Article

Uses of ICT Tools from the Perspective of Chilean University Teachers

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Abstract: The use of the ICT in university learning processes is linked to their use by the educator. This aspect will determine the use of some resources over others, and consequently, the prevalence of some methodologies over others. The main objective of this work is to determine the use of the ICT by university educators, and from this, to determine which elements will define the design of a training program on the use of the ICT. For this, and with the use of an ex post facto method with a sample of $n = 1113$ subjects, the main result obtained was that the male professors utilized the digital tools more often for their teaching tasks. Furthermore, those with less professional experience preferred to use tools found in the cloud. Thus, it is concluded that the model of training observed from the demonstrated use of digital resources is linked to the preoccupation of education professionals for caring for the digital environment, and this model should be designed as a function of the methodologies and the system of evaluations utilized by the professors.

Keywords: ICT; digital resources; university; teaching; learning

1. Introduction

The appearance of the Information and Communication Technologies (ICT) in the education sphere has brought with it changes that have affected the two main actors of the education process, students and educators. In the case of the former, their social reality has invaded their academic one through the introduction of digital resources such as videogames [1–3], Augmented and Virtual Reality [4,5], Applications (Apps) that they already used in their everyday life [6,7], the new virtual learning environments supported by tele-training platforms [8], etc., to their learning process. Today's university students are catalogued as "millennials", students who were born in the digital era, and as a result, their link with technological resources is greater than in previous eras, where the students had a more analogical profile.

As for the latter, the professors, it has been observed that they find themselves in a two-sided moment. On the one hand, they have to or need to update their teaching methods [9], and on the other, they must be in a continuous learning process, given that the continuous development of the digital tools implies the appearance of new resources or the improvement or disappearance of the existing ones, so that their use in teaching is contingent to this continuous educational renewal.

According to [10], the professors use the ICT timidly, due to a series of aspects related to the lack of previous training; the lack of infrastructure or resources provided by the universities [11,12], their attitudes and previous beliefs [9,13], their motivations [14] or feelings [15], or their resistance towards their use [11,13], etc.

Nevertheless, their use in the classroom has been increasing, for better or worse. However, just as in [16], we believe that the key element needed for the professors to utilize the digital tools in their classrooms is contingent upon their perception about the tools in general and about specific ones in particular. Thus, the works by [17,18] show that resources for sharing information such as blogs are thought of as elements that will help with their student's learning, given that it will revitalize the acquisition of vocabulary, improve their writing techniques, and foment debate among them. Furthermore, the use of Augmented Reality [4,5], in this case experiences in which the educators have enriched the notes provided to the students with this technology, has highlighted the better understanding of the contents, the availability of the material in a virtual format motivates learning [19], and the creation of new scenarios in which to practice what is learned [20]. Likewise, the addition of social networks to teaching has implied a change in the methodological process of the educator. The work by [17] shows how the use of Twitter has promoted relationships between students, just as it has contributed to the students learning about how to establish work criteria without the need for the teacher to impose them.

The present study will also allow us to determine the digital competence of the educators, given that the use of ICT tools is determined by the digital competence they possess [21,22].

The literature on the digital competence of educators found is broad, just as the instruments created for measuring it. At the European level, we find the Digital Competence Framework for Educators (DigCompEdu) [22], and more specifically in Spain, the Ministry of Education, through the INTEF, created a framework for the development of this competence. Focusing our attention on the Latin American context, and more specifically in the Chilean context, the Ministry of Education has promoted ENLACES [23], through which the standards for the pedagogic training of the professors were established, although those related to the digital competence were not specified. This results in that the differences between what the professor knows, and the resources used for teaching, are not in line with the learning expectations of the students.

In general, research on higher education and digital training has brought to light that the educators feel the need for training programs on the specific use of the ICT in their own curricular context [22,24,25]. As a result, the promotion of the use of the digital resources currently available, as well as the development of the digital competence of the professors, is needed. Thus, to promote all of these aspects, the study of the use of the digital resources by the professors is needed at present, given that by virtue of the aspects mentioned previously, the professors will utilize those instruments they are more comfortable with in their teaching. The digital education environment, which is now demanded, involves, on the one hand, an institution that provides technological and human resources to meet the demands that society asks from the higher education institutions. This is none other than an education environment where the digital competence of the student is achieved throughout higher education, so that once incorporated to the professional world, the student can contribute to the production system. On the other hand, there is the need for the professors to also be digitally competent, to know the resources available, and to have the ability to incorporate them into their teaching tasks in an efficient manner. It is this knowledge which will create an environment where the diverse digital tools available in the market will help students to become familiar with them, helping the teacher to contribute to the enrichment of the university institution in general, and society in particular. The current digital scenario of the universities finds itself at a boiling point and in a state of evolution, along with the addition of the technological resources for teaching for which training is not offered or is scarce, and with its growth in the hands of the professor's willingness to use them.

On the other hand, elements such as gender or professional experience are variables that can influence the understanding of ICTs and the particular use of them. There are several examples in the literature regarding the differences between women and men concerning ICTs use. We can find some research that supports differences in favour of men, and other research concerning women [26–28]. In conclusion, we can see that there is no common point between the research community.

Therefore, it is necessary to know which tools they utilize the most, to determine the type of training that needs to be covered by the education institutions [21,29], as they are the ones responsible for offering their educators the strategies necessary to become trained and up to date. In this sense, the main objective of this work is to determine the degree of use of the digital tools by Chilean professors, in order to establish the training parameters needed for the development of the digital competence of the Chilean university educators.

2. Materials and Methods

2.1. Methods

The design of the research study utilized a descriptive approach with the use of a cross-sectional quantitative survey, defined as such due to the numerical and reliable nature of the data collected and the use of a deductive and structured research strategy [30]. More specifically, an ex post facto method of study was utilized. Therefore, the objective will be obtained a posteriori, as point out by [30].

Starting with the general objective presented above, the following specific objectives were established:

- Specific objective 1: To determine the existence of differences related to the use of digital tools by the professors depending on gender.
- Specific objective 2: To clarify the existence of differences on the use of the digital tools as a function of the years of professional experience.
- Specific objective 3: To establish the elements that determine the use of digital tools.

Starting with these objectives, the following working hypotheses were posited:

Hypothesis 1. *The women use the digital tools more compared to the men.*

Hypothesis 2. *The professors with less professional experience utilize digital tools to a greater extent than the older ones.*

2.2. Participants

The participating sample was composed of *n* = 1113 professors from the INTEC University in Chile, and the guidelines established by [31] were followed for their selection. Of these, 31.8% were women and 68.2% men, with an average age of 41–50 years old. The mean years of professional experience was 6–10 years (see Table 1). From the total, 64.4% indicated not having pedagogical training on the use of the ICT in the classroom.

Table 1. Description of the sample.

Variables		%
Age	Less than 30	5.5
	31–40 y.o.	23.9
	41–50 y.o.	33.7
	51–60 y.o.	25.4
	Older than 60	11.5
Years of professional experience	Less than 5 years	20.8
	6–10 years	28.8
	11–15 years	16.9
	16–20 years	13
	21–25 years	6.9
	26–30 years	8.8
	More than 30	7.6
Have pedagogical training on the use of the ICT	Yes, trained	35.4
	No, no training	64.6

2.3. Instrument

For the collection of data, an adaptation of the instrument designed by [32] was utilized. This adaptation was performed at the linguistic level, given that the original was written in Spanish from Spain, and had to be adapted to Chilean Spanish. Furthermore, descriptive variables of the samples were modified. In the end, the questionnaire was composed by 58 items, which were distributed into 2 dimensions. The first corresponded to the demographic study of the participating sample, and if they had or not pedagogical training linked to the ICT, for a total of 4 items; and the second dimension referred to the use of the digital tools by the educator, comprised of 54 items. The response scale utilized was Likert-type with 7 options, where 1 was "I never use it", and 7 was "I always use it".

The reliability test, Cronbach's Alpha, provided a value of $\alpha = 0.9779$, a very high value according to the literature [32], thereby indicating that the instrument had a high reliability.

The Exploratory Factorial Analysis (EFA) performed to determine the validity was conducted through the extraction of principal axis factoring and Kaiser-normalized varimax rotation with self-values higher than 1. The instrument was adjusted to 8 factors which explained 62.96% of the variance, as factorial loads higher than 0.40 were considered [33], showing acceptable Kaiser–Meyer–Olkin variables (KMO = 0.965) [34–36], and a significant Bartlett's sphericity ($\chi2$ (1321) = 13,000.220 and $p < 0.001$). The resulting 8 dimensions had Alpha values that were very similar to the original instrument [32] (see Table 2).

Table 2. Dimension 2: Sub-dimensions of the questionnaire.

Sub-Dimension	No. Items	Alpha Value
1. Methodology of attention and assessment (MAA)	19	0.957
2. Tools for the creation of learning (TCL)	6	0.876
3. Cloud-based tools (CBT)	6	0.863
4. Safety and protection of learning (SPL)	5	0.882
5. Tools for teaching in the classroom (TTC)	7	0.894
6. Care of the digital environment (CDE)	4	0.755
7. Open ICT (OICT)	3	0.696
8. ICT for information (ICTI)	4	0.740

To verify the viability of the 8 dimensions established by the EFA, a confirmatory factorial analysis (CFA) was performed with the "Maximum Likelihood" utilized as the method of estimation. It verified the existence of 8 factors and eliminated 3 items that had a score lower than 0.90, and which affected factors 2 and 4 (see Figure A1) [37].

To assess the goodness-of-fit of the model identified, the following were considered: a $\chi2$/degrees of freedom test, the comparative fit index, the incremental fit index and the normed fit index, the Tucker–Lewis index (TLI), the root mean residual (RMR), the root means square error or approximation (RMSEA) and the expected cross validation index (ECVI), with the following values found:

The set of indices provides adequate values ($\chi2$/df with values of 1.43, values lower than 0.06 in the case of the RMSEA and SRMR; and values higher than 0.90 for CFI, IFI, NFI and NNFI [32,33], which verifies the model of factors proposed and with it, guaranteeing the validity of the construct of the instrument (see Table 3).

Table 3. Adjustment index of the model.

	$\chi2$	df	p	$\chi2$/df	CFI	IFI	NFI	NNFI (TLI)	RMSEA	ECVI
Values	4063.4	1074	0.000	3.783	0.902	0.926	0.902	0.912	0.050	4.199

Sub-dimension 1, which referred to the methodology that the teacher uses in the classroom and that links to their perception and/or beliefs regarding the incorporation of technologies into the

classroom and to the evaluation of the student, included items such as "I know how to maintain a balanced attitude in the use of technology", "I have criteria to evaluate the reliability of the sources of information", or "I know how to combine digital technology with the analogical one for searching for solutions". The second one includes items that refer to the use of instruments to develop collaborative learning, the creation of videos, the gamification of the classroom or the creation of QR codes. The third dimension encompasses items that refer to the resolution of the management and storage in the cloud, while the fourth adds to them their safe use and the protection of the student and the educator during their use when learning. The fifth sub-dimension encompasses items such as availability of spaces for updating and teaching digital competence for the classroom, the digital identity, tending to diversity in the classroom, etc. The sixth covers aspects related to the care of the digital environment due to the use of digital tools. The last two sub-dimensions group items that refer to the knowledge of software such as the digital blackboard, open projects and resources in the case of the seventh sub-dimension, and as for the eighth, it is related to the knowledge about the availability of software for information and being informed. Lastly, it was verified that the α values followed the patterns established for the instrument as a whole.

2.4. Procedure

The study is based on a positivist paradigm, commonly used in quantitative research, and is explanatory in nature, given that it seeks to define the variables that are conditioned or related between each other [34]; more specifically, the use of the ICT by Chilean professors in their everyday tasks in the classroom. For this reason, a sample of university professor was selected, after asking for the necessary permissions from the legal officers, as specified in the ethical guidelines of research.

2.5. Statistical Analysis

The analysis of the data was quantitative, starting with a basic description of the variables (measured as the central tendency and dispersion); afterwards, a multivariate analysis was performed with multiple regression analysis. A general analysis was utilized to seek a model that explained the use of the ICT by Chilean university professors for teaching in their classrooms, and a more specific one related to other predictive elements that determine the sample, all of these were performed with the statistical program SPSS v.23.

3. Results

The initial analysis of the behavior of the items (see Table 4) indicated that the participating sample was inclined towards using the ICT a few times in the classroom, as well as in their professional development. However, it should be underlined that the professors indicated not using the following ICT very much in the process of teaching: tools such as gamification and podcasts in class, or the production and/or creation of QR codes, and the different licenses needed to publish content and Augmented Reality. On the other hand, it should be highlighted that the tools that were most utilized were those that referred to the creation of presentations on the curricular content as well as navigating the internet in search of information.

Table 4. Behavior of the sub-dimensions.

Sub-Dimension	Min.	Max.	M.	SD	Asymmetry	Kurtosis
1	1.0	7.0	77.1231	29.23128	0.019	−0.894
2	1.0	7.0	18.7143	9.82798	0.544	−0.668
3	1.0	7.0	28.6208	8.12846	−0.236	−0.718
4	1.0	7.0	19.7251	8.62445	0.040	−1.026
5	1.0	7.0	25.1500	10.64612	0.240	−0.799
6	1.0	7.0	16.5256	6.18462	−0.080	−0.793
7	1.0	7.0	8.6370	4.34478	0.661	−0.047
8	1.0	7.0	20.0422	4.34478	−0.518	−0.172

If we focus our attention on the professor's gender, we verify, with Student's t-test (see Table 5), that only two sub-dimensions showed differences, and that these were in favor of the men, so that it can be inferred that they have a greater use of the tools for the creation of learning and those linked to their safety online. Thus, the first hypothesis is rejected which stated that women used the ICT tools more.

Table 5. Student's t-test according to gender.

Dimension	Gender	n.	M.	SD	t	p	Cohen's D
2	Women	354	166497	9.14544	−4.992	0.000	−0.31
	Men	759	19.6772	9.99142			
4	Women	354	17.0395	8.13649	−7.394	0.000	−0.47
	Men	759	20.9776	8.56441			

On the other hand, to verify if there were significant differences as a function of years of teaching experience, an analysis of variance (ANOVA) was performed, which indicated that there were only differences in the third dimension [$F_{(6.1106}} = 2.388$, $p = 0.027$)] between the professors who had between 6 and 10 years of professional experience, and those with more than 30 years of experience [$t_{(1106)} = 3.32$, $p = 0.019$, $\eta^2 = 0.006$], while the multiple comparisons indicate that the other dimensions were not significant, as indicated by the Bonferroni values (see Table 6).

Table 6. ANOVA.

Dependent Variable	(I) 6.-Years of Experience in Teaching	(J) 6.-Years of Experience in Teaching	Mean Difference (I-J)		Typical Error		Sig.	95% Confidence Interval	
			Lower Limit		Upper Limit	Lower Limit		Upper Limit	Lower Limit
Dimension 3	Between 6 to 10 years	Less than 5	0.29654		0.69784		1.000	−1.8285	2.4215
		11 to15	1.15384		0.74373		1.000	−1.1109	3.4186
		16 to 20	1.38964		0.81030		1.000	−1.0778	3.8571
		21 to 25	1.72444		1.02762		1.000	−1.4048	4.8537
		26 to 30	0.39017		1.10147		1.000	−2.9639	3.7443
		+30	3.28701 (*)		0.98785		0.019	0.2789	6.2951

* = Two-tailed level of significance at 0.001.

As shown in Table 7, the sub-dimensions established by the EFA performed correlated between themselves with a level of significance of 0.001, which indicates a good relationship between the 54 items of the instrument.

Table 7. Correlational study.

		SD.1	SD.2	SD.3	SD.4	SD.5	SD.6	SD.7	SD.8
SD.1	R	1							
	P								
SD.2	R	0.837 (**)	1						
	P	0.000							
SD.3	R	0.723 (**)	0.685 (**)	1					
	P	0.000	.000						
SD.4	R	0.786 (**)	0.747 (**)	0.681 (**)	1				
	P	0.000	.000	.000					
SD.5	R	0.846 (**)	0.791 (**)	0.673 (**)	0.669 (**)	1			
	P	0.000	.000	.000	.000				
SD.6	R	0.814 (**)	0.683 (**)	0.613 (**)	0.641 (**)	0.733 (**)	1		
	P	0.000	0.000	0.000	0.000	0.000			
SD.7	R	0.625 (**)	0.649(**)	0.554 (**)	0.485 (**)	0.693 (**)	0.534 (**)	1	
	P	0.000	0.000	0.000	0.000	0.000	0.000		
D.8	R	0.682 (**)	0.585 (**)	0.701 (**)	0.559 (**)	0.671(**)	0.602 (**)	0.500 (**)	1
	P	0.000	0.000	0.000	0.000	0.000	0.000	0.000	

** = Two-tailed level of significance at 0.001; D = Dimension.

Lastly, to verify is there was an explanatory model for the use of the digital tools by the Chilean professors, a stepwise multiple linear regression was performed [F(1.1111) = 131.249, $p < 0.005$], with the variable that determined it being the methodology of attention to the student and the system of evaluation (constant/MAA), showing an adjusted level of determination of $R^2 = 0.07$ and a Durbin–Watson value of 1.957 (close to 2, which indicates the interdependence of the residues, [35,37,38]) (see Table 8).

Table 8. MAA linear regression.

	Variables	B	E. S	Beta	t	Sig.	Zero Order	Partial R	Semi-Partial R	Tolerance	VIF
M. 1	Constant	−0.033	0.026		−1.256	0.005					
	CMAD	0.084	0.030	0.085	2.833	0.005	0.085	0.085	0.085	1.000	1.000

This indicates that the equation that explains MAA = −0.033 + 0.084CDE, implies that the methodology of attention to the students and the system of evaluation used by the professors (MAA) is associated the care of the digital environment (CDE). The tests performed with the residues of this regression show that the values of VIF > 1.0 (see Table 7), indicating non-multicollinearity. Likewise, the homoscedasticity and the linearity of the residues observed in the figures comply with the assumptions [30]; and lastly, the application of the Kolmogorov–Smirnov normality test (Z = 1.576 and $p = 0.014$) to the residues verifies the existence of this linearity.

4. Discussion

The discussion should start with the premise that ICTs contribute to the improvement of the teaching-learning process, although it should not be assumed that their use per se will result in an improvement or substantial change in the final result of the teaching action [39]. Starting with this idea, it should be considered that this change goes hand in hand with the use of the digital resources by the professors. In light of this, it was verified that the Chilean university professors who participated in this study, in agreement with other works [17,29], need training on the use of ICT for their implementation in their classrooms, as the degree of training received for their use, as indicated by them, was low. This indicates that there is a demand for a training structure for the professional development of the educators in the digital arena [13,16,40].

In general, the Chilean professors consulted sometimes utilized ICT in their classrooms, which denotes a low use of the digital resources, as opposed to the works by [11,13,41], who pointed out the great deployment of the technological elements utilized by the professors in their classrooms.

It is significant that while some research studies report on the great use of digital tools [11]—mainly Augmented Reality [4,19,20], gamification [1–3], podcasts [11,42], and software use licenses [43]—in this study, the participants indicated using them very little, as compared to the presentation tools such as PowerPoint, Genially or Prezi, which the professors indicated using them very often. All of this could be due to the scarce digital training possessed by the professors, as indicated by them.

It is significant that the search for information online was one of the actions performed, just as the professors from other countries or institutions [11,39].

However, not all the educators thought the same. In this sense, the men were more inclined towards the development of digital methodologies and systems of evaluation, in contrast to the studies by [18,41], who indicated that women were more prone towards this. As a result, hypothesis 1 must be rejected (The women use the digital tools more as compared to the men), just as the results from the study by [26,27,43–47], and in contrast to the results found by [26,29,48,49] whose research determined this aspect as a possible creator of a gender digital divide [50]. In this sense, it should be indicated that the academic community does not seem to have reached a consensus about the variable gender, as shown by different studies conducted about the topic [26,29,44–49]. As a result, it is interesting to utilize this variable linked to the context.

Focusing on the years of professional experience of the professors (specific objective 2), it was found that the educators with 6–10 years of professional experience, considered to be young [51], were the ones who were more inclined towards the use of the tools that are available online to store information, such as Dropbox or Google Drive, as well as to create presentations by utilizing resources such as Genially, or to manage the monitoring of access through remote desktops [11,29,50], compared to those with greater teaching experience, who depend more on the traditional methodology [52]. In this case, hypothesis 2 is accepted just as in the works from [51,53], who pointed to a technical profile in the use of the ICT of the educators as a function of the years of professional experience.

Lastly, the study conducted, which aimed to determine which elements have an effect on the use of the ICT by Chilean professors (objective 3) has shown that a single element is responsible, which is none other than the methodology of attention and evaluation, which interacts directly with the caring for the digital environment. This element indicates that the use of the ICT by the Chilean university professors is linked with the methodology and the system of evaluation, and this is in turn affected by those methods or systems that are related to the digital environment, so that the professor's professional development occurs as a function of these variables [50].

As a result of this, we consider that a training strategy, the target population of which is the educator, should first of all relate the different tools with the diverse methodologies that the professors could use.

Various studies [50,52,54–58] have stated that the educators feel self-conscious due to a lack of technological skills and the fact that the students have a greater knowledge in this field, and as a result, a greater digital competence. For this, the presentation of teaching innovation experiences which show their viability is indispensable and necessary to be able to provide support and a response to the online digital training needs, in line with that proposed by [54,57]. On the other hand, the design of a training program will need the creation of a repository of digital resources bundled according to subjects and levels of difficulty.

5. Conclusions

The main conclusion of the present work is that Chilean university professors need pedagogical training on digital resources, which will allow for the development of their digital competence. Along this line, it should be indicated that the educators in general demand training, but afterwards there is a decrease in the number of educators that link their professional development with the demand of theoretical-practical training that will allow them to update their methodologies. The social and professional demand of today imply that the professors possess digital skills and competencies and are able to transform the knowledge transmitted to the students through the use of diverse digital resources.

On the other hand, it was verified that the university institutions are responsible for implementing a training program that allows the educators to place value on the pedagogic usefulness of said resources if they want to be at the forefront of higher education. In this sense, it established that the participating professors have a more technological view on the use of the ICT in the classroom as opposed to a pedagogical one, and this is reason why this variable should be utilized in the training processes implemented by the institutions.

We considered that the institutions are not experiencing great transformations in the field of the development of the educator's digital culture, and the fact that the growth is dependent on the will of the educators has resulted in the stagnation of the education centers.

For this, three aspects are vital as the pillars of education proposals: work methodologies linked to digital resources, an efficient system of evaluation with a digital format, and caring for the digital environment through the use of tools designed for this purpose. In conclusion, it is necessary to provide Chilean professors with an attractive education proposal that is not rooted in their willinginess to improve and that promotes the professor's initiative.

Conflicts of Interest: The authors declare no conflict of interest.
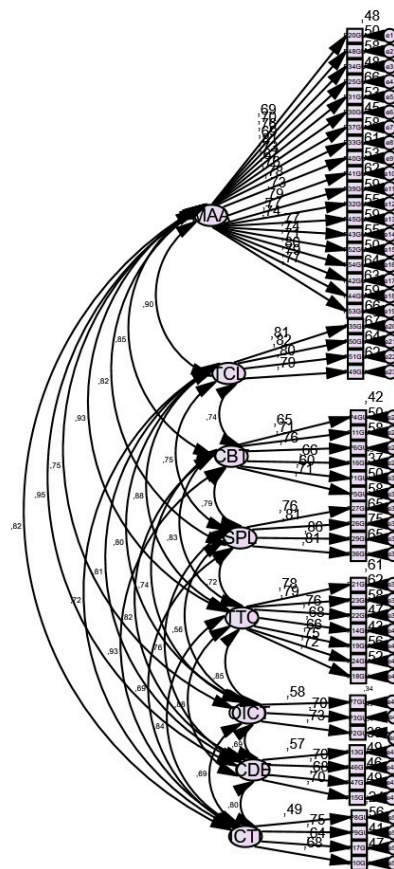
Appendix A

Figure A1. Eight-factor model. Confirmatory Factor Analysis.

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