Croatian Journal of Education
Vol.21; No.4/2019, pages: 1103-1131
Original research paper
Paper submitted: 30th May 2018
Paper accepted: 21st December 2018
https://doi.org/10.15516/cje.v21i4.3244

ICT and Functional Diversity in the University

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Abstract

Given the social need of progress in the use of information and communication technologies (ICT) applied to people with disabilities, the objective of this investigation is to verify the existence of significant differences in knowledge regarding ICT applied to the functional diversity (F.D.) on students in the Early Childhood Education Degree programme and Primary Education Degree programme, according to gender, course, title degree and if they have previously received training on ICT and functional diversity. To that end, we have used a sample of students from the University of Jaén (n= 440). In the analysis, we compared the means for independent samples (Student's t) and calculated the effect size (Cohen's d), along with a basic descriptive. The results show that, with a medium-low knowledge among the students, there are differences in favour of male students enrolled in the 3rd course who received specific training on the matter. We conclude that is essential to adopt measures in initial training to promote the qualification, knowledge and application of ICT to people with functional diversity due to the direct connection that exists between training level and applicability.

Keywords: *inclusive education; ICT; initial teacher education; technological resources; functional diversity.*

Introduction

For several decades, our society has been immersed in a technological revolution based on information, and therefore, in the use of Information and Communication Technologies (ICT); which have been gradually incorporated into the field of education (Marín, Vázquez, & McMullin, 2014). In the same way, we can affirm that the educational use and the attitude of teachers regarding the incorporation of ICT to their educational practice will be highly influenced by their training on those matters.

In this sense, the initial training received at the University is what will determine the inclusion of ICT by teachers into their teaching practice (Cabero and Guerra, 2011; Fernández, 2016; Fernández, Reyes & Homran, 2018; Molina, Pérez, and Antiñolo, 2012; Ramírez, Cañedo, & Clemente, 2012).

It is worth mentioning the shortage of studies in the university field focused on the analysis of technological competences (Cabero, Leal, Lucero, & Llorente, 2009; Duart, Gil, Pujol, & Castaño, 2008; Marín & Reche, 2012). Studies on the students' technological competences are limited, but there are even fewer studies whose aim is to determine students' knowledge of ICT applied to people with functional diversity.

In the last few years, there have been some studies highlighting the lack of training of teachers in order to teach ICT successfully, in connection with the attention to functional diversity people (Altinay & Altinay, 2015; Bryant, Erin, Lock, Allan, & Resta, 1998; Liu, 2012; Vladimirovna & Sergeevna, 2015; Yusof, Gnanamalar, Yun, & Kamarulzaman, 2014), an essential education to train the future, 21st-century teachers in the appropriate use of technologies in the classroom (Janssen & Lazonder, 2016) so as to guarantee that the outcome of the teaching-learning process of students with functional diversity is as satisfactory as possible.

Focusing on the objective of our study, Toledo and Llorente (2016) carried out an investigation with the aim to determine the level of training and technological knowledge that future primary education teachers have on the application of ICT to people with different types of disabilities. The students showed very little knowledge regarding the application of ICT to people with some kind of disability, and their knowledge varied depending on the type of need they presented, being their training and technological knowledge level higher regarding visual disabilities, followed by physical and hearing disabilities, and with very low training levels regarding cognitive disabilities. In the same way, it was proved that they hardly receive training during their academic training on how ICT could be used in the education of disabled students, whereas, although low, they received training on the design and universal accessibility for the educational application of ICT in this field.

In the research by Pegalajar (2015), the objective was to describe the attitudes of the students of *Early Childhood Education Degree* and *Primary Education Degree* towards the use of ICT in the development of inclusive internships. The research showed that future teachers have positive perceptions towards the didactic possibilities of these kinds of educational resources in the teaching-learning process of students with special educational needs, which contribute to the professional development and the inclusion of students. In this sense, Cabero, Fernández and Barroso (2016) present an investigation whose purpose is to identify the level of training and technological knowledge that the students of teaching degrees have regarding the application of ICT to people with functional diversity. Among the results obtained, the low qualification of the students regarding the application of ITC to people with functional diversity stands out, where male students showed more positive training perceptions than female students.

Fernández and Colmenero (2016) carried out a study with the purpose of determining how the teaching staff uses and integrates ICT in inclusive classrooms. The result shows that male teachers, in general, have a more positive attitude towards ICT and interact more frequently with them than female teachers. This will also promote inclusive policies among the school networks and appears as an important factor in the development of good educational practices supported by ICT.

In the study carried out by Sánchez, Andrés and Soriano (2014), the results show that, in general, both students and teachers have positive attitudes towards the use of technological resources for achieving the teaching-learning process of students with functional diversity, even though they would involve fundamental changes regarding the way of giving and receiving classes. Regarding the gender effect, traditionally it has been pointed out that male students have had a more positive attitude towards technology, but when applied to functional diversity, female students are shown to value them more positively.

In the same way, Suriá (2011) observes that teachers show a lack of training handling information and communication technologies and applying them in order to facilitate their educational integration, being that younger teachers are the ones who feel more prepared to apply ICT compared to senior teachers.

Similarly vein, the research conducted by Gutiérrez, Palacios, and Torrego (2010) reveals the impact of technology integration in the classroom, showing the lack of knowledge and attitudes, negative in many cases, towards getting used to ICT, concluding that is necessary to encourage the initial training of teachers to achieve a successful educational integration of ICT in basic education.

At the global level, investigations regarding teachers' training and qualification (Istenic, 2010; Wearmouth, Smith, & Soler, 2004; Winter & McGhie-Richmond, 2005), show the training needs that new teachers have in their interaction with senior teachers, and therefore the need to prepare future teachers to explore ICT as a learning facilitator which contributes to the change of teaching pedagogical practice.

In addition, the study carried out by Díez and Sánchez (2015) regarding the training of teachers dealing with diversity in the University, concludes that is necessary to train the teaching staff on the application of the universal design model to the learning process and on its advantages when providing the same opportunities to all students, regardless of their individual features.

Bearing these previous studies and investigations in mind, we consider appropriate to include descriptors that integrate the use of ICT for different types of disabilities in teaching degrees. The perfect subject to integrate knowledge and competencies acquired by students in their initial training is the *Prácticum*, as it is an essential connecting bridge between theory and practice (Zabalza, 2011). Thus, the conclusions of the research conducted by Mendoza and Covarrubias (2014) indicate that the main sources of orientation and help for students during the *Prácticum*, in order to acquire and develop professional competences, are the internship centres and collaborating

teachers. In this vein, Prada and Zuleta (2005) identified differences and examined attitudes during the *Prácticum* and how students managed to overcome them. The study revealed that constant thinking allows students to overcome difficulties and go beyond them.

All of the above raises a series of questions in this research such as the following:

1. What training do the students in the Prácticum of Early Childhood Education Degree and Primary Education Degree have regarding ICT applied to functional diversity?
2. What is the connection between students' training and technological knowledge and the different types of disabilities: visual, hearing, cognitive, or physical?
3. Are there any significant differences between the Early Childhood Education Degree and the Primary Education Degree regarding the technological knowledge applied to functional diversity?

The working hypothesis from which the research is developed states that there are significant differences regarding the knowledge of ICT applied to functional diversity (FD) on students of Early Childhood Education Degree and Primary Education Degree, according to gender, course of study, title degree and previous training on ICT and functional diversity.

Thus, we pose the objective of the study to analyse the knowledge of students from Early Childhood Education Degree and Primary Education Degree regarding the knowledge of ICT applied to functional diversity.

Method

Participants

The target population in the study consisted of 901 students enrolled during the academic year 2016/2017 in the *Prácticum* of *Early Childhood Education Degree* and *Primary Education Degree* of the University of Jaén (Spain). The non-probability sampling technique used is incidental; we have used a simple random probability sampling method to select the subjects so that all the subjects who agreed to answer to the questionnaires drawn up to that purpose were added to the sample (n = 440).

Of the sample of 440 students from the University of Jaén, 76.6 % were women and 23.4 % were men, attending the 3rd course (47.7 %) and 4th course (52.3 %) of the Early Childhood Education Degree (52 %) and Primary Education Degree (48 %).

During their studies, 43.2 % of the students received training on topics regarding the use of Information and Communication Technologies (ICT) applied to people with functional diversity, and 46.4 % received training about design and universal accessibility for the application of ICT to the teaching method. The subjects including topics regarding the use of ICT applied to people with functional diversity that provided more training to the surveyed students were School Organisation (39.9 %), Learning Resources With a Focus on Diversity (31 %) and Psycho-Pedagogic Bases of

Special Education (21.5 %). The subjects that provided more training to the surveyed students about the design and universal accessibility for the educational application of ICT were School Organisation (72.9 %) and Learning Resources With a Focus on Diversity (15.9 %). All the subjects where students received some kind of training can be found in Table 1.

Table 1

Percentage of students who have received training in any of the programme subjects on topics regarding the use of ICT applied to people with functional diversity or on the design and universal accessibility for the educational application of ICT.

Subject	ICT	Education
Learning Resources With a Focus on Diversity	31.0 %	15.9 %
Psycho-Pedagogic Bases of Special Education	21.5 %	1.2 %
School Organisation: Time, Space, Means, and Educational Resources	39.9 %	72.9 %
Multimedia in Pre-School and Primary Education	5.7 %	5.9 %
Integrated Projects and Innovation in the Areas of Primary Education	.6 %	0 %
Society, Family, and School	.6 %	0 %
Development Disorders and Learning Difficulties	1.3 %	0 %
Education Psychology	.6 %	0 %
Educational Processes in Primary Education	.6 %	.6 %
P.E. Didactics in Pre-School Education	0 %	.6 %
Computer Resources in Science Teaching	3.2 %	2.9 %
Integrated Projects and Innovation in the Areas of Primary Education	1.3 %	1.8 %
Psychological Aspects of Cognitive and Communication Difficulties	.6 %	.6 %
Elaboration and Assessment of ICT Materials for Pre-School Education	2.5 %	.6 %
Elaboration and Assessment of ICT Materials for Primary Education	0 %	.6 %
Inclusive Education	1.3 %	.6 %
Pedagogical Aspects of Physical and Sensory Difficulties	.6 %	0 %
Educational Processes and Contexts During Pre-School Education	0 %	.6 %
Family, Society, and Communication Networks	0 %	1.2 %

(1) training on topics regarding the use of ICT applied to people with disabilities.
(2) training on design and universal accessibility for the educational application of ICT.

Students consider that, during their studies, they have received more training related to the use of ICT than to its educational application. This way, they indicate to have received slightly more training on the use of AV and IT technologies applied to functional diversity ($\overline{X}$=6.61; SD=1.862) than on their use of and educational approach ($\overline{X}$=6.29; SD=1.899). In another respect, they also consider having more training on the technical operation of the Internet ($\overline{X}$=7.24; SD=1.804) than on its educational use ($\overline{X}$=6.76; SD=1.774). Nevertheless, they highly evaluated ICT as a supporting and necessary resource for people with disabilities ($\overline{X}$ = 8.08; SD = 1.806) (see *Table 2* and *Figure 1*).

Table 2

Self-assessment of the training that students have on ICT and the importance they give to it.

	Min.	Max.	M	$\overline{X}$	SD[2]	SEM[3]
Training on the technical use of ICT[1]	1	10	7	6.61	1.862	.089
Training for the use of ICT in education	1	10	7	6.29	1.899	.091
Training on the technical use of the Internet	1	10	8	7.24	1.804	.086
Training on the use of the Internet in education	1	10	7	6.76	1.774	.085
I consider ICT as a resource to support people with disabilities	1	10	8	8.08	1.806	.086

[1] Audiovisual and Computer Technology [2] Standard Deviation. [3] Standard Error of the Mean.

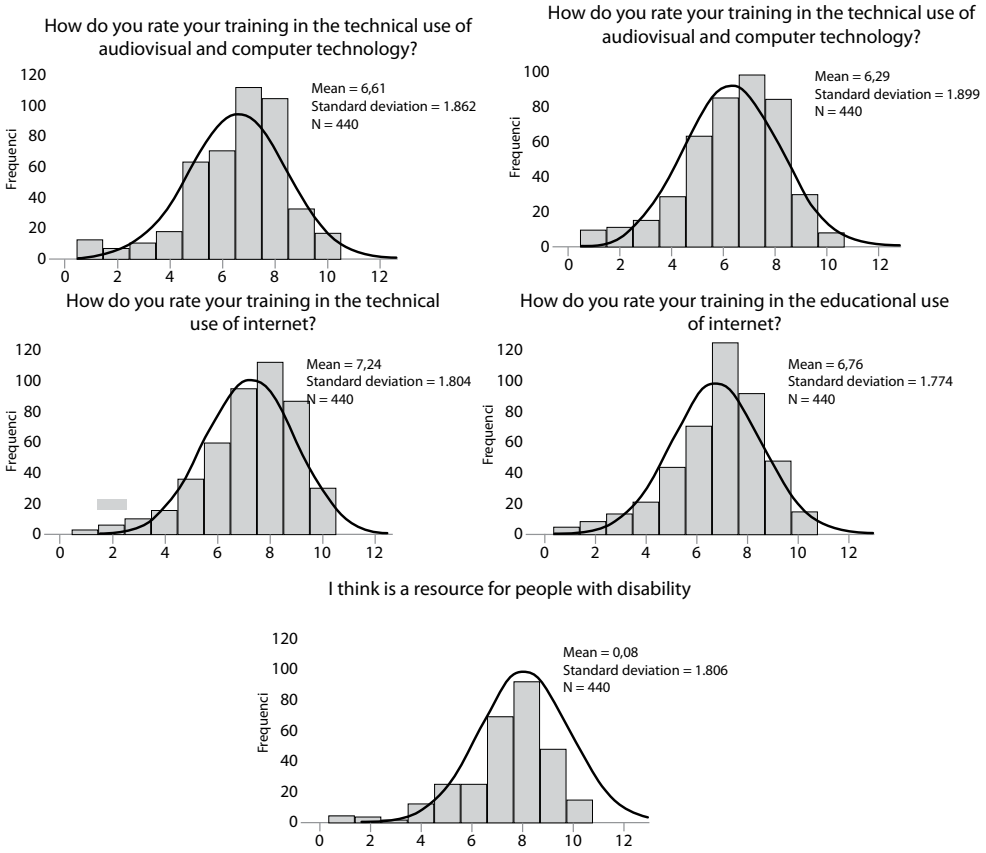

Figure 1. Distribution of the points obtained from students regarding training on ICT and its application with people with functional diversity.

Instrument

The instrument applied (adapted from Cabero, Fernández and Córdoba, 2016) called "Teaching degree student's technological knowledge on the use of Information and Communication Technologies (ICT) for people with disabilities" consists of two main sections: the first one comprises 12 items intended to collect information about different characteristics of the surveyed person (gender, degree, subjects attended, level of training) and the second one, which comprises 65 items to collect information on the general knowledge that students have regarding ICT applied, generally, to subjects with some type of disability, and of those, with specific disabilities (visual, hearing, cognitive, physical and regarding accessibility).

For every item, students were asked to score the importance granted on a 10-point scale, where 1 represented the incompetence of the student to perform the action presented, 5 a moderate competence to perform it, and 10 their efficacy to complete the action.

The validity of the content was assessed with the technique "Expert judgments" (Cabero, Fernández and Córdoba, 2016), obtaining average evaluations higher than value "4" (important), on a scale "from 1 to 5", where 1 represented "not important at all" and 5 "very important", which lead to decide not to eliminate any item (Cortada de Kohan, 1999).

The reliability of the instrument, analysed through the Cronbach's Alpha coefficient (O´Dwyer & Bernauer, 2014), is excellent with a global score of .99 -similar to the one obtained in the original questionnaire validation of Cabero, Fernández and Córdoba (2016) that was .992, and indicates an appropriate internal consistency of the scale (Mateo, 2004). In order to analyse the relation of every item with the total alpha internal coefficient reached, the correlation item-total was obtained of the whole instrument to know if the elimination of some items would increase the instrument's reliability index. That consistency would not improve when eliminating any formulated item, resulting in the same measure as in the global test. At the same time, indicate that the indexes for every dimension (disabilities) were also very high (General Aspects: .91; Visual D.: .89; Hearing D.: .95; Physical D.: .79; Cognitive D.: .83; Accessibility: .89).

The sampling adequacy Kaiser-Meyer-Olkin (.982) and Barlett's sphericity test ($\chi 2$ =31989.60; gl=2080; p<.001) indicate that the conditions to perform the factor analysis are met. Applying the principal component extraction method and the varimax rotation method with Kaiser normalization, the results of the analysis point out a better adjustment to the data with six factors, which explains the 78.050 % of the total variance (Table 3). The sedimentation graph can be found in Figure 2.

Table 3

Total Variance Explained.

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	43.501	66.924	66.924	43.501	66.924	66.924	13.810	21.246	21.246
2	2.267	3.487	70.411	2.267	3.487	70.411	12.743	19.604	40.851
3	1.681	2.586	72.998	1.681	2.586	72.998	10.026	15.424	56.275
4	1.258	1.935	74.933	1.258	1.935	74.933	8.632	13.279	69.554
5	1.023	1.574	76.507	1.023	1.574	76.507	3.272	5.033	74.587
6	1.003	1.543	78.050	1.003	1.543	78.050	2.251	3.463	78.050

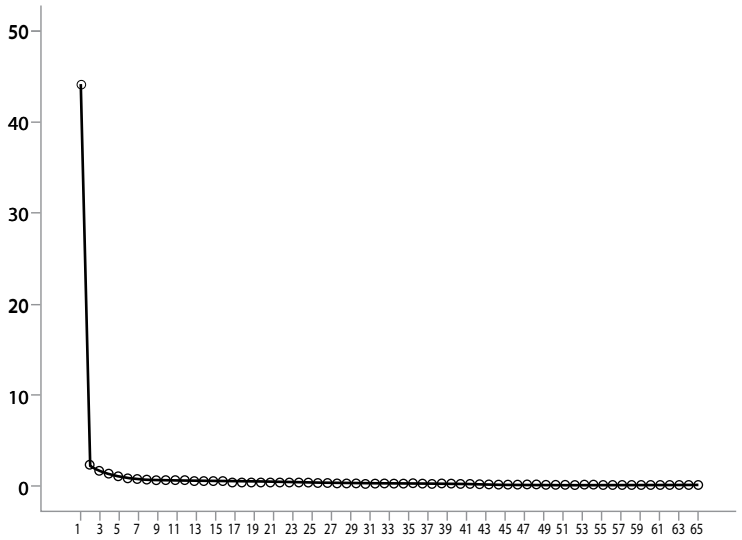

Figure 2. Sedimentation graph

With the aim to empirically examine if the structure obtained from the exploratory factor analysis (EFA) fits the gathered data, which in the end was different from the theory of the questionnaire, the model was put to the test through a confirmatory factor analysis (CFA) applying the maximum likelihood method.

The results show that the model presents an acceptable fit, although improvable, according to the goodness of fit indexes (Hair, Black, Babin, & Anderson, 2009). That is, if the values corresponding to the model's goodness of fit indicators are within the limit close to the model's acceptable fit, these indicate a value that represents a high fit ($\chi^2_{(1942,\ N=440)}$=7267.237, p=.000; χ^2/g.l.=3.74; CFI=.834; SRMR=.041; y NFI=.787), with the exception of the Root Mean Square Error of Approximation which shows a good fit (RMSEA=.087). The obtained model's fit indexes and the recommended values are shown in Table 4.

Table 4

Fit indexes obtained from the model and the reference model.

Fit measures	Values of the proposed model	Good fit	Acceptable fit
Chi-squared model[1]	χ^2 (1942, N=440) = 7267.237 p = .000	0≤χ^2≤2g.l. .05<p ≤1.00	2g.l.≤χ^2≤3g.l. .01<p ≤.05
χ^2/g.l.	χ^2/g.l.= 3.74	0≤ χ^2/g.l.≤2	2≤ χ^2/g.l.≤3
Comparative Fit Index	CFI = .834	.97≤CFI≤1.00	.95≤CFI≤.97
Root Mean Square Error of Approximation Index	CFI = .087 p = .90	0≤RMSEA≤.05 .10≤p≤1.00	.05≤RMSEA≤.08 .05≤p≤.10
Square Root Mean Square Residual	SRMR = .041	0≤SRMR≤.05	.05≤SRMR≤.10
Normed Fit Index	NFI = .787	.95≤NFI≤1.00	.90≤NFI≤.95
Kaike Information Criterion	AIC =7543.237	The highest of the comparisons made.	
Bayesian Information Criterion	BIC = -4163.577	The highest of the comparisons made.	

Procedure

The instrument was administered online to students in the *Practicum* during the first semester of the 2016/2017 academic year. The purpose of the study and data confidentiality was explained with an introductory letter with the link to the questionnaire attached.

Data analysis

A descriptive analysis of the independent variables was carried out, in particular, of the basic statistical data, mode, median, mean, standard deviation, standard error of the mean, as well as the minimum and maximum values of the scores obtained by the participants.

Assuming the normality of the distributions (Martínez, Sánchez, Toledo and Faulin, 2014) and their independence, the Student' t-distribution for independent samples was applied. With this, we analysed if there were significant differences between students' answers depending on the gender, course (3rd and 4th), degree (*Early Childhood Education Degree* or *Primary Education Degree*) if they had received training on the use of ICT applied to people with functional diversity, and information on the design and universal accessibility for the educational application of ICT in the course of their studies. To complete the information, we also calculated *Cohen's d* (1988) in order to find out the effect size of the differences found.

In terms of software, we used R for the calculation of EFA and CFA, and SPSS.22 for the descriptive analysis and hypothesis testing.

Results

Among the possible values that students can score in total from the questionnaire (65-650), the mean is set in 287.90 (SD=137.45), 65 being the most selected value, (see *Figure 3*). If, as a reference, the point in between the minimum and maximum possible values in the questionnaire (325) was taken, we could say that the competence level on ICT and functional diversity is medium-low. In the same way, we can also say that the level that students present in different dimensions of the questionnaire is medium-low (see table 5).

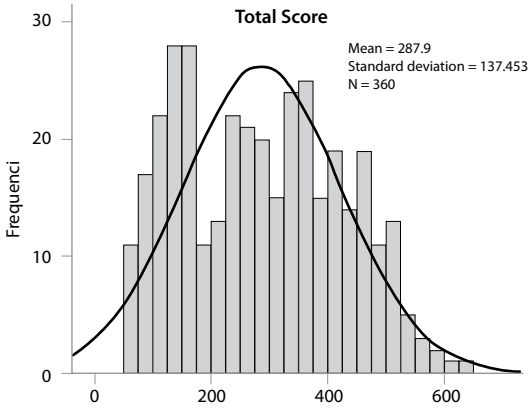

Figure 3. Distribution of the scores obtained from the students in the whole questionnaire.

Table 5

Markers corresponding to the questionnaire dimensions.

Factor	N	M_o	M_d	$\overline{X}$	SD	SEM	Min-Max Sample[(1)]	Min-Max. Quest.[(2)]	Interm. Point[(3)]
General aspects	416	45	70	70.54	30.66	1.50	15-150	15-150	75
Visual D.	416	15	66	65.05	33.32	1.63	15-146	15-150	75
Hearing D.	423	7	31	31.46	15.09	.73	7-70	7-70	35
Physical D.	417	11	49	49.74	24.29	1.19	11-105	11-110	55
Cognitive D.	430	4	16	17.11	9.47	.46	4-40	4-40	20
Accessibility	407	13	52	54.36	28.59	1.42	13-130	13-130	65
Total	360	65	285.5	287.9	137.45	7.24	65-635	65-650	325

(1) Minimum and maximum values given by the students.
(2) Minimum and maximum possible values given by the students.
(3) Intermediate value of possible scores in the questionnaire.

In particular, the mean in general aspects related with ICT and functional diversity is 70.54 (SD=30.66), 65.05 (SD=33.32) in visual disability, 31.46 (SD.=15.09) in hearing disability, 49.74 (SD.=24.29) in physical disability, 17.11 (SD=9.47) in cognitive disability and 54.36 (SD=28.59) in accessibility. In another respect, the most selected value in general aspects related with ICT and disability is 45 (min=15; Max=150), in

visual disability 15 (min=15; Max=150), in hearing disability 7 (min=7; Max=70), in physical disability 11 (min=11; Max=110), in cognitive disability 4 (min=4; Max=40) and in accessibility 13 (min=13; Max=130).

Differences found in students according to gender. Male students show more knowledge ($\overline{X}$=54.76; SD=21.88) than female students ($\overline{X}$=48.26; SD=24.79) in physical disability ($t_{(2,415)}$=-2.306; p<.05), with a small effect size (d=-.22). In the same way, the group of male students show a higher score ($\overline{X}$=60.20; SD=26.14) than female students in accessibility ($\overline{X}$=52.67; SD=29.07), showing a statistically significant difference ($t_{(2,159.72)}$= -2.361; p<.05), with a small effect size as well (d=-.37) (see table 6).

Table 6

Differences found in students according to gender.

Factor	Gen.	N	$\overline{X}$	SD	SEM	t	df	p	$\overline{X}_1$-$\overline{X}_2$	DSE	d
General aspects	F	321	68.98	31.25	1.74	-1.916	414	.056	-6.83	3.56	-.23
	M	95	75.82	28.07	2.88						
Visual D.	F	321	64.32	33.99	1.89	-.814	414	.416	-3.17	3.89	-.08
	M	95	67.49	30.95	3.17						
Hearing D.	F	327	31.00	15.19	.84	-1.141	421	.255	-1.99	1.75	-.11
	M	96	33.00	14.69	1.49						
Physical D.	F	322	48.26	24.79	1.38	-2.306	415	.022	-6.50	2.82	-.22
	M	95	54.76	21.88	2.24						
Cognitive D.	F	330	16.70	9.50	.52	-1.613	428	.107	-1.74	1.07	-.15
	M	100	18.45	9.27	.92						
Accessibility(1)	F	316	52.67	29.07	1.63	-2.361	159.72	.019	-7.53	3.19	-.37
	M	91	60.20	26.14	2.74						

Gen. = Gender; F = Female; M = Male; SD = Standard Deviation; SEM = Standard Error of the Mean; t = Student's t-distribution for independent samples; df = degrees of freedom; p = significance level; X_1-X_2 = difference of means; DSE = differences of standard error; d = Cohen's d.

(1) Equal variances are not accepted.

Differences found in students according to course. Students attending the 3rd course show, in general, higher scores than 4th course students, always with a small effect size in general aspects, physical disability, cognitive disability and accessibility. In the case of general aspects, the mean in the 3rd course is 74.54 (SD=27.79) and in the 4th course is 66.91 (SD=32.69), being statistically significant ($t_{(2,412.22)}$=2.571; p<.05; d=.25). That difference decreases in physical disability ($t_{(2,413.19)}$=3.319; p<.01; d=.33), whose mean among the students of the 3rd course is 53.83 (SD=21.70) and 46.09 (SD=25.91) among the students of the 4th course (see table 7).

Table 7
Differences found in students according to course (3rd and 4th).

Factor	Course	N	$\overline{X}$	SD	SEM	t	df	*p*	$\overline{X}_1$-$\overline{X}_2$	DSE	*d*
General aspects(1)	3rd	198	74.54	27.79	1.97	2.571	412.22	.010	7.63	2.97	.25
	4th	218	66.91	32.69	2.21						
Visual D.(1)	3rd	196	67.60	30.26	2.16	1.489	412.94	.137	4.82	3.24	.15
	4th	220	62.78	35.74	2.41						
Hearing D.(1)	3rd	201	32.42	13.97	.98	1.263	420.42	.207	1.84	1.46	.12
	4th	222	30.58	16.01	1.07						
Physical D.(1)	3rd	197	53.83	21.70	1.55	3.319	413.19	.001	7.74	2.33	.33
	4th	220	46.09	25.91	1.75						
Cognitive D.(1)	3rd	205	18.12	8.76	.61	2.117	427.29	.035	1.92	.90	.20
	4th	225	16.20	10.01	.67						
Accessibility(1)	3rd	193	58.86	25.86	1.86	3.073	403.75	.002	8.56	2.79	.30
	4th	214	50.30	30.33	2.07						

SD = Standard Deviation; SEM = Standard Error of the Mean; t = Student's t-distribution for independent samples; df = degrees of freedom; *p* = significance level; X_1-X_2 = difference of means; DSE = differences of standard error; *d* = Cohen's d.
(1) Equal variances are not accepted.

Even though the difference decreases considerably in cognitive disability ($t_{(2,427.29)}$=2.117; *p*<.05; *d*=.20), the mean among the students of the 3rd course is still higher ($\overline{X}$=18.12; SD=8.76) than of those of 4th course ($\overline{X}$=16.20; SD=10.01). Nevertheless, the difference between courses increases again in accessibility ($t_{(2,403.75)}$= 3.073; *p*<.01; *d*=.30), in favour of the 3rd course ($\overline{X}$=58.86; SD=25.86) compared with the 4th course ($\overline{X}$=50.30; SD=30.33).

Differences found in students according to the degree. We only found significant differences in physical disability ($t_{(2,409.18)}$=-2.133; *p*<.05; *d*=-.21) between students of *Primary Education Degree* ($\overline{X}$=52.38; SD=21.13) compared with students of *Early Childhood Education Degree* ($\overline{X}$=47.38; SD=26.63) (see table 8).

Table 8
Differences found in students according to the degree (Early Childhood Education Degree and Primary Education Degree).

Factor	D.	N	$\overline{X}$	SD	SEM	t	df	*p*	$\overline{X}_1$-$\overline{X}_2$	DSE	*d*
General aspects(1)	DI	217	68.29	33.37	2.26	-1.578	408.66	.115	-4.70	2.97	-.16
	DP	199	72.99	27.26	1.93						
Visual D.(1)	DI	219	64.31	36.21	2.44	-.477	410.93	.633	-1.55	3.24	-.05
	DP	197	65.86	29.84	2.12						
Hearing D.(1)	DI	222	31.13	16.11	1.08	-.470	419.99	.639	-.68	1.45	-.04
	DP	201	31.81	13.89	.97						
Physical D.(1)	DI	220	47.38	26.63	1.79	-2.133	409.18	.034	-5.00	2.34	-.21
	DP	197	52.38	21.13	1.50						
Cognitive D.(1)	DI	225	16.67	10.26	.68	-1.035	424.35	.301	-.94	.90	-.10
	DP	205	17.60	8.51	.59						
Accessibility(1)	DI	214	51.88	31.09	2.12	-1.865	400.90	.063	-5.22	2.79	-.19
	DP	193	57.10	25.31	1.82						

D. = degree; DI = Early Childhood Education Degree; DP = Primary Education Degree; SD = Standard Deviation; SEM = Standard Error of the Mean; t = Student's t-distribution for independent samples; df = degrees of freedom; p = significance level; X_1-X_2 = difference of means; DSE = differences of standard error; d = Cohen's d.
(1) Equal variances are not accepted.

Differences found in students depending on the reception of formation on the use of ICT applied to people with functional diversity, in the course of their studies. As it was expected, we found significant differences in all the questionnaire dimensions in favour of, in all cases, students who received formation on topics regarding the use of ICT applied to people with functional diversity, with a big effect size, with the exception of hearing disability and accessibility, where the effect size was medium (see table 9).

Table 9

Differences found in students depending on the reception of formation on the use of ICT applied to people with disabilities.

Factor	ICT	N	$\overline{X}$	SD	SEM	t	df	*p*	$\overline{X}_1$-$\overline{X}_2$	DSE	*d*
General aspects	Yes	179	85.54	26.77	2.00	9.571	414	.000	26.32	2.75	.94
	No	237	59.21	28.50	1.85						
Visual D.	Yes	180	81.35	30.14	2.24	9.635	414	.000	28.74	2.98	.95
	No	236	52.61	30.15	1.96						
Hearing D.	Yes	184	36.88	14.19	1.04	6.830	421	.000	9.60	1.40	.66
	No	239	27.28	14.43	.93						
Physical D.	Yes	179	60.93	22.43	1.67	8.889	415	.000	19.60	2.20	.87
	No	238	41.33	22.18	1.43						
Cognitive D.	Yes	186	21.12	9.15	.67	8.239	428	.000	7.07	.85	.80
	No	244	14.06	8.53	.54						
Accessibility	Yes	171	66.37	26.86	2.05	7.717	405	.000	20.71	2.68	.77
	No	236	45.66	26.62	1.73						

ICT = reception of formation on ICT; SD = Standard Deviation; SEM = Standard Error of the Mean; t = Student's t-distribution for independent samples; df = degrees of freedom; *p* = significance level; X_1-X_2 = difference of means; DSE = differences of standard error; *d* = Cohen's d.

In particular, the biggest difference is found in general aspects ($t_{(2,414)}$=9.571; p<.001; d=.94) and in visual disability ($t_{(2,414)}$=9.635; p<.001; d=.95). In the first case, the mean of the group who received the formation is 85.54 (SD=26.77) and the mean of the group who did not is 59.21 (SD=28.50), in the second case, the mean of the group who received the formation is 81.35 (SD=30.14) and of the group who did not is 52.61 (SD=30.15).

Those differences decrease significantly in accessibility ($t_{(2,405)}$=7.717; p<.001; d=.77) and in physical disability ($t_{(2,415)}$=8.889; p<.001; d=.87). In the first case, the mean of the group who received the formation is 66.37 (SD=26.86) and the mean of the group who did not is 45.66 (SD=26.62), in the second case, the mean of the group who received the formation is 60.93 (SD=22.43) and of the group who did not is 41.33 (SD=22.18). Finally, the slightest difference between the scores is found in hearing disability ($t_{(2,421)}$=6.830; p<.001; d=.66) and in cognitive disability ($t_{(2,428)}$=8.239; p<.001; d=.80). In the case of the hearing disability, the mean of the group who received the formation is 36.88 (SD=14.19) and the mean of the group who did not is 27.28 (SD=14.43), in

the second case, the mean of the group who received the formation is 21.12 (SD=9.15) and of the group who did not is 14.06 (SD=8.53).

Differences found in students depending on the reception of information on the design and universal accessibility for the educational application of ICT in the course of their studies. Data shows that there are significant differences in all of the questionnaire dimensions, with the exception of hearing disability, in favour of students who received formation on the design and universal accessibility for the educational application of ICT, being the effect size small in all cases (see *table 10*). The biggest differences are found in visual disability ($t_{(2,414)}$= 2.673; p<.01; d=.26), accessibility ($t_{(2,405)}$= 2.618; p<.01; d=.26) and general aspects ($t_{(2,414)}$= 2.406; p<.05; d=.24). In the first case, the mean of the group who received the formation is 69.73 (SD=33.19) and the mean of the group who did not is 61.03 (SD=32.97); in the second case, the mean of the group who received the formation is 58.35 (SD=27.39) compared with the mean of the group who did not which is 50.96 (SD=29.19); and in the third case, the mean of the group who received formation is 74.43 (SD=29.88) and 67.21 of the group who did not (SD=30.98).

Table 10
Differences found in students depending on the reception of formation on the design and universal accessibility for the educational application of ICT.

Factor	ICT	N	$\overline{X}$	SD	SEM	t	df	p	$\overline{X}_1$-$\overline{X}_2$	DSE	d
General aspects	Yes	192	74.43	29.88	2.15	2.406	414	.017	7.21	2.99	.24
	No	224	67.21	30.98	2.07						
Visual D.	Yes	192	69.73	33.19	2.39	2.673	414	.008	8.69	3.25	.26
	No	224	61.03	32.97	2.20						
Hearing D.	Yes	192	32.87	14.43	1.04	1.768	421	.078	2.60	1.47	.17
	No	231	30.28	15.54	1.02						
Physical D.	Yes	196	52.98	23.48	1.67	2.579	415	.010	6.11	2.37	.25
	No	221	46.87	24.69	1.66						
Cognitive D.	Yes	201	18.36	9.26	.65	2.568	428	.011	2.34	.91	.25
	No	229	16.02	9.53	.63						
Accessibility	Yes	187	58.35	27.39	2.00	2.618	405	.009	7.39	2.82	.26
	No	220	50.96	29.19	1.96						

ICT = reception of formation on ICT; SD = Standard Deviation; SEM = Standard Error of the Mean; t = Student's t-distribution for independent samples; df = degrees of freedom; p = significance level; X_1-X_2 = difference of means; DSE = differences of standard error; d = Cohen's d.

Regarding physical disability, the differences decrease even more ($t_{(2,415)}$=2.579; p<.05; d=.25), showing a higher score for the trained students ($\overline{X}$=52.98; SD=23.48) than for those who were not informed ($\overline{X}$=46.87; SD=24.69). In the case of cognitive disability, the difference is much more pronounced ($t_{(2,428)}$=2.568; p<.05; d=.25), resulting in a small difference between informed and uninformed students, the mean of trained students being higher ($\overline{X}$=18.36; SD=9.26) than the mean of those who were not trained ($\overline{X}$=16.02; SD=9.53).

Conclusions

As mentioned earlier, the principal objective of this study was to analyse the knowledge of students in the *Early Childhood Education Degree* programme and *Primary Education Degree programme* regarding the general application of ICT to subjects with some kind of disability, as well as regarding the accessibility. Therefore, if we understand the obtained data according to the dependent variables studied (training on ICT applied to functional diversity) and considering the results, this research concludes that, in general, students show qualification and training of medium-low level regarding the application of ICT to people with functional diversity. In the same way, in the different study programmes there are subjects that train for ICT skills and competences, showing their students high knowledge levels on general aspects, visual disability and accessibility.

This leads to the conclusion that higher education students need to know how to use educational software in order to work with diversity and, therefore, teachers need to have ICT knowledge to take care of any kind of disability that may be present in the classroom (Soto, 2008; Toledo & Llorente, 2016). It is necessary that future teachers become aware that ICT needs to be accessible because it contributes to better education and social understanding for all of us (Toledo, 2008; Toledo & Llorente, 2016).

By applying contrastive analysis for the different independent variables present in the study and, beginning with the gender, as it has been pointed out in other studies (Cabero, Fernández, & Barroso, 2016), we can observe that the biggest differences between men and women are found in physical disability and accessibility. In both cases, as in the rest of the dimensions that make up the instrument, the score is higher and more significant among men than among women.

Regarding the course, we have reached similar conclusions as Toledo and Llorente (2016), i.e., that students attending the 3rd year generally achieve higher scores than students in the 4th year, as in this final year, where more ICT and functional diversity subjects are offered, the most significant differences in general aspects, physical disability, cognitive disability and accessibility dimensions are found.

The research also showed that the knowledge that students have regarding the application of ICT to people with functional diversity depends on the degree they are attending, where students in the Primary Education Degree program show a higher level of knowledge compared to students from the Early Childhood Education Degree programme, although we only found significant differences regarding physical disability.

In the same way, to answer the question of whether there is a connection between technical knowledge and the different types of disability or not, as it was expected, we found significant differences in all of the questionnaire dimensions, in favour of, in all cases, the students who received training on topics regarding the use of ICT applied to people with disabilities. As in other investigations, we agree with them regarding the highest and lowest levels of training and technical knowledge (Toledo & Llorente, 2016). In particular, in our investigation, the highest levels of training were found in

general aspects and visual disabilities, followed by accessibility and physical disabilities whereas the lowest levels of training were found in hearing and cognitive disabilities.

As we have seen in this study, there is a significant relationship between all the questionnaire dimensions, with the exception of hearing disabilities, in favour of students who did receive training on the design and universal accessibility for the educational application of ICT, as a result of the importance that is being given to the use of ICT by people with some kind of disability (Gargiulo & Metcalf, 2011; Toledo, Sánchez & Gutiérrez, 2013; Torres, 2007). In our case, the biggest differences are found in visual disability and accessibility. In the case of physical disability, differences decrease even more, showing a higher score for students who were trained compared with those who were not. Finally, there is little difference between trained students and not informed regarding cognitive disability.

The findings of this study make us think of the need of future teachers to consider ICT and diversity from a holistic point of view, where training and its application can be acquired in both institutional or students' informal contexts. We should emphasize the importance of future teachers' knowledge and higher education study programmes because of the direct connection between a higher level of training and its applicability. For all of this, we share the opinion of Cabero, Fernández and Barroso (2016) that it is necessary to adopt measures in the initial training of the programmes of Early Childhood Education and Primary Education in order to promote, in addition to resources, the qualification and application of ICT to people with different types of disability, especially considering that schools are becoming increasingly more technological and diverse.

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IKT i raznolikost funkcionalnih poteškoća na sveučilištu

Sažetak

S obzirom na potrebu za napretkom u korištenju informacijske i komunikacijske tehnologije (IKT) kod osoba s teškoćama, cilj ovoga istraživanja je potvrditi postojanje značajnih razlika vezanih uz IKT koja se primjenjuje u radu s osobama s funkcionalnim teškoćama u konkretnom slučaju kod studenata u programu Rani odgoj i obrazovanje te kod studenata u programu Primarno obrazovanje s obzirom na spol, godinu studija, program studija te s obzirom na prijašnje osposobljavanje u području IKT-a i funkcionalne raznolikosti. U tu svrhu, uzorak ispitanika činili su studenti na Sveučilištu Jaén (n= 440). U analizi smo usporedili srednje vrijednosti nezavisnih uzoraka (Student t) te smo izračunali veličinu učinka (Cohenov d), s osnovnim deskriptivom. Rezultati pokazuju da kod srednje-slabijega znanja studenata postoje razlike u korist studenata upisanih u treću godinu i koji imaju specifičnu obuku iz toga područja. Zaključujemo da je neophodno unijeti promjene u inicijalnom obrazovanju učitelja da bi se promicala osposobljenost, znanje i primjena IKT-a kod osoba s funkcionalnom poteškoćom zbog izravne povezanosti koja postoji između razine osposobljavanja i primjene.

Ključne riječi: *funkcionalna raznolikost; IKT; inkluzivno obrazovanje; inicijalno obrazovanje učitelja; tehnološki resursi.*

Uvod

Već nekoliko desetljeća naše je društvo uronjeno u tehnološku revoluciju zasnovanu na informacijama odnosno na korištenju informacijskih i komunikacijskih tehnologija (IKT) koje su postupno uvrštene i u područje obrazovanja (Marín, Vázquez, & McMullin, 2014). Na isti način možemo potvrditi da je korištenje IKT-a u obrazovanju i stav učitelja vezan uz IKT u obrazovnoj praksi pod vrlo visokim utjecajem njihove razine osposobljenosti za ta pitanja. U tom smislu, inicijalno obrazovanje učitelja na Sveučilištu je ono koje će odrediti učiteljevo uključivanje IKT-a u nastavnu praksu (Cabero & Guerra, 2011; Fernández, 2016; Fernández, Reyes & Homran, 2018; Molina, Pérez, & Antiñolo, 2012; Ramírez, Cañedo, & Clemente, 2012).

Vrijedno je spomena da u visokom obrazovanju nedostaju istraživanja koja se bave analizom tehnoloških kompetencija (Cabero, Leal, Lucero, & Llorente, 2009; Duart, Gil,

Pujol, & Castaño, 2008; Marín & Reche, 2012). Istraživanja o tehnološkim kompetencijama studenata su ograničena, no čak je manje istraživanja čiji je cilj odrediti znanje IKT-a koje studenti imaju u radu s osobama smanjene funkcionalne sposobnosti.

Posljednjih nekoliko godina nailazimo na istraživanja koja upozoravaju na nedostatak osposobljavanja učitelja za učinkovitim poučavanjem IKT-a, a usko povezano s osobama s različitim funkcionalnim poteškoćama (Altinay & Altinay, 2015; Bryant, Erin, Lock, Allan, & Resta, 1998; Liu, 2012; Vladimirovna & Sergeevna, 2015; Yusof, Gnanamalar, Yun, & Kamarulzaman, 2014). Upravo je učinkovito korištenje tehnologija u razredu (Janssen & Lazonder, 2016) ključno za osposobljavanje učitelja 21. stoljeća kako bi se osiguralo da ishod procesa poučavanja-učenja studenata smanjene funkcionalne sposobnosti bude na što višoj razini.

Fokusirajući se na cilj ovoga istraživanja, Toledo i Llorente (2016) proveli su istraživanje s ciljem određivanja razine osposobljenosti i tehnološkoga znanja budućih učitelja primarnoga obrazovanja s obzirom na primjenu IKT-a u radu s osobama različitih funkcionalnih teškoća. Studenti su pokazali vrlo nisko znanje vezano uz primjenu IKT-a u radu s osobama s nekim oblikom invalidnosti, a njihovo znanje razlikovalo se ovisno o vrsti potrebe koju su prikazali, o njihovoj osposobljenosti, s time da je njihova osposobljenost i tehnološko znanje bilo veće u području slabovidnosti, zatim kod fizičkih invalidnosti te kod oštećenja sluha. Vrlo niska razina osposobljenosti bila je za kognitivne invalidnosti. Također je potvrđeno da je osposobljavanje tijekom akademskoga školovanja o tome kako se IKT može koristiti u obrazovanju studenata s funkcionalnim teškoćama vrlo slabo. Iako na nižoj razini, studenti su ipak dobili saznanja o kreiranju i univerzalnoj dostupnosti primjene IKT-a u obrazovne svrhe u tome području.

U istraživanju koje je proveo Pegalajar (2015), cilj je bio opisati stavove studenata u studijskom programu Rani i predškolski odgoj i obrazovanje te u programu Primarno obrazovanje o korištenju IKT-a o razvoju inkluzivnoga stažiranja. Istraživanje je pokazalo da ove vrste obrazovnih resursa u procesu poučavanja-učenja studenata s teškoćama doprinose profesionalnom razvoju i inkluziji studenata. U tom smislu, Cabero, Fernández i Barroso (2016) prikazali su istraživanje čija je svrha bila identificirati razinu osposobljenosti i tehnološkoga znanja koje studenti – budući učitelji imaju vezano uz primjenu IKT-a s osobama smanjene funkcionalne sposobnosti. Iz dobivenih rezultat ističe se niska razina znanja studenata o primjeni IKT-a s osobama smanjene funkcionalne sposobnosti, pri čemu studenti imaju pozitivniju percepciju osposobljavanja od studentica.

Fernández i Colmenero (2016) proveli su istraživanje s ciljem određivanja načina na koji nastavnici koriste i integriraju IKT u inkluzivnim razredima. Rezultati su pokazali da učitelji općenito imaju pozitivnije stavove prema IKT-u te su češće u interakciji s IKT-om nego učiteljice. To također potiče inkluzivnu politiku među školskim mrežama te se čini kao važan čimbenik u razvoju dobre obrazovne prakse koju podupire IKT.

U istraživanju koje su proveli Sánchez, Andrés i Soriano (2014), rezultati su pokazali da, općenito, i studenti i učitelji imaju pozitivne stavove prema korištenju tehnologije u procesu poučavanja-učenja studenata smanjene funkcionalne sposobnosti, čak i s

obzirom na to da bi to podrazumijevalo temeljne promjene u načinu učenja i poučavanja. S obzirom na spol, tradicionalno se naglašava da studenti imaju pozitivnije stavove prema tehnologiji od studentica, no kada je riječ o primjeni kod osoba smanjene funkcionalne sposobnosti, studentice pokazuju pozitivniji stav od studenata.

Na isti način, Suriá (2011) donosi podatke da nastavnici pokazuju manjak osposobljenosti u primjeni informacijskih i komunikacijskih tehnologija i kako bi pospješili obrazovnu integraciju, s time da se mlađi nastavnici osjećaju spremniji primijeniti IKT u odnosu na starije nastavnike.

Nadalje, istraživanje koje su proveli Gutiérrez, Palacios, i Torrego (2010) otkriva utjecaj integracije tehnologije u razredu i ukazuje na nedostatak znanja te uglavnom negativnih stavova prema korištenju IKT-a. Istraživanje zaključuju ističući potrebu za poticanjem učinkovite integracije IKT-a u primarnom obrazovanju u sklopu inicijalnoga obrazovanja učitelja.

Na međunarodnoj razini, istraživanja vezana uz obrazovanje učitelja i njihovu osposobljenost (Istenic, 2010; Wearmouth, Smith, & Soler, 2004; Winter & McGhie-Richmond, 2005), ukazuju na potrebu osposobljavanja budućih učitelja za interakciju sa starijim učiteljima te potrebi za osposobljavanjem budućih učitelja za istraživanje IKT-a kao facilitatora učenja koji doprinosi promjeni pedagoške prakse poučavanja.

Nadalje, istraživanje koje su proveli Díez i Sánchez (2015) vezano uz obrazovanje budućih učitelja o temi raznolikosti na Sveučilištu, zaključuju da je potrebno osposobiti nastavnike o primjeni univerzalnoga modela procesa poučavanja i njegove prednosti u osiguravanju istih prilika za sve studente neovisno o njihovim individualnim karakteristikama.

Imajući na umu spomenuta istraživanja, smatramo primjerenim uključiti deskriptore koji integriraju korištenje IKT-a kod različitih vrsta invalidnosti u studijske programe za obrazovanje učitelja. Najbolji predmet za integraciju znanja i kompetencija koje su studenti usvojili tijekom inicijalnoga osposobljavanja je *Prácticum*, s obzirom na to da je on osnovni predmet koji spaja teoriju i praksu (Zabalza, 2011). Stoga zaključci istraživanja koje su proveli Mendoza i Covarrubias (2014) pokazuju da su glavni izvori za orijentaciju i pomoć studentima tijekom Practicuma, centri za stažiranje i suradnju učitelja, gdje mogu usvojiti i razviti svoje profesionalne kompetencije. U tom smislu, Prada i Zuleta (2005) identificirali su razlike i proučili stavove tijekom trajanja Practicuma i načine na koji su ih studenti prebrodili. Istraživanje je pokazalo da stalno promišljanje omogućuje studentima da prebrode poteškoće i posegnu za rješenjima.

Sve gore navedeno otvara niz pitanja koja smo u ovome istraživanju sveli na sljedeće:

1) Kakvo osposobljavanje imaju studenti u Practicumu u sklopu studijskoga programa Rani odgoj i obrazovanje i u programu Primarno obrazovanje?
2) Postoji li povezanost između osposobljenosti studenata i tehnološkoga znanja te različitih vrsta invalidnosti: slabovidnost, oštećenje sluha, kognitivne ili fizičke teškoće?
3) Postoje li značajne razlike između programa Rani odgoj i obrazovanje i programa Primarno obrazovanje vezano uz tehnološko znanje primijenjeno na osobe smanjenih funkcionalnih sposobnosti?

Radna hipoteza iz koje je razvijeno istraživanje jest da postoje značajne razlike vezane uz znanje IKT-a primijenjene na funkcionalnu raznolikost (FD) kod studenata u programu Rani odgoj i obrazovanje i studenata u programu Primarno obrazovanje, s obzirom na spol, godinu studija, program studija te prijašnje iskustvo u osposobljavanju u području IKT-a i funkcionalne raznolikosti.

Stoga je cilj istraživanja bio analizirati znanje studenata u programu *Rani odgoj i obrazovanje* te u programu *Primarno obrazovanje* vezano uz znanje IKT-a primjenjujući ih u rad s osobama smanjenih funkcionalnih sposobnosti.

Metoda

Ispitanici

Ciljna populacija u istraživanju obuhvaćala je 901 studenta upisanih tijekom akademske godine 2016./2017. u kolegij *Prácticum* u programu Rani odgoj i obrazovanje te u programu Primarno obrazovanje na Sveučilištu Jaén (Španjolska). Uzorkovanje bilo je slučajno, korištena je metoda jednostavnoga slučajnog uzorkovanja kako bi se odabrali ispitanici i kako bi se ispitanici koji su pristali odgovoriti na pitanja u upitniku dodali uzorku (n = 440).

Iz uzorka od 440 studenata sa Sveučilišta Jaén, 76,6 % su žene, a 23,4 % muškarci u 3. godini (47,7 %) i 4. godini (52,3 %) programa Rani odgoj i obrazovanje (52 %) i Primarno obrazovanju (48 %).

Tijekom studija, 43,2 % studenata imali su akademsko osposobljavanje o temama vezanima uz korištenje informacijske komunikacijske tehnologije (IKT) za potrebe osoba smanjene funkcionalne sposobnosti, a 46,4 % imali su osposobljavanje o kreiranju i univerzalnom pristupu primjene IKT-a u nastavnim metodama. Kolegiji koji sadržavaju teme o korištenju IKT-a s osobama smanjenih funkcionalnih sposobnosti su Organizacija škole (39,9 %), Nastavni resursi s posebnim osvrtom na raznolikost (31 %) i Psihološko-pedagoške osnove obrazovanja za posebne potrebe (21,5 %). Predmeti koji su ponudili više informacija ispitanicima o kreiranju i univerzalnoj primjeni IKT-a u obrazovanju su Organizacija škole (72,9 %) i Nastavni resursi s osvrtom na raznolikost (15,9 %). Svi kolegiji u kojima su studenti dobili akademsko osposobljavanje mogu se naći u tablici 1.

Tablica 1

Studenti smatraju da su tijekom da su tijekom akademskoga obrazovanja stekli veću osposobljenost za korištenje IKT-a nego u primjeni IKT-a u obrazovne svrhe. Na taj način ukazuju da su bili neznatno više osposobljeni u korištenju AV i IT tehnologije primijenjenih kod funkcionalne raznolikosti ($\overline{X}$ = 6,61; SD = 1,862) nego za korištenje u obrazovne svrhe ($\overline{X}$ = 6,29; SD = 1,899). S druge strane, također smatraju da su bolje osposobljeni za tehničku operacionalizaciju na internetu ($\overline{X}$ = 7,24; SD = 1,804) nego za korištenje IKT-a u obrazovne svrhe ($\overline{X}$ = 6,76; SD = 1,774). Međutim, visoko su procijenili IKT kao podupirući i potreban resurs za osobe s teškoćama ($\overline{X}$ = 8,08; SD = 1,806) (vidi tablicu 2 i sliku 1).

Tablica 2

Slika 1.

Instrument

Korišteni instrument (prilagođen od Cabero, Fernández i Córdoba, 2016) nazvan „Tehnološko znanje studenata, budućih učitelja, o korištenju Informacijske i komunikacijske tehnologije (IKT) s osobama s poteškoćama", sastoji se od dva glavna dijela: prvi dio sastoji se od 12 čestica s ciljem dobivanja informacija o karakteristikama ispitanika (spol, program obrazovanja, kolegiji, razina osposobljenosti). Drugi dio sastoji se od 65 čestica i ima za cilj prikupiti podatke o općem znanju studenata o IKT-u koji se može primijeniti u radu s osobama s nekom vrstom teškoće i s osobama sa specifičnim poteškoćama (slabovidnost, oštećenja sluha, kognitivne teškoće, fizičke teškoće i dostupnost).

Za svaku česticu, studenti su na skali od 10 stupnjeva morali procijeniti svoju kompetentnost gdje 1 znači nekompetentnost studenta da provede aktivnost u praksi, a 5 znači srednja kompetencija da provede aktivnosti, dok 10 označava njihovo učinkovito izvršavanje aktivnosti.

Valjanost sadržaja procijenjena je tehnikom „ekspertne procjene (Cabero, Fernández i Córdoba, 2016), dobivanje prosječnih procjena viših od vrijednosti „4" (važno), na skali od 1 do 5 gdje 1 znači „u potpunosti nevažno" a 5 „vrlo važno" što je dovelo do toga da se ni jedna čestica nije eliminirala (Cortada de Kohan, 1999).

Pouzdanost instrumenta analizirana Cronbachov Alpha koeficijenttom (O´Dwyer & Bernauer, 2014), odlična je s ukupnim rezultatom .99 – što je slično rezultatu dobivenom u originalnom upitniku Cabero, Fernández and Córdoba (2016) čija je pouzdanost bila .992 te upućuje na odgovarajuću unutarnju konzistentnost skale (Mateo, 2004). Za analizu odnosa svake čestice s ukupnom alpha unutarnjom konzistentnošću, korelacija čestica-ukupno dobivena je za cijeli instrument ne bi li se eliminacijom nekih čestica poboljšao indeks pouzdanosti instrumenta. Konzistentnost se ne bi poboljšala eliminacijom formuliranih čestica, što je rezultiralo istim mjerenjem kao i u globalnom testu. U isto vrijeme, indeksi za svaku od dimenzija teškoće također su vrlo visoki (opći aspekti: .91; slabovidnost: .89; oštećenje sluha: .95; fizičke poteškoće: .79; kognitivne poteškoće: .83; pristupačnost: .89).

Prikladnost uzorkovanja Kaiser-Meyer-Olkin (.982) i Bartlettov test sferičnosti ($\chi 2 = 31989.60$; $gl = 2080$; $p < .001$) pokazuju da su uvjeti zadovoljeni. Primjenom metode ekstrahiranja glavne komponente i metode varimax rotacije s Kaiserovom normalizacijom, rezultati analize ukazuju na bolju prilagodbu podacima sa šest faktora što objašnjava 78,050 % ukupne varijance (tablica 3). Prikaz sedimentacije može se vidjeti u slici 2.

Tablica 3

Slika 2

Cilj je empirijski istražiti odgovara li struktura dobivena eksplorativnom faktorskom analizom (EFA) dobivenim podacima koji su na kraju drukčiji od teorije prikazane u upitniku, a model je testiran potvrdnom faktorskom analizom (CFA) primjenjujući metodu maksimalne vjerojatnosti.

Rezultati pokazuju da model ukazuje na prikladnu prilagodbu koja se može poboljšati s obzirom na indeks kakvoće prilagodbe (Hair, Black, Babin, & Anderson, 2009). Drugim riječima, ako vrijednosti odgovaraju kakvoći prilagodbe modela koji su unutar granica a blizu prikladne prilagodbe, te vrijednosti predstavljaju visoku kakvoću prilagodbe ($\chi^2_{(1942, N=440)}$ = 7267,237, p = .000; χ^2/g.l. = 3,74; CFI = .834; SRMR = .041; y NFI = .787), s izuzetkom korijena srednje kvadratne pogreške (RMSEA = .087). Dobiveni indeksi prilagodbe modela i preporučane vrijednosti prikazane su u tablici 4.

Tablica 4

Procedura

Instrument je bio ponuđen u *online* okruženju studentima koji su pohađali nastavu iz kolegija *Practicum* tijekom prvoga semestra akademske godine 2016./2017. Svrha istraživanja i tajnost podataka navedeni su u uvodnom pismu s poveznicom na upitnik u privitku.

Analiza podataka

Provedena je deskriptivna analiza nezavisnih varijabli, osnovnih statističkih podataka, mod, medijan, standardna devijacija, standardna pogreška srednje vrijednosti kao i minimalne i maksimalne vrijednosti rezultata dobivenih od ispitanika.

Uz pretpostavku normalnosti distribucija (Martínez, Sánchez, Toledo i Faulin, 2014) i njihove ovisnosti, primijenjena je t-distribucija studenata za nezavisne uzorke. Time smo analizirali postoje li značajne razlike među odgovorima studenata s obzirom na spol i godinu studija (3. ili 4.) studijski program (*Rani odgoj i obrazovanje* ili *Primarno obrazovanje*), jesu li bili podvrgnuti osposobljavanju o korištenju IKT-a s osobama s funkcionalnim teškoćama te osposobljenost u kreiranju i univerzalnoj dostupnosti primjene IKT-a u obrazovne svrhe tijekom svojega akademskog školovanja. Informacije su nadopunjene primjenom Cohenovoga d testa (1988) kako bi se saznala veličina učinka dobivenih razlika.

Vezano uz testiranje i računalne programe, korišten je R za izračun EFA i CFA te SPSS.22 za deskriptivnu analizu i testiranje hipoteza.

Rezultati

Od ukupnoga broja mogućih vrijednosti koje su studenti mogli ostvariti iz upitnika (65-650), aritmetička sredina postavljena je na 287,90 (SD = 137,45), a 65 je najčešće birana vrijednost, (vidi sliku 3). Ako odredimo referentnu točku između minimalne i maksimalne moguće vrijednosti u upitniku (325), možemo reći da je razina kompetencije IKT-a u radu s osobama s funkcionalnom teškoćom srednje niska. Na

isti način možemo reći da je razina koju studenti pokazuju u različitim dimenzijama upitnika srednje niska (vidi tablicu 5).

Slika 3

Aritmetička sredina vezana uz opće aspekte IKT-a i funkcionalne različitosti je 70,54 (SD = 30,66), 65,05 (SD = 33,32) kod slabovidnosti, 31,46 (SD = 15,09) kod oštećenja sluha, 49,74 (SD = 24,29) kod fizičkih poteškoća, 17,11 (SD = 9,47) kod kognitivnih poteškoća kao i kod dostupnosti 54,36 (SD = 28.59). S druge strane, najčešće birana vrijednost kod općih aspekata vezanih uz IKT i teškoće je 45 (min = 15; Max = 150), kod slabovidnosti 15 (min = 15; Max = 150), kod oštećenja sluha 7 (min = 7; Max = 70), kod fizičkih teškoća 11 (min = 11; Max = 110), kod kognitivnih teškoća 4 (min = 4; Max = 40) te kod dostupnosti 13 (min = 13; Max = 130).

Tablica 5

Razlike među studentima s obzirom na spol. Ispitanici muškoga spola pokazuju veće znanje ($\overline{X}$ = 54,76;SD = 21,88) od ispitanica ženskoga spola ($\overline{X}$ = 48,26; SD = 24,79) vezano uz fizičke teškoće ($t_{(2,415)}$=-2,306; p<.05), s malom veličinom učinka (d =-.22). Na isti način, skupina ispitanika muškoga spola ostvarila je više rezultate ($\overline{X}$ = 60,20; SD = 26,14) od ispitanica za domenu pristupačnosti ($\overline{X}$ = 52,67; SD = 29,07), gdje se pokazala i statistički značajna razlika ($t_{(2,159.72)}$ = -2,361; p<.05), također s malom veličinom učinka (d =-.37) (vidi tablicu 6).

Tablica 6

Razlike među studentima s obzirom na godinu studija. Studenti treće godine, općenito su ostvarili više bodova od studenata četvrte godine, uvijek s malom veličinom učinka i u domeni opće značajke, fizičke teškoće, kognitivne teškoće i dostupnost. U domeni opće značajke, srednja vrijednost za treću godinu je 74,54 (SD = 27,79) a za četvrtu godinu 66,91 (SD = 32,69), što ju čini statistički značajnom ($t_{(2,412.22)}$=2,571; p<.05; d =.25). Ta razlika se smanjuje kod fizičkih teškoća ($t_{(2,413.19)}$ = 3,319; p<.01; d =.33) gdje je srednja vrijednost među studentima treće godine 53,83 (SD = 21,70) a 46,09 (SD = 25,91) kod studenata četvrte godine (vidi tablicu 7).

Tablica 7

Iako se razlika značajno smanjuje kod kognitivnih teškoća ($t_{(2,427.29)}$=2,117; p<.05; d = .20), srednja vrijednost među studentima treće godine još je uvijek veća ($\overline{X}$ = 18,12; SD = 8,76) nego kod studenata četvrte godine ($\overline{X}$ = 16,20; SD = 10,01). Ipak, razlika s obzirom na godinu studija povećava se ponovno u domeni pristupačnost ($t_{(2,403.75)}$ = 3,073; p<.01; d = .30), i to u prilog studenta treće godini ($\overline{X}$ = 58,86; SD = 25,86) u usporedbi sa studentima četvrte godine ($\overline{X}$ = 50,30; SD = 30,33).

Razlike među studentima s obzirom na studijski program. Značajne razlike pronađene su samo u domeni fizičke teškoće ($t_{(2,409.18)}$ =-2.133; p<.05; d = -.21) između studenata

u programu *Primarno obrazovanje* ($\overline{X}$ = 52,38; SD = 21,13) u usporedbi sa studentima u programu *Rani odgoj i obrazovanje* ($\overline{X}$ = 47,38; SD = 26,63) (vidi tablicu 8).

Tablica 8

Razlike među studentima s obzirom na recepciju informacije o korištenju IKT-a tijekom studija u radu s osobama smanjenih funkcionalnih sposobnosti. Kao što je i očekivano, značajne razlike dobivene su u svim dimenzijama upitnika u korist studenata koji su primili informacije o temama vezanima uz korištenje IKT-a u radu s osobama različitih funkcionalnih teškoća, s velikom veličinom učinka uz iznimku u domenama oštećenje sluha i dostupnost, sa srednjom veličinom učinka (vidi tablicu 9).

Tablica 9

Posebno velika razlika uočena je u domeni opće značajke ($t_{(2,414)}$ = 9,571; p<.001; d = .94) i slabovidnost ($t_{(2,414)}$ = 9,635; p<.001; d = .95). U prvom slučaju, srednja vrijednost skupine koja je imala osposobljavanje je 85,54 (SD = 26,77), a srednja vrijednost za skupinu koja nije imala osposobljavanje 59,21 (SD = 28,50). U drugom slučaju, srednja vrijednost skupine koja je imala osposobljavanje 81,35 (SD = 30,14), a skupine koja nije imala osposobljavanje je 52,61 (SD = 30,15).

Razlike se značajno smanjuju u domeni dostupnost ($t_{(2,405)}$ = 7,717; p<.001; d = .77) i domeni fizičke teškoće ($t_{(2,415)}$ = 8,889; p<.001; d =.87). U slučaju pristupačnosti, srednja vrijednost skupine koja je imala osposobljavanje je 66,37 (SD = 26,86), a srednja vrijednost skupine koja nije imala osposobljavanje je 45,66 (SD = 26,62). U drugom slučaju, srednja vrijednost skupine koja je imala osposobljavanje je 60,93 (SD = 22,43), a skupine koja nije imala osposobljavanje je 41,33 (SD = 22,18). Konačno, najmanje razlike među rezultatima nalazimo u domeni oštećenje sluha ($t_{(2,421)}$ = 6,830; p<.001; d = .66) te kognitivne poteškoće ($t_{(2,428)}$ = 8,239; p<.001; d = .80). U slučaju oštećenja sluha, srednja vrijednost skupine koja je imala osposobljavanje je 36,88 (SD = 14,19), a srednja vrijednost skupine koja nije imala osposobljavanje je 27,28 (SD = 14,43). U drugom slučaju, srednja vrijednost skupine koja je imala osposobljavanje je 21,12 (SD = 9,15), a skupine koja nije imala osposobljavanje je 14,06 (SD = 8,53).

Razlike među studentima s obzirom na recepciju informacije o kreiranju i univerzalnom pristupu za primjenu IKT-a u obrazovanju tijekom njihova studija. Podatci pokazuju da postoje značajne razlike u svim domenama koje upitnik sadrži, osim oštećenja sluha i to u korist studenata koji su imali osposobljavanje o kreiranju i univerzalnoj dostupnosti za primjenu IKT-a u obrazovne svrhe, s malom veličinom učinka u svim slučajevima (vidi tablicu 10). Najveće razlike uočene su u domeni slabovidnost ($t_{(2,414)}$ = 2,673; p<.01; d = .26), pristupačnost ($t_{(2,405)}$ = 2,618; p<.01; d = .26) i opće značajke ($t_{(2,414)}$ = 2,406; p<.05; d = .24). U prvome slučaju, srednja vrijednost za skupinu koja je imala osposobljavanje je 69,73 (SD = 33,19), a srednja vrijednost za skupinu koja nije imala osposobljavanje je 61,03 (SD = 32,97). U drugom slučaju, srednja vrijednost za skupinu koja je imala osposobljavanje je 58,35 (SD = 27,39) u

usporedbi sa srednjom vrijednošću skupine koja nije 50,96 (SD = 29,19). U trećem slučaju, srednja vrijednost skupine koja je imala osposobljavanje je 74,43 (SD = 29,88) a 67,21 skupine koja nije imala osposobljavanje (SD = 30,98).

Tablica 10

U domeni fizičke teškoće, razlike su smanjene ($t_{(2,415)}$ = 2,579; p<.05; d = .25), što pokazuje visoki rezultat za osposobljene studente ($\overline{X}$ = 52,98; SD = 23,48) nego kod onih koji nisu osposobljeni ($\overline{X}$ = 46,87; SD = 24,69). U domeni kognitivnih teškoća, razlike su izrazitije ($t_{(2,428)}$ = 2,568; p<.05; d = .25), što rezultira manjom razlikom među osposobljenim studentima i onima koji to nisu, pri čemu je srednja vrijednost osposobljenih studenata bila viša ($\overline{X}$ = 18,36; SD = 9,26) od srednje vrijednosti onih koji nisu osposobljeni ($\overline{X}$ = 16,02; SD = 9,53).

Zaključci

Kao što je navedeno, glavni cilj ovoga istraživanja bio je analizirati znanje studenata u programu *Rani odgoj i obrazovanje* te studenata u programu *Primarno obrazovanje* o općenitoj uporabi IKT-a u radu s osobama s poteškoćama kao i vezano uz pristupačnost. Stoga, ako gledamo rezultate sa stajališta zavisnih varijabli (osposobljavanje za primjenu IKT-a kod funkcionalne raznolikosti) i cjelokupne rezultate, zaključujemo da, općenito, studenti pokazuju srednje-nisku razinu kvalifikacije i osposobljenosti za primjenu IKT-a u radu s osobama s funkcionalnim poteškoćama. Isto tako, u različitim studijskim programima postoje kolegiji koji osposobljavaju za razvoj IKT vještina i kompetencija što ukazuje na to da studenti imaju visoku razinu znanja o općim značajkama, u domeni slabovidnost i u domeni dostupnost.

To dovodi do zaključka da se studenti u visokom obrazovanju trebaju znati koristiti obrazovnim softverom da bi mogli raditi s osobama različitih funkcionalnih teškoća, iz čega slijedi da učitelji moraju imati IKT znanje kako bi mogli kompetentno pristupiti bilo kojem učeniku u razredu koji ima neki oblik funkcionalne teškoće (Soto, 2008; Toledo & Llorente, 2016). Budući učitelji morali bi biti osviješteni o tome da IKT treba biti dostupan jer doprinosi boljem obrazovanju i društvenom razumijevanju svih dionika (Toledo, 2008; Toledo & Llorente, 2016).

Primjenjujući kontrastivnu analizu za različite nezavisne varijable u ovome istraživanju, počevši sa spolom, kao i u nekim prijašnjim istraživanjima (Cabero, Fernández, & Barroso, 2016), možemo primijetiti da najveće razlike između muških i ženskih ispitanika nalazimo u domeni fizičke teškoće i dostupnost. U oba slučaja, kao i kod ostalih domena koje čine instrument, rezultat je veći i značajniji kod muških ispitanika.

Kada je riječ o godini studija, zaključujemo slično kao i Toledo i Llorente (2016), da su studenti treće godine, općenito, ostvarili više bodova od studenata četvrte godine, s obzirom na to da su toj godini imali više kolegija vezanih uz IKT i funkcionalnu raznolikost, a najveće razlike uočene su u domeni opće značajke, fizičke teškoće, kognitivne teškoće i dostupnost.

Istraživanje je također pokazalo da znanje studenata o primjeni IKTa- u radu s osobama s funkcionalnom poteškoćom ovisi o programu koji su upisali, pri čemu studenti u programu *Primarno obrazovanje* pokazuju višu razinu znanja u usporedbi sa studentima u programu *Rani odgoj i obrazovanje*, iako su značajne razlike uočene samo u domeni fizička teškoća.

Na pitanje postoji li veza između tehničkoga znanja i različitih vrsta funkcionalnih teškoća ili ne, potvrđen je očekivani odgovor da su uočene značajne razlike u svim domenama upitnika u korist u svim slučajevima, onih studenata koji su bili osposobljeni o temama vezanima za korištenje IKT-a u radu s osobama s funkcionalnom poteškoćom. Usklađeni smo s rezultatima drugih istraživanja o pitanju najviših i najnižih razina osposobljavanja i tehničkoga znanja (Toledo & Llorente, 2016). Naime, u našem istraživanju, najvišu razinu osposobljenosti uočili smo u domeni opće značajke te u domeni slabovidnost, a zatim u domeni dostupnost i fizičke teškoće, dok su najniže razine uočene u domeni osposobljenost, oštećenje sluha i kognitivne poteškoće.

Kao što smo vidjeli u ovome istraživanju, postoji značajna povezanost među svim domenama upitnika, osim domene oštećenje sluha u korist studenata koji su imali neku vrstu osposobljavanja o kreiranju i univerzalnoj dostupnosti za obrazovnu primjenu ITK-a, kao i rezultat važnosti koju osobe s teškoćama pridaju IKT-u (Gargiulo & Metcalf, 2011; Toledo, Sánchez & Gutiérrez, 2013; Torres, 2007). U našem slučaju, najveće razlike uočene su u domeni slabovidnost i dostupnost. U domeni fizičke teškoće razlike se smanjuju te osposobljeni studenti imaju bolje rezultate od onih koji nisu osposobljeni. Konačno, postoji mala razlika između osposobljenih studenata i onih koji to nisu kada je riječ o kognitivnim teškoćama.

Rezultati ovoga istraživanja navode nas na promišljanje o potrebi za osvještavanjem budućih učitelja o korištenju IKT-a u radu s osobama s funkcionalnom poteškoćom s holističkoga stajališta. Osposobljavanje i primjena trebala bi biti omogućena studentima kroz institucionalni ili manje formalni kontekst. Također naglašavamo važnost znanja budućih učitelja te studijskih programa o izravnoj vezi između razine osposobljenosti i primjene u praksi. Zbog svega navedenoga, dijelimo mišljenje Cabero, Fernández i Barroso (2016) da je neophodno poduzeti mjere u inicijalnom obrazovanju učitelja u programima *Rani odgoj i obrazovanje* kako bi se promovirala kvalifikacija i primjena IKT-a u radu s osobama različitih vrsta teškoća, posebice uzimajući u obzir da su škole sve više tehnološki opremljene različitim obrazovnim programima.