development of 21st century skills.

In addition, it acknowledges the challenge associated to the development of these 21st century skills by using ICTs in university classrooms, a fact that has been discussed in other studies [51]. To approach this challenge, Koehler and Mishra [52] propose original strategies that defend the implementation of a collaborative structure on technological supports to design curricular materials fostering development of these types of skills. Therefore, these types of learning experiences are aimed at allowing university students to, as much as possible, work towards improving their skills for an 21st century society. Even so, it must be considered that some professors report certain difficulties with this type digital pedagogy since this can enter conflict with their own more conventional pedagogical practices [53].

The use and handling of programs and technological devices not only responds to the acquisition of isolated technological abilities. To the contrary, as revealed by Ferrari [54], the attitudes and conscious and critical use of the same generates deep understanding of the digital environments used in universities. In fact, applications differentiated by the professors are seen, according to these beliefs and attitudes toward the use of technologies and their influence on student learning. A clear example of these variations is seen in the work of Mama and Hennessy [55] in which, from a more conventional view of the use of technology, the professors use digital devices in their classrooms to support the presentation of study materials or searching for information of the Internet. To the contrary, in classrooms where work is being conducted on constructive learning technology is understood as a cognitive development tool that, from a more integral viewpoint, allows authentic learning [56].

The way that professors make use of ICT tools is directly related to the personal pedagogical method used in their teaching task and, in turn, with their way of understanding the need for fostering in their students the 21st century abilities and skills [57]. Without forgetting, as Makrakis [58] stresses in his study, that ICTs are described as transforming tools of any educational process. Among other questions, this information society has included, for the educational community, the need for adapting to new circumstances characterized by progressive digitalization. Therefore, educational institutions and the different agents involved in them assume new challenges that have the aim of providing quality education for everyone. Therefore, the findings found herein underline the need for giving support to a university teaching culture characterized by professional development that has, the main aim of integrating ICTs in a pedagogical method subject to constant and permanent changes [59]. In fact, the schooling culture has been highlighted, by authors like Hennessy, Ruthven and Brindley [60], as one of the variables that has great influence on the taking of decisions and attitudinal positioning of the professors.

5. Conclusions

ICTs are at the core of the skills demanded in this 21st century [61]. Therefore, different authors [57] recommend that educational activities programmed under these technological supports must be presented together with an investment of efforts on the development of 21st century skills such as critical thinking, problem resolving, communication, or collaboration, among others. The fact of capitalizing the ICT benefits, accompanied by quality teaching to the ongoing improvement service and adapted to current social demands, will allow constant renovations and innovation in universities. In addition, Guillén-Gámez and Mayorga-Fernández [39] suggest that Higher Education systems are those that promote the transversal incorporation of ICTs and use, as a starting point, greater practical training in ICTs for the professors.

University transformation towards a scenario where technology forms an inherent part of the same, will become an inevitable process [62]. In addition, this reflection leads to the need of rethinking of how these changes can affect the learning experience of the agents directly involved (that is, both professors and students). If the students are aware of the positive advantages these digital environments can acquire, they can easily have access to quality information, participate in specific groups of interest and, likewise, publish and divulge their own works.

However, consider, that in the mentioned processes the professors acquire a substantial role. Parallel to becoming aware of the need to foster a technological learning culture, it would be wise to carefully attend to the capacity they have of designing lessons in which the students are involved and that prepare them for this 21st century [63,64]. This new learning culture is, as indicated by Kim, Tan and Bielaczyc [65], collaborative, participative, and fundamentally defined by the students themselves. Consequently, ICTs consist of a considerably larger field than the mere acquisition of technical knowledge.

In this very shocking time, in which the whole society is immerse, university systems have assumed the responsibility of redesigning institutional educational contexts. During this COVID-19 global crisis, the capacity of educational systems is being put to the test to continue their activities as best as is possible. Now more than ever, Higher Education professionals are faced with the challenge of strengthening their abilities to handle ICTs A recent research conducted by Lederman [66] about the use of technology in university classrooms, revealed that the amount of professors having previous experience to support remote teaching, did not reach 50% of the sample. Consequently, the supports and ongoing training they are offered will be the fundamental key for success in online teaching-learning processes. In accordance to Galanek and Gierdowski [67], this is exactly the information received about how to adopt ICTs as an inherent part of the teaching activity, which can contribute to modifying the perceptions of the professors.

Finally, and regarding study limitations, additional research is required to recompile a larger amount of data from different geographical areas. This way, the interpretation of the findings could be extended to the entire Spanish Higher Education system. As an added aspect to the study of differences based on gender and years of teaching experience, it would be interesting to investigate the impact that ICT usage in their lectures have on professors' attitudes and perceptions. In addition to the above, the perspectives that arise from university students must be added that would also result being fundamentally interesting and, therefore, requiring to be taken into consideration. In turn, and assuming that the perceptions are understood as subjective evaluations, future studies must be incorporated into an additional qualitative analysis that will allow knowing in depth the attitudinal positioning of these university professors.

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