Digital Competence: Importance of Being Included in the Higher Education Curriculum

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Abstract

The constant inclusion of new digital skills in job positions is evidence of the effects that the accelerated adoption of technology has generated in the labor market because of the pandemic; posing a challenge for the university education system that seeks to train its students to be successfully inserted in jobs. The objective of this study is to compare the dimensions of the digital competence found in the job offers of companies with those present in the syllabus' contents of a university program in Social Sciences, as well as the relationship between academic performance and the level of the indicators of the dimensions of the digital competence. For the study, 20 companies were chosen from the ranking of the 500 largest companies in Peru in 2021 carried out by "América Economía", 43 syllabi of the program, and the survey was applied to 185 students. In this research, it was found that the understanding of technical concepts, research and visual and/or audible identification indicators present the highest averages, that is, they are the skills most required by companies. Visual and/or audible identification and respect for others have low averages because it is not common to find them in the job offers of the companies, and problem solving has not been found in any of the job offers. These same results were found in the syllabus' contents. More than half of the students are distributed in the high and very high levels, with 04 indicators in which no student is in the low level. We concluded that, despite the high and very high level of the dimensions of digital competence achieved by a high number of the students who participated in our study, it is coinciding with the current requirements of the company; it is imminent not only to reformulate the curriculum that already contains training in digital skills, but also to include it in the curricula that do not consider it, so that the University ensures that its students can successfully face the technological innovations that companies will make in the future.

Key words

Digital competence, job offers, syllabus' content, academic performance.

1. Introduction

Being part of the knowledge society involves developing digital competence, defined as the skills, knowledge and attitudes that are required when Information and Communications Technology (ICT) and digital media are used to solve problems, manage information, create, and share content and build knowledge [1]. The markets, companies and productive sectors are highly influenced by aspects such as globalization and technological development, the latter in exponential growth due to the pandemic

CITIE 2022: IV International Congress of Trends in Educational Innovation. Arequipa. Perú

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[2]. This has repercussions on a natural need of the productive sector to request –within their job offers– high levels of digital competence [3].

The labor market has been analyzed through information collected from online job offers, with Big Data analysis in this regard in European countries [4]. Job offers require increasingly specific digital skills, according to the job position; that is why the coherence between the academic offer and the labor demand must be reinforced, directing the efforts so that the formal academic training manages to focus on the needs of the students, workers, and society, innovating teaching and learning in such a way that respond to the digital age [5].

Analyzing the digital skills that jobs require from graduates is the starting point to represent them in the syllabi of subjects that form the dimensions of Digital Competence in university students; Research on curricula at different educational levels is projected into the future, knowing that the comparative analysis of curricular plans will contribute with findings on the current situation [6]. The comparison between faculties of a university in Latvia, indicates that the students of Agricultural Engineering and Forest Sciences and Forest Engineering have the lowest evaluation of their digital skills; unlike the specialty Information technologies for sustainable development, a specialty that has the highest [7].

The objective of this research is to compare the indicators of the dimensions of the digital competence of the job offers of the companies and the contents of the syllabi of the curricular plan, as well as the relationship between the academic performance and the level of the indicators of the dimensions of digital competence in university students.

2. METHODS

This study followed a cross-sectional, observational, and analytical study [8].

2.1. Methodological stages

To meet the proposed objective, the following steps were taken:

2.1.1. Selection of companies

The companies were selected from the ranking of the 500 largest companies in Peru 2021 made by "América Economía" and published in the following link:

https://www.americaeconomia.com/negocios-industrias/estas-son-las-500-mayores-empresas-del-peru-2021, considering as inclusion criteria that they must be based in Arequipa, belong to the value chain of the sectors or items prioritized in the Arequipa region and training requirements in advertising.

The search for the job offers of the selected companies was carried out on the Internet, using the following links:

- Google jobs: https://www.google.com/
- LinkedIn: https://www.linkedin.com/
- Bumeran and other digital job boards: https://www.bumeran.com.pe/

2.1.2. Selection of syllabi from the 2016 curriculum

For the selection of the syllabi, subjects with digital skills in the contents were included; elective subjects were excluded.

2.1.3. Application of the survey to students

For the study, the participation of students enrolled in semesters VI, VIII and X of the even semester 2022 of the University was requested, who after voluntarily accepting the informed consent, completed a survey via Microsoft Forms which included 03 dimensions, 08 indicators and 47 items (Table 1) with

proven content validation and internal consistency reliability [9]. Each item was measured using a five-point Likert scale, ranging from 1 representing the lowest rating to 5 being the highest.

Table 1

Structure of the survey for measuring dimensions of digital competence.

DIMENSION	INDICATORS	CODE	NUMBER OF ITEMS
Technology	Understanding of technical concepts	UTC	11
	Problem solving	PS	5
	Visual and/or audible identification	VAI	6
Cognitive skills	Organization and connection of textual and visual data	OTV	4
	Structured data organization	SDO	4
	Research	R	7
Ethical awareness	Staying safe online	SSO	5
	Respect for others	RO	5
TOTAL ITEMS			**47**

Source: Self-made

2.2. Data analysis

The coding matrices were obtained from the qualitative analysis carried out with New NVivo software. Data analysis was performed with Statistical Package for the Social Sciences (SPSS), version 26. The descriptive measures that were included were: absolute frequency and percentage (%), median and interquartile range by Me(IQR), Kolmogorov-Smirnov normality test, nonparametric Mann Whitney U test and Spearman's Rho coefficient. A value of $p \leq 0,05$ was considered statistically significant.

3. Results

The results correspond to the study of the job offers of 20 companies, 43 subjects of the 2016 study plan (07 of General Studies, 04 of Research, 13 of Basic Vocational Training, 17 of Specialty and 02 of pre professional practices) and 185 surveys resolved voluntarily by students of semesters VI, VIII and X of a school professional in the Social Sciences area of a University of Arequipa.

3.1. Comparison of the dimensions of digital competence present in the job offers of the companies and syllabus'contents

The hierarchy of the 20 selected companies was carried out considering the number of items per indicator of the dimensions of digital competence, according to Ward's link and the re-scaled distance of 4, finding that they are distributed in 07 clusters, in each of them there are presence of greater similarity in digital skills that companies request as requirements in job offers. Similarly, the 43 subjects that record content related to digital dimensions are distributed in 06 clusters. In Table 2, it is observed that the indicators UTC, R and VAI present the highest averages, that is, they are the skills most required by companies. SSO and RO have low averages, because it is not common to find them in the job offers of the companies, and PS has not been found in any of the job offers. These same results were found in the syllabus' contents.

It is important to mention that there is a significant difference ($p < 0.05$) between the indicators of the dimensions of digital competence requested by the companies and those found in the syllabi of the different subjects of the curricular plan studied, except in PS and RO. Table 3 shows the digital skills that are requested by 100% of the companies studied. As a result of the comparison of the dimensions

of digital competence present in the job offers of companies and syllabus' content, it is important to mention:

- Are not present:
  The digital skills of the "troubleshooting" indicator: PS1: I can use a variety of programs/applications to deal with computer virus problems; PS2: I can solve computer system problems like clear cache and cookies, recover files from trash; PS3: I can solve software problems by looking them up online; PS4: I can solve non-complex hardware problems (connecting peripherals, connecting external storage devices) and PS5: I can identify hardware problems and know which service or people to go to solve them.
  Digital skills SSO3: I can identify content that makes me feel uncomfortable, insecure, or worried (cyberbullying, cyberbullying) and RO2: I know that online harassment is a criminal offense.
- The ability RO1: I am aware that I must request permission from the people who appear and can be identified in a photo to publish it on the Internet; was found in a syllabus' content, which none of the companies requested in their job offer.

3.2. Level of digital competence and Spearman's Rho coefficient

Table 4 shows that in the UTC indicator of the technological dimension, 80,54% of students reached a very high level, and 62,16% of students in RO of the ethical knowledge dimension reached the same level. In R of the cognitive skills dimension, 61,08% have a high level. It is important to mention that in all indicators more than 50,00% of students are distributed in the high and very high levels, with 04 indicators in which no student is in the low level.

Table 5 shows that the highest median value (4,55) is found in UTC. In indicators VAI, OTV, SSO and RO the values exceed 4,00, being an indicator that the levels are between high and very high. In the PS, SDO and R indicators, the values exceed 3, with levels between regular and high.

Table 2
Average digital skills by indicator and each cluster of companies and syllabi.

OBJECT OF STUDY	CLUSTER	INDICATORS							
		UTC	PS	VAI	OTV	SDO	R	SSO	RO
Companies	1	8,00	0,00	6,00	4,00	0,00	3,00	0,00	0,00
	2	8,33	0,00	2,00	2,67	3,67	2,67	0,67	0,00
	3	10,43	0,00	2,29	1,71	4,00	6,14	1,29	0,57
	4	11,00	0,00	5,75	3,75	4,00	4,25	0,25	0,00
	5	10,50	0,00	6,00	4,00	4,00	7,00	4,50	4,00
	6	11,00	0,00	6,00	4,00	1,00	7,00	2,00	0,00
	7	11,00	0,00	6,00	1,00	4,00	5,00	3,50	0,00
	Overall average	10,20	0,00	4,05	2,65	3,60	5,10	1,50	0,60
Syllabi	1	4,30	0,00	4,10	0,30	0,00	0,50	0,30	0,30
	2	1,00	0,00	4,44	1,22	0,67	0,22	0,00	0,00
	3	8,75	0,00	3,75	2,75	2,75	6,50	0,00	0,50
	4	0,00	0,00	0,13	0,25	0,25	0,63	0,75	0,38
	5	1,89	0,00	0,89	1,00	1,00	6,78	0,00	0,11
	6	9,33	0,00	4,67	0,33	0,33	0,00	0,00	0,00
	Overall average	3,07	0,00	2,77	0,86	0,67	2,30	0,21	0,21
U Man Whitney p-valor		0,000 p < 0,05	0,000 p > 0,05	0,023 p < 0,05	0,000 p < 0,05	0,000 p < 0,05	0,001 p < 0,05	0,000 p < 0,05	0,437 p > 0,05

Source: Coding of information from job offers of 20 companies and syllabi of 43 subjects under study.

Likewise, we observed that the study of the relationship between academic performance and the level of the indicators of the dimensions of digital competence found a significant minimum direct correlation [10] ($p < 0,05$) in the SDO indicator, and a significant low direct correlation in the VAI and OTV indicators, even though the highest percentage of students present high and very high levels and 89.19% present an academic performance that exceeds 14 as a weighted average.

4. Discussion

We are currently witnessing that the digital competence, in people of all ages, has acquired strategic relevance in the academic and work environment, the success in the development of various activities depends on the level of competence that people have developed, which has mostly occurred in an informal environment.

The fourth industrial revolution is driving a digital transformation that manifests itself as complex and with interconnection between the different sectors of society, being in turn, a great challenge for higher education [11].

In this research, it was found that there is a coincidence in the skills of the job offers requested by the companies studied, observing that a greater percentage are concentrated in the UTC and IV indicators of the technological dimension and II of cognitive skills.

Table 3

Digital skills requested by 100% of companies studied

DIMENSION	INDICATOR	CODE	DIGITAL SKILL
Technology	Understanding of technical concepts	UTC1	I can use at least one personal computer in terms of hardware (turn on computer, operate keyboard and mouse, connect devices)
		UTC 2	I can use at least one operating system (Windows, OSX, Android, iOS, others)
		UTC 3	I can install and uninstall a program or application
		UTC 6	I can use email (create an account, write, and send emails, attach, and download files)
		UTC 11	I can use mobile technology (download applications, register data/forms, use messaging)
	Visual and/or audible identification	VAI1	I can use some software programs to visualize data in charts, tables, graphs, maps, infographics, dashboards, etc.
		VAI5	I have knowledge of the format and/or extensions that a multimedia file requires for publication on a channel, application, or digital platform (video: MPEG4, MP4, AVI. Images: JPG, PNG, GIF)
Cognitive skills	Organization and connection of textual and visual data	OTV4	I can identify key ideas using digital tools (Acrobat, Microsoft Office) that allow the management of textual information (to highlight, annotate, draw, etc.)
	Research	R1	I am confident browsing and searching for information online
		R2	I am confident to evaluate and discriminate information online
		R3	I am confident when searching for information in databases such as networks, directories, enterprise resource planning (ERP) systems, repositories, virtual libraries, online search engines, etc.

Source: Coding matrix obtained from the qualitative analysis carried out in the NVivo software

In the curricular plan of the program, depending on the nature of the subject, it is considered in their content certain skills that, when added together, ensure that graduates have achieved the digital skills requested as requirements by companies.

In none of the cases, company or syllabus, is the PS indicator found, even though it integrates skills that everyone should know at a basic level, to be used immediately and optimize work in the company.

Regarding the RO indicator, only 14% of subjects consider it and 10% of companies request it. This indicator integrates skills that are very important for coexistence in the digital world.

Our results, related to the job offer, have similarity with those reported by [12] who investigated the job offer for Marketing professionals finding a percentage of 15.60% in social network management, followed using Microsoft Office with 14,40%, SEO and SEM positioning with 13,30%, e-mailing with 8,90% and other skills with percentages ranging from 8.30% to 0.60%.

Table 4

Levels of indicators of digital competence dimensions in students at a university program in Social Sciences.

DIMENSION	INDICATORS	INDICATOR LEVELS							
		LAW		REGULAR		HIGH		VERT HIGH	
		n	%	n	%	n	%	n	%
Technology	UTC	0	0,00	2	1,08	34	18,38	149	80,54
	PS	9	4,86	59	31,89	87	47,03	30	16,22
	VAI	2	1,08	12	6,49	95	51,35	76	41,08
Cognitive skills	OTV	2	1,08	23	12,43	92	49,73	68	36,76
	SDO	10	5,41	55	29,73	96	51,89	24	12,97
	R	0	0,00	12	6,49	113	61,08	60	32,43
Ethical awareness	SSO	0	0,00	8	4,32	78	42,16	99	53,51
	RO	0	0,00	10	5,41	60	32,43	115	62,16

Source: Survey applied to students via Microsoft Forms

Table 5

Descriptive measures of the indicators of the digital competence dimensions and Spearman's Rho coefficient.

DIMENSION	INDICATORS	STATISTICS				
		Me(RIC)	Vmín	Vmáx	R	Rho de Spearman
Technology	UTC	4,55(0,64)	2,64	5,00	2,36	0,13
	PS	3,40(0,80)	1,40	5,00	3,60	-0,07
	VAI	4,00(0,83)	1,00	5,00	4,00	0,24*
Cognitive skills	OTV	4,00(1,00)	1,50	5,00	3,50	0,31*
	SDO	3,25(0,75)	1,00	5,00	4,00	0,16*
	R	3,86(0,86)	2,29	5,00	2,71	0,00
Ethical awareness	SSO	4,20(1,00)	2,60	5,00	2,40	-0,11
	RO	4,20(0,80)	2,80	5,00	2,20	0,01

Source: Survey applied to students via Microsoft Forms

According to ECLAC (2021), in Latin American and Caribbean countries "…less than 40% of the population has basic digital skills such as moving information within a document, sending emails, copying, or moving files. Less than 30% have skills for intermediate activities such as the use of spreadsheets, management of software for presentations. Less than 25% of the population have more advanced digital skills such as downloading and installing software and connecting and installing new devices; and only 7% acknowledge having used a programming language" [13].

The low correlation found between students' academic performance and their level of digital competence is since the evaluation instruments measure the contents of the subjects without directly considering the indicators of digital competence. Our results differ from those obtained in a study by [14] which concluded that students with higher levels of digital competence obtain better academic performance in university education.

However, a report by the Inter-American Development Bank mentions that "Latin America and the Caribbean have one of the largest skills gaps in the world and talent training systems, including schools, focus on degrees behind which there are curricula not updated to the new reality. Student performance is extremely poor compared to other regions" [15].

In [16] it is mentioned that the technological change that is currently happening has an impact on the level and composition of labor demand predicting that it will be accentuated soon because most companies already use digital platforms, cloud computing and the Internet of Things; as well as the use of Artificial Intelligence, Big Data, Robots, Automation and Cybersecurity that is growing.

In [17] it is stated that new teaching models are bound to be linked to digital learning methodologies being important to innovate in the development of virtual learning environments that simulate and interact with practical learning modalities.

Similarly, this reality allows us to conclude that although the high and very high level of the dimensions of digital competence achieved by the highest percentage of students who participated in our study is in line with the current requirements of the company, it is imminent not only to reformulate the curricula that already contain training in digital skills, but also to include in those curricula that do not consider it, so that the University ensures that its graduates can successfully face the technological innovation that companies will make in the future.

The scarce existing literature motivates to continue investigating the relationship between academic performance, level of digital competence in all academic areas and digital competence profile demanded by the labor market, with the aim of proposing a structure of contents to be included in the curricular plans, which should be measurable and adaptable to the dynamics of technological development.

Acknowledgments

This work has been financed with Research Funds 2021-I allocated by the Universidad Católica de Santa María according to Resolution 28748-R-2022.

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