Recibido: Mar. 12, 2021 | **Aceptado:** Jun. 28, 2021

Digital skills in university professors of administrative economic sciences

Las competencias digitales en los profesores universitarios de las ciencias económico administrativas

Competências digitais em professores universitários de ciências econômicas e administrativas.

Research Article

DOI: https://doi.org/10.21803/penamer.14.28.447

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¿Cómo citar este artículo?
Torres-Flórez, D. & Pachón, Y. (2021). Las competencias digitales en los profesores universitarios de las ciencias económico administrativas. *Pensamiento Americano, 14*(28), 77-92. DOI: https://doi.org/10.21803/penamer.14.28.447

Abstract

Introduction: Teachers today must appropriate digital skills that contribute to their teaching work based on the evaluation of 4 dimensions (information; communication and collaboration; use of digital devices and tools; and content creation). **Objective.** With the purpose of analyzing relationships between variables that contribute to the design of educational digital literacy plans. **Methodology.** For this, the *Test to Diagnose the Teaching Competences in Digital Knowledge of Professors in Higher Education* was applied to the professors of the faculties of economic sciences of the Institutions of Higher Education IES of Villavicencio .**Results.** Finding that the information dimension is in a medium-high degree of appropriation, while the other dimensions are in an intermediate degree. On the other hand, it is established that said literacy plans must be designed differently with respect to the age range and degree of training of the teachers. **Conclusion.** The variables are directly related to the degree of appropriation of digital skills.
Key words: Digital literacy; TIC; Teacher Training; Villavicencio.

Resumen

Introducción: Los profesores en la actualidad deben apropiar competencias digitales que aporten a su quehacer docente a partir de la evaluación de 4 dimensiones (información; comunicación y colaboración; uso de dispositivos y herramientas digitales; y creación de contenidos) **Objetivo**. Con el propósito de analizar relaciones entre variables que contribuyan al diseño de planes de alfabetización digital docente. **Metodología.** Para ello, se aplicó el *Test para Diagnosticar las Competencias Docentes en Saberes Digitales de Profesores en Educación Superior* a los profesores de las facultades de ciencias económicas de las Instituciones de Educación Superior IES de Villavicencio. **Resultados.** Encontrándose que la dimensión de información, se encuentra en un grado de apropiación medio alto, mientras las demás dimensiones se encuentran en un grado intermedio. Se establece, por otro lado, que dichos planes de alfabetización deberán ser diseñados diferenciadamente con respecto al rango de edad y grado de formación de los profesores. **Conclusión.** Las variables guardan relación directa con el grado de apropiación de las competencias digitales.
Palabras Clave: Alfabetización digital; TIC; Capacitación docente; Villavicencio.

Resumo

Introdução: Os professores de hoje precisam adquirir competências digitais que contribuam para seu trabalho de ensino baseado na avaliação de 4 dimensões (informação, comunicação e colaboração; uso de dispositivos e ferramentas digitais; e criação de ferramentas digitais); e criação de conteúdo). **Objetivo.** Com o objetivo de analisar as relações entre as variáveis que contribuem para o projeto do digital à concepção de planos de alfabetização digital para professores. **Metodologia.** Para este fim, aplicamos o Teste para Diagnosticar Competências de Ensino em Alfabetização Digital de Professores do Ensino Superior foi aplicado ao Instituições de Ensino Superior (IES) em Villavicencio, Colômbia. **Resultados:** Foi descoberto que a dimensão de informação está em um nível médio-alto de apropriação, enquanto as outras dimensões estão em um nível intermediário de apropriação. Por outro lado, é estabelecido que esses planos de alfabetização devem ser projetados Os planos de alfabetização devem ser concebidos de forma diferente de acordo com a faixa etária e o nível de treinamento dos professores. **Conclusão.** As variáveis estão diretamente relacionadas com o com o grau de apropriação de competências digitais.
Palavras-chave: Alfabetização digital; TIC; Formação de professores; Villavicencio.

Introduction

This document arises in the framework of the research project to diagnose digital competencies in higher education teachers in comparative Colombia - Mexico for the academic and research network GESTIO that is proposed as part of the collaborative agreement between the Academic Body Planning and technological innovation of the Universidad Veracruzana (Mexico) and the Research Group GYDO of the Universidad de los Llanos (Colombia) as a result of the research with which digital competencies were diagnosed in the teachers of the faculties of economic sciences of higher education institutions in Villavicencio (Meta). This research defined the degree of appropriation of the digital competencies of teachers and provided elements of analysis on those digital skills that need to be reinforced in the framework of a virtual education modality appropriate to the current circumstances of social isolation as a preventive measure for the spread of Covid - 19.

This also allows reflecting on the opportunity to involve digital tools in a transversal way in the curricula seeking to make more efficient and innovative teaching and learning processes, which could be a key factor to boost academic performance and reduce university student dropout. In context with the bet contained in the National Development Plan 2018 - 2022 on knowledge management mediated by ICT in higher education, an analysis such as the one proposed will allow to deepen the reflection on the importance of the role of the teacher in the framework of the virtualization of education and constitutes a starting point for understanding the challenge to which the management of digital competencies in the teaching staff responds at regional level since there are no studies of this segment in the municipality of Villavicencio, Colombia.

II. DEVELOPMENT OF THE ARTICLE

Theoretical Context

Information and Communication Technologies. UNESCO (2005) defines them as a set of increasingly effective instruments to create and disseminate knowledge, as well as to use it in common, pointing out that, for people's success in life, computer skills are as essential as basic knowledge in reading, writing and arithmetic, which indicates how ICTs contribute to the development of information management and processes related to educational training.

From the research field, the definition proposed by Thompson et al. (2004) stands out, as the set of devices, tools, equipment and electronic components, designed to operate information and that support the development and economic growth of organizations. Rosario (2006) simplifies the concept by considering it as the sum of technologies that generate the acquisition, production, storage, processing, communication, recording and presentation of information in multiple formats (voice, text, image or video).

ICT in Education. In the last decade, ICT (Information and Communication Technologies) have evolved to become Technologies for Learning and Knowledge (TAC) Vivancos (2008), which is due to the exponential development of digital technologies and the growing democratization in the use of the Internet, the latter being one of the changes that has most transformed the context of the educational process (Viñals Blanco and Cuenca, 2016).

This process has stimulated diversification in the theoretical constructions that refer to the process of implementation of digital tools in the field of higher education. Thus, Alonso and Gallego (2002) conceptualize CT as a cognitive instrument, which, if properly used, can modify learning and improve the human

mind, while Segura (2002) refers to them as resources and systems for the digitized elaboration, storage and dissemination of information supported by the use of information technology that seeks the generation of new knowledge. In this regard, Karam et al. (2013) argue that the integration of CT in universities has gone through several stages: 1) Automation of administrative procedures, 2) Implementation of computer rooms, 3) Systematization of academic procedures, 4) Use of ICT in different courses and methodologies and, 5) Use of virtual classrooms and web environments, from which the classroom is transcended, formal and informal education is integrated and the creation of knowledge is made possible collectively at any time and place.

Consequently, the implementation of ICT has implied a broader conception of teachers' professionalism, demanding for its integration, greater doses of planning and work going beyond the mere integration of technologies in educational centers and propitiating true processes of curricular integration of ICT (Cruz Rodríguez, 2019).Digital Competences.

In the course of the last decade, these have been defined by several authors in a more or less homogeneous way, always based on the concept of digital literacy, referred to as the skills needed to manage information and the ability to make decisions regarding ICT (Villaroel and Castaño, 2008).Al respecto, Rangel y Peñalosa (2013) afirman que en el actual contexto se requiere implementar nuevas habilidades, actitudes y competencias, esto en coherencia con el proceso de alfabetización digital en cada uno de los niveles de la educación formal.

In the same sense, the International Society for Technology in Education (ISTE, 2008, cited by García-Valcárcel, 2018) stipulates that digital competencies refer to those that enable the use of digital media and environments to work and communicate to support individual learning and contribute to the learning of others in a collaborative environment.

According to Ocaña et al. (2019), they point out that digital competencies deserve to be understood in the light of a holistic vision that encompasses both knowledge and skills of a technological nature which should be developed as a priority in higher education and should also have a high level of complexity in technological literacy as a support, without losing the functional nature that is defined from the different dimensions that constitute digital competencies.

In this regard, the NETS -National Educational Technology Standards- emerge as the most relevant theoretical reference. Developed by the ISTE (International Society for Technology in Education of the USA), these standards define six dimensions within digital competence (ISTE, 2008): communication and collaboration, creativity and innovation, critical thinking, problem solving and decision making, research and effective location of information, digital citizenship and, finally, ICT operations and concepts. More broadly, Vivancos (2008, cited by Acosta Barros, 2010) highlights six dimensions of digital competencies: cognitive, communicational, collaborative, creative-innovative, axiological-ethical and technological-instrumental. The significance of this approach lies in the fact that it contains those dimensions that would comprise digital competence in the lifelong learning process of human beings. Already in recent studies we find the contribution of Prendes et al. (2018, cited by Guizado et al., 2019) for whom digital competence also presents six dimensions, but it is organized from the operational approach of each dimension: technical, learning, informational and communicative, educational, analytical and social and ethical.

III. OBJECTIVES

ObjectivesGeneral Objective

To analyze the digital competencies of the professors of the faculties of economic sciences of the Higher Education Institutions of Villavicencio.

Specific Objectives

- To characterize the higher education professors of the faculties of economic sciences of the Higher Education Institutions of Villavicencio, according to their level of training and socio-demographic characteristics.

- To identify the digital competencies and their level of development of higher education teachers of the economic faculties of the Higher Education Institutions of Villavicencio.

To analyze relationships between variables that contribute to the design of programs for the management of digital competencies of higher education teachers of the faculties of economic sciences of the Higher Education Institutions of Villavicencio.

IV. METHODOLOGY

A non-experimental, quantitative, descriptive research is carried out, implementing the inductive method, with differentiation and relational elements. The participating population is composed of 107 university professors attached to the faculties of economic sciences of Villavicencio, who filled out the information collection instrument in the format of a digital form of Google Forms, which was sent to their respective institutional e-mails.

Techniques and instruments for collecting information. The instrument Test para Diagnosticar las Competencias Docentes en Saberes Digitales de Profesores en Educación Superior validated by Gazca-Herrera et al. (2020), composed of 38 questions grouped in the following four dimensions, was used:

1. Information: measures the degree of use of available information that can be collected through different specialized databases and search engines.

2. Communication and collaboration: measures the degree of knowledge and use of platforms for communication, the creation of VPAs, programs for digital learning such as blogs and wikis and social networks.

3. Use of digital devices and tools: determines the degree of use and knowledge of platforms, technological means, software and equipment configuration that enhance teaching activities.Content creation: evaluates the level of use of tools for the creation of digital content, as well as the use of specialized software for the transformation of previous knowledge format into new teaching resources.

4. Los resultados obtenidos se analizaron mediante software estadístico SPSS versión 23 para determinar los elementos descriptivos y de asociación de variables.

With the intention of analyzing the degree of appropriation of digital competencies among teachers, the following measurement scale is defined, which allows the degree of appropriation to be placed in five different criteria based on the comparison of means between the variables analyzed, with 1 being the value that indicates a very low appropriation and 4 the value that indicates a high appropriation of the competency.

RESULTS AND DISCUSSION

It is found that the information obtained when validating the instrument applied has been evaluated in its internal consistency and it is concluded that for the instrument used there is certainty of the reliability of the information contained since the coefficient obtained was 0.963. Hernandez and Pascual Barrera, (2018, citing George and Mallery, 2003) recommend as a general criterion for evaluating internal consistency coefficients based on Cronbach's alpha to consider an alpha coefficient < 5 as unacceptable and > 9 as excellent. The following reliability statistics correspond to each of the dimensions evaluated.

Tabla 1.
Escala de Interpretación

Desde	Hasta	Criterio	Grado de apropiación de la competencia
1,000	1,890	Muy malo	Muy baja
1,900	2,600	Malo	Baja
2,610	3,170	Regular	Media
3,180	3,630	Bueno	Media alta
3,640	4,000	Muy bueno	Alta

Nota: *Elaboración de los autores*

Characterization of participating teachers

It is identified that 64.5% of the research participants are male professors, on the other hand, it is found that 60.7% of the professors are in a master's degree training and it is observed that 66.4% of the professors have full-time dedication in their teaching work, the above, keeps explanation in the parameters of the quality conditions for obtaining, This is explained in the parameters of the quality conditions for obtaining, updating and transformation of the qualified registration of higher education programs defined in resolution 021795 of November 19 of the Ministry of National Education, which explains that higher education

Tabla 2.
Confiabilidad del instrumento en general y por dimensiones evaluadas

Elemento	Alfa de Cronbach	N Ítems
1. Información	0,881	12
2. Comunicación y Colaboración	0,900	8
3. Uso de Herramientas Digitales	0,888	9
4. Creación de Contenidos	0,931	9
Confiabilidad Instrumento aplicado	0,963	38

Nota: *Elaboración de los autores*

institutions, when striving for the quality of academic programs, generally hire professionals with a master's degree as full-time professors, since this guarantees support for training, academic and scientific activities from a research component.

On the other hand, it is established that 57.9% of the teaching staff is working in public sector HEIs and 66.3% of the teachers are between 18 and 45 years old, being predominant the young adult population group with 41.1% of the total sample participants, while 14.1% corresponds to older adults, i.e. teachers over 60 years old, 1 % corresponds to older adults, i.e. teachers older than 60 years, the above allows inferring that in the HEIs of Villavicencio are mainly teachers whose age range does not directly affect the deepening of the generational digital divide, which is defined by Busquet Duran et al. (2013) as the existing cultural distance between the so-called digital natives and digital immigrants that within the classroom induces a series of conflicts between young people and adults (teachers) that tend to deepen when there are medium or low degrees of appropriation of digital competencies in teachers.

Tabla 3.
Caracterización de acuerdo con el grado de formación y características socio demográficas de los profesores

Elemento		%	Elemento		%
Sexo	Mujer	35,5	Dedicación como profesor	Tiempo completo	66,4
	Hombre	64,5		Hora Catedra	32,7
Ultimo grado de formación	Profesional	3,7		Medio Tiempo	0,9
	Especialista	29,9		18 a 25 años	4,7
	Maestría	60,7		26 a 35 años	36,4
	Doctorado	5,6		36 a 45 años	25,2
Carácter de la IES en que labora	Pública	57,9	Edad	46 a 60 años	19,6
	Privada	42,1		Mayor a 60	14,1

Nota: *Elaboración de los autores*

Digital competencies and their degree of appropriation among professors. The measurement of digital competencies carried out allowed identifying that, among university professors of the faculties of economic-administrative sciences of Villavicencio, the information dimension, is in a medium-high degree of appropriation, while the other dimensions evaluated are in an intermediate degree of appropriation (see Table 4). If it is taken into account that Iordache et al. (2017, cited by Lévano-Francia et al., 2019) mention the relationship that digital literacy has with the way of measuring training processes, it is found that in general terms it is necessary to articulate a teacher training process focused on strengthening the digital competencies of those dimensions that are in an intermediate degree of appropriation, since they are necessary for teachers to be able to skillfully implement ICT in their educational practice, since they constitute the essential variable to guarantee the success of the digital transformation process (Viñals Blanco and Cuenca, 2016).

The competencies with a medium-high degree of appropriation in the information dimension are those related to the knowledge and use of both cloud storage platforms and backup devices, as well as the structured search and management of accurate and timely information. On the other hand, competencies with a medium degree of appropriation are identified as those related to the use and management of specialized search engines, databases and academic-scientific journals. This means that they need to be reinforced in terms of the ability to recognize when information is not truthful, as well as the use of repositories of academic and scientific journals that offer information in optimal digital format

and the ability to filter information from databases to generate reports that can be used later in the creation of content.

Tabla 4.
Grado de apropiación por dimensiones de competencias evaluadas

Competencia	media	Desviación estándar
Dimensión de información	3,238	0,50837
Dimensión de comunicación y colaboración	3,092	0,63746
Dimensión creación de contenidos	3,046	0,73338
Dimensión de uso de herramientas digitales y dispositivos	2,987	0,48015

Nota: *Elaboración de los autores*

In this regard, it was found that teachers have an adequate level of knowledge about anti-plagiarism web applications and bibliographic managers designed to verify the sources of documents consulted on the Internet, which is a factor to be taken into account in the design of literacy plans, since communication and inquiry skills are considered necessary to strengthen the processes of observation, hypothesis formulation, data systematization, reflection and investigative action, from which it is possible to strengthen the capacity for critical thinking; This allows teachers to deliberate on the validity, veracity and congruence of the information (Gros and Contreras, 2006). In this sense, it is established that the greater the degree of reliability of the information consulted and managed by teachers, the better the quality of the educational content they will be able to create and share with their students.

Tabla 5.
Grado de apropiación de las competencias propias de la dimensión información

Competencia	Media	Desviación estándar
• Conozco plataformas de almacenamiento en la nube	3,495	0,6919
• Reúno información digital necesaria de páginas de Internet para su uso en actividades académicas	3,449	0,6179
• Utilizo plataformas de almacenamiento en la nube	3,411	0,7885
• Conozco las herramientas en línea apropiadas para la búsqueda de información veraz y oportuna.	3,402	0,6849
• Almaceno información, documentos, trabajos o archivos en dispositivos de almacenamiento (Discos Duros, Memorias USB, Unidades CD)	3,374	0,8187
• Hago copias de seguridad de documentos e información personal de diferentes dispositivos (Respaldos)	3,336	0,7884
• Conozco la manera de realizar búsquedas estructuradas para localizar información	3,290	0,7139
• Uso de motores de búsqueda de información especializados	3,121	0,7231
• Obtengo información de bancos de datos	3,112	0,8279
• Reconozco cuando la información no es verídica	3,112	0,7439
• Utilizo colecciones de revistas académicas - científicas que brindan información digital de calidad	2,981	0,8239
• Filtro información de bancos de datos para generar reportes	2,776	0,9839

Nota: *Elaboración de los autores*

The competencies with a medium-high degree of appropriation in the communication and collaboration dimension are those related to knowledge of platforms for the creation of virtual learning environments, social networks and other virtual environments that allow interaction with other teachers

and students. As for the competencies of this dimension that have an intermediate degree of appropriation, those related to the use of interaction resources within the classroom (blogs and wikis) and social networks stand out, and the competency associated with collaboration in digital learning groups is identified as having a lower degree of appropriation.

Tabla 6.
Grado de apropiación de las competencias propias de la dimensión de comunicación y colaboración

Competencia	Media	Desviación estándar
• Conozco plataformas virtuales para la comunicación	3,449	0,6900
• Utilizo gestores de contenidos como MOODLE, como plataformas de aprendizaje.	3,449	0,7553
• Conozco las redes sociales y le permiten relacionarse con compañeros y estudiantes	3,355	0,7429
• Utilizo entornos virtuales para generar mensajes multimedia para la comunicación.	3,252	0,7659
• Uso las redes sociales como recurso dentro del aula	2,991	0,8741
• Conozco programas para el aprendizaje digital	2,953	0,8836
• Utilizo programas para el aprendizaje digital	2,673	0,9191
• Colaboro en agrupaciones de aprendizaje digital	2,617	0,9775

Nota: *Elaboración de los autores*

Based on the proposal of Marques Graells (2008) who points out that the role of teachers is not so much to teach as to learn to learn and to unlearn in order to relearn autonomously within the framework of a culture of change, in order to promote their personal and cognitive development through critical and applicative actions using ICT to transform information into knowledge, It makes sense to establish that, in order to make way for this transformation, it is necessary to promote the use of collaborative platforms, because although it is true that there is a high degree of knowledge of these resources, their implementation in teaching scenarios is certainly limited, as indicated by the intermediate degree of appropriation identified. An example of this is that only one third of the professors handle with a high degree of appropriation the competence associated with collaboration in digital learning groups, which opens the door to the debate about the need to implement these collaborative scenarios within HEIs in an organic manner.

One way to strengthen this competence is to include in the work plans of university professors an area of development associated with the creation of Knowledge Networks that lead, on the one hand, to the socialization of information relevant to each teacher's area of performance and, on the other, to the collaborative construction of knowledge among heterogeneous teaching and learning communities within the framework of principles such as the active participation of community members, the development of discussion groups, collaborative learning and exchange among peers or with experts (Bustos Sánchez and Coll Salvador, 2010). The importance of these communities lies in their contribution to the creation of spaces where issues related to teaching can be echoed, shared and discussed by other actors involved in the educational process.

Regarding the evaluation of the competencies related to the knowledge and use of platforms, technological means, software and configuration of equipment that improve teaching activities, the competencies associated with the knowledge and use of computer equipment, Smartphone among other devices and their configuration and linkage with each other were identified with a high degree of appropriation, while the competencies associated with the identification, use and configuration of VPA and cloud collaboration as well as the management of digital platforms for group work with messaging

showed a medium-high degree of appropriation. However, in this dimension there is still a low degree of appropriation in the use of software relevant to research environments such as statistical analysis, which is a critical indicator to diagnose the ability to analyze statistical information, which is one of the key competencies today in the labor market for professionals in the area of knowledge of economic and administrative sciences, since, as Espinoza and Fernández (2014) indicate, it is currently common in the training processes associated with statistics to work with large volumes of data, which through the use of statistical software, allow students to develop the ability to reason in situations of uncertainty and make inferences to make decisions based on such data, which, as the authors point out, are not simply numbers, but numbers in a context.

Tabla 7.
Grado de apropiación de las competencias propias de la dimensión de uso de dispositivos y herramientas digitales

Competencia	Media	Desviación estándar
• Empleo aparatos portátiles tales como computadoras, Smartphone, Tablet.	3,841	0,4376
• Identifico los diversos puertos de entrada y salida de un equipo de cómputo	3,785	0,4562
• Identifico las herramientas para la gestión de carpetas y archivos.	3,617	0,6679
• Utilizo las herramientas para la administración de carpetas y archivos de manera local	3,579	0,6735
• Configuro dispositivos periféricos de la computadora (proyectores, impresoras y audio etc.)	3,570	0,6883
• Trabajo en ambientes de aprendizajes y colaboración en la nube.	3,308	0,8289
• Empleo plataformas digitales de trabajo grupales con mensajería	3,262	0,8505
• Uso de gestores bibliográficos	2,972	0,8737
• Uso de software para análisis estadístico	2,561	1,0567

Nota: *Elaboración de los autores*

In this regard, it should be noted that this type of software requires annualized licenses, a component that limits access to this type of resources for both teachers and students. Furthermore, it should be taken into account that not all teachers practice research on a permanent basis, this being the main reason why teachers with doctoral training stand out with a high degree of appropriation in the use of statistical software, since their activity is fundamentally investigative due to their intention to conceive new knowledge.

Regarding the dimension that concentrates the competences related to the creation of contents from the use of software for the transformation of previous knowledge format into different educational resources, as well as the implementation of tools for the creation of digital contents, it is observed that they are generally in an intermediate degree of knowledge and in a low degree of appropriation, particularly because the potential offered by the use of these tools to present curricular contents in an innovative way does not seem to be significant for the teaching staff. It is concluded that, although it is true that there is an important degree of knowledge of platforms, tools, software and devices, it is required to enhance the use of these in the framework of the creation of virtual learning environments AVA with content appropriate to each training context, especially from an investigative approach that results in the creation of new knowledge from the transformation of the format of knowledge appropriated by university professors.

In this regard, Moya (2013) stresses the importance of promoting this competence, since the classification, selection of digital content and methodologies is the platform on which the teaching-learning

process will be based, so that the teacher must also be competent in the use of information, with respect to the digital competence that will be used every day in the classroom, thus assuming a constructivist, collaborative, and cooperative character, not only with other academic peers but also with the students themselves. The results of a study that shows that teachers who are better prepared technologically use ICT more frequently, implement more changes and raise competence in students (Pozuelo, 2014, cited by Zempoalteca Durán, et al, 2017).

Tabla 8.
Grado de apropiación de las competencias propias de la dimensión de creación de contenido

Competencia	Media	Desviación estándar
• Uso software para hojas de cálculo aplicando formulas y formatos	3,196	0,8735
• Adapto contenidos de investigaciones en archivos para el aprendizaje del estudiante	3,187	0,7664
• Uso software para presentaciones multimedia	3,112	0,9042
• Utilizo investigaciones para generar nueva información	3,112	0,8048
• Elaboro recursos multimedia para su uso en el aula	3,103	0,8788
• Utilizo conocimientos adquiridos previamente para poder emplearlos en formatos multimedia	3,028	0,9562
• Uso software de procesadores de texto para el diseño de contenidos	2,972	0,9261
• Conozco el software que le permite visualizar y reproducir archivos en diferentes formatos	2,860	1,0136
• Creo y edito contenido multimedia (Audios, Videos, imágenes, textos)	2,841	1,0829

Nota: *Elaboración de los autores*

Relationship between the most significant variables found in the study

A descriptive comparison of the findings of the most significant socio-demographic variables with the dimensions evaluated yields the following results:

With respect to the dimension of use of digital devices and tools, it is established that the degree of appropriation of these competencies is at an intermediate level among all teachers, regardless of the institution in which they work. On the other hand, it is found that the dimensions of information, communication and collaboration and content creation have a medium-high degree of appropriation among professors working in private sector HEIs, while among professors working in public sector HEIs these dimensions have an intermediate degree of appropriation. The above allows inferring that there is a differentiated situation between public and private sector HEIs in the municipality in terms of digital literacy processes for teachers of economic-administrative faculties, which inevitably affects the learning processes of students in the academic programs of each institution, being this a factor that may affect the degree of appropriation of knowledge taught in digital environments.

Tabla 9.
Comparativo entre IES por dimensiones

Carácter de la IES	Dimensión de información	Dimensión de comunicación y colaboración	Dimensión de uso de dispositivos y herramientas digitales	Dimensión creación de contenidos
Pública	3,124	2,923	2,853	2,932
Privada	3,396	3,325	3,170	3,202

Nota: *Elaboración de los autores*

In this sense, knowledge management based on ICT should start from a prioritized approach to the design of literacy plans appropriate to the context of each university institution, considering that this process leads both teachers and students to develop and use the skills and competencies acquired to create a teaching process in which meaningful learning is strengthened (Morales Espíndola et al., 2020).

It is found that the university professors who are best technologically trained are those whose last degree of training is professional, since they have a medium-high degree of appropriation in all the dimensions evaluated and reflect a high degree of appropriation of the dimension that groups the competencies associated with the creation of contents, while the professors whose last degree of training is a doctorate have a medium-high degree of appropriation in all the digital competencies, highlighting with a high degree of appropriation the group of competencies associated with the dimension of information. This can be explained by the fact that teachers with a professional degree have recently graduated from their academic program, which is why they have had the opportunity to be trained in a context permeated by ICT, while teachers with a doctoral degree have been forced to update their digital competencies given the research approach required by the doctoral degree.

Tabla 10.
Comparativo último grado de formación por dimensiones

Último grado de formación:	Dimensión de información	Dimensión de comunicación y colaboración	Dimensión uso de dispositivos y herramientas digitales	Dimensión creación de contenidos
Profesional o licenciado	3,479	3,500	3,250	3,667
Especialista	3,214	3,059	3,010	3,194
Maestría	3,197	3,071	2,923	2,882
Doctorado	3,653	3,229	3,370	3,611

Nota: *Elaboración de los autores*

With respect to those with specialist training, there is evidence of a medium-high degree of appropriation in the information and content creation dimensions, an intermediate degree in the collaboration dimension as well as in the use of digital devices and tools, while in the master's degree, only the digital competencies of the information dimension are found in a medium-high degree of appropriation, since the other dimensions reflect an intermediate degree of appropriation. Accordingly, it is valid to point out that a higher degree of education is not necessarily related to a higher degree of appropriation of digital competencies. In this sense, it is appropriate to point out that it is the teachers with specialization and master's degrees who require a more significant concentration of resources and time in their digital literacy processes in order to improve their performance, appropriation and adequate development with respect to the dimensions of the digital competencies evaluated, to the extent that the determining characteristics of successful teachers are not only a broad compilation of pedagogical skills, as well as a vast mastery of the subject, but also an appropriate use of technological tools in their academic and research work (Arenas Castellanos and Fernández de Juan, 2009).

When crossing the grouped age variable with the evaluated dimensions, it is found that young teachers and those between 46 and 60 years of age have a medium-high degree of appropriation of the information dimension, while those between 36 and 45 years of age and those characterized as older adults have an intermediate degree of appropriation. On the other hand, it is found that teachers cha-

racterized as young adults have a medium-high degree of appropriation of the competencies of the communication and collaboration dimension, while teachers over 36 years of age and older have an intermediate degree of appropriation.

Tabla 11.
Comparativo Edad agrupada por dimensiones

Edad agrupada	Dimensión de información	Dimensión de comunicación y colaboración	Dimensión uso de dispositivos y herramientas digitales	Dimensión creación de contenidos
18 a 25 años	3,583	3,400	3,178	3,356
26 a 35 años	3,359	3,253	3,162	3,148
36 a 45 años	3,127	2,972	2,893	3,004
46 a 60 años	3,321	3,095	2,931	3,021
Mayor a 60 años	2,894	2,783	2,711	2,785

Nota: *Elaboración de los autores*

Regarding the dimension of use of digital devices and tools, it is found that regardless of the age of the teachers, the degree of appropriation is intermediate, and regarding the dimension of content creation, it is evident that only young teachers have a medium-high degree of appropriation, being a constant for teachers older than 26 years the intermediate degree. With this, it is shown that, although the age of teachers is a factor that has an important impact on the deepening of the so-called generational digital divide, the current context of access to ICT raises as a possibility the fact that teachers can acquire and master digital skills at any time of their career demonstrating the adaptability of teachers who have been in their mission for years and how they determine their suitability for their work, and that this allows them to have merits to obtain more rewards in the future (Bokek - Cohen, 2018, cited by Lévano-Francia et al. , 2019). In this regard Rangel and Peñalosa (2013) mention that it is necessary the appropriation of digital skills in high degree that provide the teacher with the ideal use of ICT that will achieve a significant performance regarding digital competencies, this implies the timely validation of the knowledge acquired after the implementation of digital literacy processes designed for each group of teachers.

When performing the significance analysis through the Anova test in the SPSS software of the variables evaluated descriptively above, it is found that there is no significant difference between teachers who work in private sector HEIs and those who work in public sector HEIs in terms of the degree of appropriation of the dimension of content creation. On the other hand, it is observed that regardless of the last degree of training of the teachers, the dimensions of information, communication and collaboration; use of digital devices and tools do not show significant differences, while the dimension of content creation shows differences in its degree of appropriation depending on the degree of training of the teachers, with recent graduates and teachers with a doctorate having the highest degrees of appropriation in this dimension. Finally, with respect to age, it is established that the dimensions of communication and collaboration and content creation do have significant differences depending on the age range of the teachers, which is explained in detail in the following correlation table.

Pearson's correlation test identified a negative correlation between the variable age and the dimensions of information, communication and collaboration, and the use of digital devices and tools, which allows inferring that the older the teachers are, the lower the degree of appropriation of the competencies of these three dimensions. The above shows the existence of a scenario in which teachers who

Tabla 12.
Grado de significancia entre variables y dimensiones evaluadas

Variables	Dimensión de información	Dimensión de comunicación y colaboración	Dimensión uso de dispositivos y herramientas digitales	Dimensión creación de contenidos
Carácter de la IES	0,006	0,001	0,001	0,059
Último grado de formación	0,145	0,563	0,098	0,01
Edad Agrupada	0,008	0,084	0,013	0,461

Nota: *Elaboración de los autores*

are part of the group of older adults will possibly resort to a lesser extent to the use of ICT in their teaching-learning processes than young teachers, based on the fact that the former, having a lower degree of appropriation of digital skills, will tend to avoid their use consciously or unconsciously, in the face of this, digital literacy processes for teachers emerge as the effective way to counteract this situation, which must necessarily go hand in hand with the construction of an educational model, involving the teaching-learning processes, the higher education institution, students and teachers, given that the teacher by acquiring technological competencies will tend to transform the traditional forms of teaching that have been used so far, generating changes in effective and novel didactic strategies (Cruz Rodríguez, 2019).

Tabla 13.
Correlación entre las variables de edad y año de graduado con respecto a las 4 dimensiones (Rho spearman)

Variable	Dimensión de información	Dimensión de comunicación y colaboración	Dimensión de uso de dispositivos y herramientas digitales	Dimensión creación de contenidos
Edad	-.269**	-.261**	-.314**	-0,190
Año graduado	.218*	.275**	.240*	0,190

Nota: *Elaboración de los autores*

On the other hand, it is identified that there is a positive correlation between the year of graduation variable, which refers to the date of obtaining the professional degree by the teachers and the mentioned dimensions, which indicates that the less recent the date of obtaining the professional degree by the university teachers, the lower the degree of appropriation of the competences of these dimensions, This is also a determining factor when defining possible training plans for teachers to improve digital competencies, since this, together with the finding on the degree of appropriation of digital competencies according to age, defines the starting point of the learning path that higher education institutions should adopt to promote the acquisition and improvement of those digital competencies that are appropriate to the university educational context.

V. CONCLUSIONS

As a key element, a process of digital literacy of the professors of the economic-administrative faculties of the IES of Villavicencio is necessary, the training in competences of the dimensions of communication and collaboration, use of digital tools, with the creation of contents, which are found in an intermediate degree of appropriation among the professors participating in the research. Likewise, the competencies associated with the information dimension, although they are at a medium-high degree of appropriation, need to be reinforced in what has to do with the ability to identify the veracity of the information obtained through different digital media.

This digital literacy process needs to be designed in a differentiated manner according to the age range of the teachers and their level of training since, as demonstrated, these two variables are directly related to the degree of appropriation of the different digital competencies; additionally, it should focus mainly on those competencies related to the use of software for statistical analysis and content creation, which showed an average degree of appropriation of 2.541 and 2.841 respectively, being the lowest values recorded among all the competencies evaluated.

The above is relevant considering that in the context of the Covid-19 pandemic, the university teacher has been playing a role not only as a knowledge manager and as a guide in the teaching-learning processes, but also has gradually assumed the role of producer of educational digital content in a wide range of formats (blog, activity or interactive exercise in AVA, Web site, podcast, among others). In this context, the use of software related to the research context for the analysis of large volumes of data as well as the implementation of tools for the creation of educational content in multiple formats by university teachers becomes important, which could mean an evolution in methodological terms since the teacher will be facing the possibility of accessing those metrics of digital content (views, interaction, comments) that make measurable the degree of acceptance or rejection by the audience (as it is conceived today in the lexicon of content creators of different digital media).

Extrapolating this scenario to the context of the economic faculties of the HEIs of Villavicencio, it is possible to glimpse that a digital literacy plan can be the catalyst for a process that places teachers in the ability to collect, organize and interpret the data generated in digital environments and based on their analysis within the framework of the curriculum of each academic program, to be able to develop appropriate digital content for each subject in the formats with the best indicators of relevance and interaction obtained in each experience of use with students, thus turning digital competencies into the pillar of a student-centered teaching-learning process that will require, of course, to assume the challenge of rethinking the teaching practice and from this, to design dynamic, attractive and interactive content that respond to the new forms of communication of young people of the XXI century.

There is a need to create training plans for teachers focused on deepening the digital knowledge they have and focus them on the competencies associated with the dimension of content creation, which is the one that reflected the lowest degree of appropriation after the research, since the preparation in digital competencies of teachers is a key component in promoting the methodological transformation in the teaching work.

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