RICHTMANN PUBLISHING

Research Article

Relationship Between Digital Competencies and Critical Thinking: A Review of the Scientific Literature from 2015 to 2022

Karla Mavel Bolo-Romero[1]

Flavio Gutiérrez-Velasco[1]

Helí Alejando Córdova-Berona[2]

Sofía Almendra Alvarado-Suyo[3]

[1]Universidad Femenina del Sagrado Corazón,
Av Los Frutales 954, La Molina 15023, Peru
[2]Universidad Privada del Norte,
Av Retablo 570, Comas 15314, Peru
[3]Universidad Anáhuac, Av. Universidad Anáhuac 46,
Lomas Anahuac, 52786 Lomas Anáhuac,
Mexico

Abstract

The objective of this research was to develop a systematic review of the scientific literature between 2015 and 2022 on the relationship between digital competencies and critical thinking. In the methodological aspect, the PRISMA methodology was taken as a starting point, having chosen the Scielo, Scopus, Ebsco, and Eric databases, in English and Spanish. Neither language nor place was considered an element of exclusion. As for the results: out of 30 sources, 13 correspond to Spain with 8 publications, the rest to different countries; 18 in Spanish and 12 in English; the greatest number of publications have been in 2021 with 11; a third part has been published in SciELO; the predominant methodological approach is quantitative; 60% have an indirect relationship between the two categories; and in terms of linkage, 56% contribute to improving learning. In the discussion and conclusions: it is in Spain that there is the greatest concern for publications of this type, so most are in Spanish; it is inferred that the highest peak is 2021 due to the pandemic; the majority quantitative approach is due to the preference for quantifiable statistical data especially for the digital competencies category; the indirect relationship between the two categories is because both have different methodologies; and finally the ability for digital competencies significantly improve learning and contribute to providing solutions to different learning situations.

Keywords: digital competencies, critical thinking, learning, COVID-19, problem-solving

1. Introduction

The rise of technology has had a significant impact on every aspect of human development, especially in education. This is most noticeable in the teaching and learning processes at all levels of education.
    In addition, the COVID-19 pandemic has been an important factor that has contributed to the

influence of technology on teaching and learning processes. This impact has caused users (teachers and students) to develop the necessary competencies for its use.

However, to use the tools coming from technologies focused on learning and developed in digital competencies, it is necessary to start from criteria that help to discern the best use that can be made of them, these criteria do not come from pedagogy, but from critical thinking. These criteria do not come from pedagogy, but from critical thinking, which generates an adequate context for the correct use of technologies for learning. Thus, critical thinking and digital competencies are closely linked and it is the task of this research to find these links.

On the contrary, what does it mean to develop technological competencies? It means acquiring deep knowledge and a constant and efficient adaptation to the management of technology (Bernate et al., 2021; Harris, 2021). In other words, it is not just a matter of using the tools sporadically or for basic issues, but using them efficiently in different tasks, the same ones that favor the learning experience.

Competencies such as computerization and information literacy, communication and collaboration, and problem-solving are considered vital for learning development, while digital content creation and computer security are not highly valued (Martínez-Garcés & Garcés-Fuenmayor, 2020). As can be seen, there are two marked aspects in the use of technologies: the first is oriented to their use, developed in different ways; and the second is oriented to creation and security, which has not been prosperous, as it demands greater demands in more specific aspects.

When addressing the first dimension in the use of technologies, it is observed that there is a particular level of reflection on the part of the students (De la Portilla Maya et al., 2019). There is the ability to choose the tools they need to generate their learning. To this extent, it can be said that there are four orientations: first, those who learn from individual digital resources; second, those who are oriented from participation in videoconferences; third, those who work in collaborative environments; and fourth, self-learning, those who use multiple resources such as web, blogs, and articles (Suárez-Guerrero et al., 2021).

The development of these digital skills generates positive aspects in the academic life of students and provides them with better performance (García Prieto, 2022), The use of these tools allows them to reach the learning objectives in less time and, at the same time, to achieve the expected knowledge optimally. On the teachers' side, greater difficulties are observed when it comes to technology safety and lesser difficulties in problem-solving skills (Sánchez Trujillo & Rodríguez Flores, 2021). It can be said that they are more successful in those oriented to design evaluation systems incorporated in mobile devices and applications since these tools generate an immediate feedback process (Rodríguez-Hoyos et al., 2021; Suyo-Vega et al., 2022).

This means that the use of technology in learning is not only benefiting students but also teachers. For them to achieve their learning, they need to use them efficiently. Thus, the teacher's learning to use technology and prepare class sessions is reflected in the student's use to capture the information developed by the teacher. In this sense, it can be affirmed that there is a synergy between teachers, technology for learning, and students.

Therefore, the benefits of the use of technology for learning generate a greater predisposition for its use, both in students and teachers. In the latter, it is observed that they have a direct influence on their digital competencies. (Sánchez Campos, 2016).

Now, at the beginning of these lines, reference was made to the link between digital competencies and critical thinking, and after emphasizing the former, it is time to refer to critical thinking.

Critical thinking is important in the development of problem-solving thinking and learning-focused decision-making (Cabero-Almenara et al., 2022). Thus, when students need to use certain digital tools, they are faced with situations that force them to make decisions about the use and management of that tool, which can lead them to a good path or, in the worst case, to fall behind. To this extent, critical thinking will generate improvements in the processes of inquiry and understanding for adequate decision-making on the technological tool to use (Potzsch, 2019).

As can be seen, critical thinking provides a north to the use of technology, which is put into practice in digital competencies. Now it should be considered that digital competencies are developed in online environments, while critical thinking requires another type of dynamic, it needs face-to-face environments to develop much better, because direct contact with the other generates an emotional impact that produces a significant learning in the student's consciousness (Dmitrievich, 2021).

Finally, after the presentation of these elements and some ideas that link them, the problem of their relationship arises, especially how this is presented, since, from the literature reviewed, it is clear that there is a relationship, but it is not presented how this linkage is shown. Therefore, the objective of this systematic literature review will be to expose the main ideas linking digital competencies and critical thinking in the sources published between 2015 and 2022.

2. Methodology

The strategy used in this review is based on the adaptation of the PRISMA [Preferred Reporting Items for Systematic Reviews and Meta-Analyses] methodology, as it can be applied to different types of meta-analysis of research texts and not only to clinical analyses (Urrutia & Bonfill, 2010). Based on this methodology, we have chosen the databases for the search of the sources for this research and established the inclusion and exclusion criteria used to choose the sources with which this systematic review was carried out.

Concerning the information search process, four international access databases were considered: Scopus, Ebsco, Eric, and Scielo.

To find the required information, first of all, the following search formula was used to find the information required:

(Digital competency) and (critical thinking)

To complete the information selection process, the terms were broadened to focus on a wider spectrum, the formula was:

(critical thinking) and (digital literacy) or (communication and collaboration) or (digital content creation) or (digital safety) or (problem-solving)

(Critical thinking) and (digital content creation)

Secondly, for the SciELO search process, given its regional origin, only the Spanish search formula was considered.

"Competencia digital" y "pensamiento crítico"

"pensamiento crítico" y "alfabetización digital"

"pensamiento crítico" y "comunicación y colaboración"

"pensamiento crítico" y "creación de contenido digital"

From these search equations, the year was established as the first exclusion, in that sense, 2015 and 2022 were established as an interval since a greater age could lead the research to collect information that is not very relevant to meet the objectives that follow. On the other hand, it was taken into consideration, in the context of the research units that are the subject of this study, that it should be presented in the university environment so that the study would focus exclusively on the relationship between critical thinking and digital competencies in higher education classrooms.

On the other hand, to include the texts in the research, they should have both critical thinking and digital competencies or some of their dimensions as fundamental elements. In this sense, we did not consider texts that only had one of the research units or one of its dimensions; both needed to be present.

Finally, neither language nor place was considered an element of exclusion to be able to cover as many sources as possible.

Therefore, the information obtained was as follows:
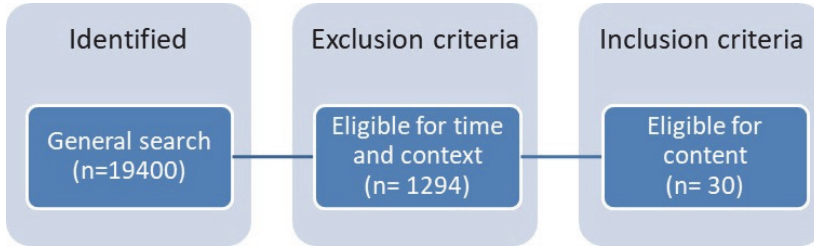
3. Results

After the search process in the four digital databases used (Scopus, Ebsco, Eric, and Scielo), based on the search equations and having considered the exclusion and inclusion criteria mentioned above, 30 sources were obtained, from which the following results were obtained:
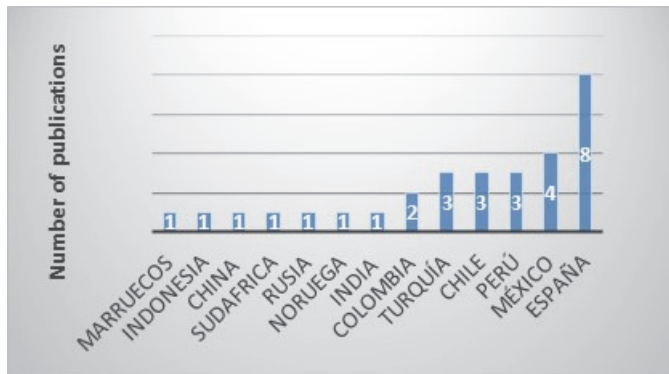

Figure 1: Countries of publication

Figure 1 shows that, of the 30 publications that relate the variables digital competencies and critical thinking, 8 are produced in Spain, while in countries such as Mexico, Peru, and Chile, 3 each. And in countries such as India, Russia, Indonesia, etc., it is only 1, for each country.
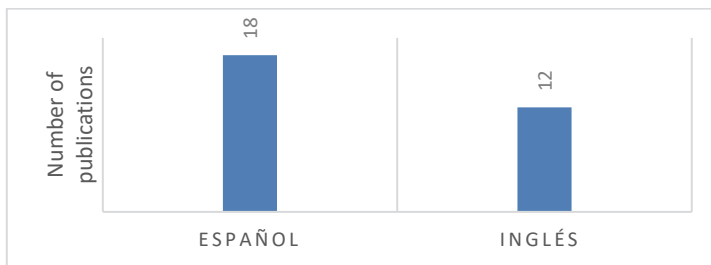

Figure 2: Language of publication

Figure 2 shows that, of the 30 publications that relate the variables of digital competencies with critical thinking, 18 are written in Spanish, while 12 are in English.
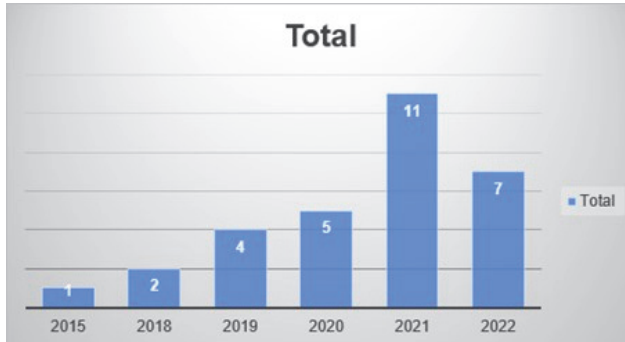
Figure 3: Year of publication

Figure 3 shows that, of the 30 articles that relate the variables of digital competence and critical thinking, 12 of them were published in 2021. Between 2015 and 2021 the production was increasing; however, 2022 has decreased.
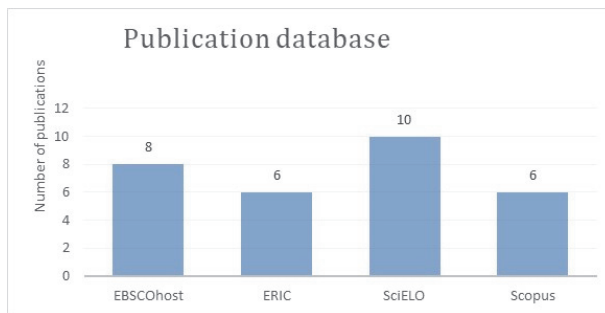

Figure 4:

Figure 4 shows that, of the 30 publications considered in this research, one-third (10) correspond to the SciELO database, while 8 correspond to EBSCOhost and 6 to both ERIC and Scopus, which indicates that the database where most of this type of research is published in SciELO.
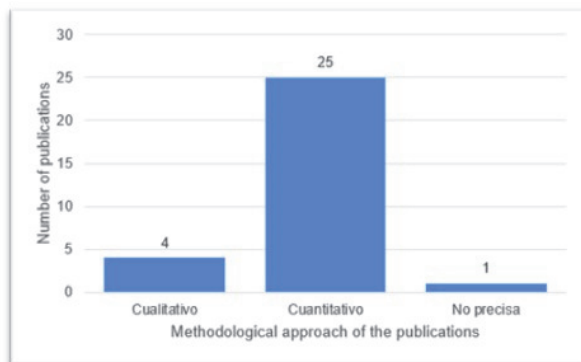

Figure 5: Methodological approach to publications

Figure 5 shows that, of the 30 publications, 25 have a quantitative approach and only 4 have a qualitative approach, as well as one in which it is not specified, which reveals that research on digital competencies and critical thinking is quantitative.
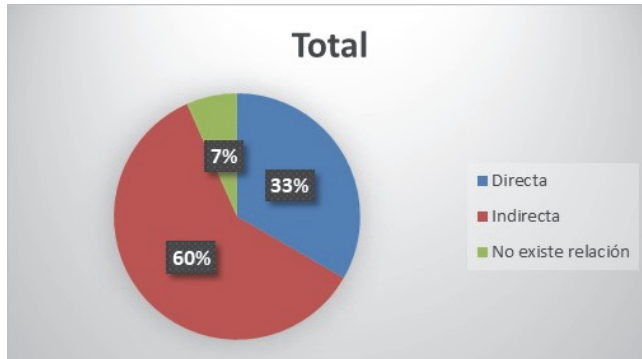

Figure 6: Relationship between research categories

Figure 6 shows that the relationship between the two categories, digital skills, and critical thinking, is indirect (60%), only 33% is direct and 7% is not precise, which indicates that very few studies show a direct relationship between the two categories.
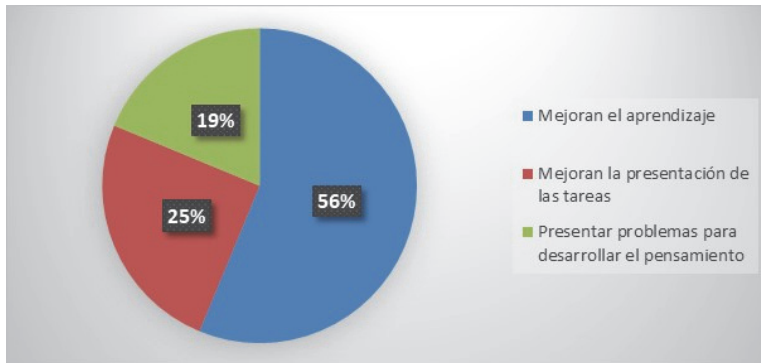

Figure 7: Main linkage elements

Figure 7 shows that the link between digital competencies and critical thinking is based on three elements, the first, and the one with the strongest relationship, is the possibility of improving learning in people who present these competencies, since this link is found in 56% of the sources studied. In second place, the relationship is found in the possibility of improving the presentation of tasks, with 25%, and, in third place, is the possibility of proposing different solutions to problems based on these competencies, with 19%.

4. Discussion and Conclusions

From the systematic review of the articles, it is found that the publication on digital competencies and critical thinking have a higher production in Spain and Mexico (40%); while in countries such as Peru, Colombia, and Chile it is 26%; it is also observed that the publication decreases in countries in

Asia and Europe. From this information, it can be inferred that in Spain there is a greater concern for variables such as digital competencies and critical thinking, as their research shows that since 2015, they have been publishing on these topics.

Concerning language, 60% have been published in Spanish and 40% in English. As shown in Figure 1, Spain and Mexico are the countries with the highest number of publications. From these results, it can be understood that there is a greater concern for topics related to critical thinking and digital competencies in Spanish-speaking countries.

About the year of publication, we have that between 2015 and 2019 the production was only 23%, the same that increased notably in 2020, being the highest peak in 2021 with 36%, for 2022 this production was 23%. It can be understood from this data reading that the pandemic influenced the production on the subject of digital competencies more than critical thinking.

Concerning the database, it can be observed that one-third of the research reviewed comes from SciELO, which shows that there is significant interest, at the Latin American level, in the publication of works that analyze the link between digital competencies and critical thinking. It is also observed that a significant number of these publications are found in EBSCOhost. Concerning the ERIC and Scopus databases, it can be indicated that the publication of papers shows a growing interest in these topics.

About the methodological approach, the main protagonist is the quantitative approach, since 26 of the 30 studies developed it, this is because, traditionally, this approach has been considered more accurate, since the data obtained are statistically measurable, which allows greater objectivity in the information. That is to say, the information that comes from the statistical analysis has been better received by researchers, as they do Cabero-Almenara et al., (2022) by using the partial least squares method to demonstrate the consistency of the variables studied in this research.

However, in recent years the qualitative paradigm has also been gaining importance since the analysis of critical thinking can also be developed from focus groups, as was done by Qablan et al., (2019) who considered the Miles-Huberman model for the analysis of these data, an analysis that allowed them to demonstrate that habits of reflection and questioning are fundamental for the development of critical thinking and digital competencies

One of the very important results found in this research is that the predominant relationship between digital competencies and critical thinking is indirect, equivalent to 60%, while the direct relationship is only 33%. From these lines, it can be deduced that there are very few investigations that find immediate links between these two categories, so digital competencies are more of a technological nature, while critical thinking is more analytical, reflective, critical, and consequently digital competencies are very little directly related to critical thinking. However, it is important to emphasize that adequate use of technologies cannot be purely mechanical, but must contribute to the development of critical thinking, as expressed by Harris (2021). On the other hand, adequate use of technologies should contribute to achieving a certain level of particular reflection by students, an aspect that is highlighted by De la Portilla Maya et al (2019).

The link found between digital competencies and critical thinking in the articles reviewed shows that there are three main characteristic elements: They improve people's learning, they can better develop their tasks and they can problematize different situations from critical thinking. Regarding the first one, the linking of these competencies is of utmost importance, because thanks to the use of the dimensions of critical thinking and technological tools it is possible to achieve that students enhance their knowledge (Bernate et al., 2021; Mshayisa & Basitere, 2021), in addition, considering critical thinking as the axis of the development of thinking it can be achieved that the formative processes of students improve their structures of formal thinking (De la Portilla Maya et al., 2019). As for the second, students improve the development of their academic tasks, since the competencies studied provide them with the necessary technological tools for better time management (Jamila, 2020).

Also, this linkage can be observed in the use of different information synthesis strategies, as indicated by Sirgnano & Moddalena, (2019), who state that for some years there has been a growing

use of concept maps and diagrams, as metacognitive tools used by students to reflect on and manage their knowledge. And thirdly, and no less important, is the relationship that seeks to present solutions to problems of different kinds, especially when it comes to adapting to different learning situations (García Prieto, 2022). This situation is also observed in aspects related to social responsibility since decision-making implies ethical conduct in favor of society, conduct that can have a short or medium-term impact (Barragán Codina et al., 2021).

Finally, the relationship between "digital competencies" and "critical thinking" is linked to the type of approach, since digital competencies have been developed under the quantitative approach and critical thinking is eminently qualitative, which has allowed research and publication in various countries, especially in Spain and Mexico, under the quantitative approach. Regarding the benefits of digital competencies and critical thinking, it can be pointed out that they improve the learning of university students; favor the development of their academic tasks; and allow them to adapt to different learning situations.

References

Arispe Alburqueque, C. M., & Yangali Vicente, J. (2022). Factores personales en la percepción hacia las tecnologías de información y comunicación que influyen en la competencia digital en docentes de posgrado. Revista Electrónica Interuniversitaria de Formación Del Profesorado, 25(1), 105–116. https://doi.org/10.6018/reifop.506921

Barragán Codina, M. R., Barragán Codina, J. N., & Guerra Rodríguez, P. (2021). Impacto de la ética en la toma de decisiones de negocios. Una comparativa internacional. Vinculatégica, 7(1), 1–16. https://doi.org/10.29105/vtga7.1-142

Bernate, J., Fonseca, I., Guataquira, A., & Perilla, A. (2021). Competencias Digitales en estudiantes de Licenciatura en Educación Física. Retos, 2041(41), 310–318. https://doi.org/10.47197/retos.v0i41.85852

Cabero-Almenara, J., Gutiérrez-Castillo, J. J., Guillén-Gámez, F. D., & Gaete Bravo, A. F. (2022). Competencias digitales de estudiantes universitarios: creación de un modelo causal desde un enfoque PLS-SEM. Campus Virtuales, 11(1), 167–179. https://doi.org/10.54988/cv.2022.1.1008

Carrillo-Lopez, P. J., & Hernández-Gutiérrez, A. A. (2022). Competencia digital de los docentes Canarios para atender a la diversidad funcional. Revista Electrónica Interuniversitaria de Formación Del Profesorado, 25(1), 1–17. https://doi.org/10.6018/reifop.496281

De la Portilla Maya, S. R., Dussan Lubert, C., Landínez Martínez, D. A., & Montoya Londoño, D. M. (2019). Diferencias en los Perfiles de Pensamiento Crítico en Estudiantes de un Programa de Medicina. Revista Latinoamericana de Estudios Educativos (Colombia), 15(2), 31–50. https://doi.org/10.17151/rlee.2019.15.2.3

Dmitrievich, Z. M. (2021). Вузовская философия: требуется перезагрузка. Высшее Образование в России, 30(10), 99–107.

García Prieto, F. J. (2022). Competencia digital del alumnado universitario y rendimiento académico en tiempos de COVID-19. Pixel-Bit, Revista de Medios y Educación, 64, 165–199. https://doi.org/10.12795/pixelbit.91862

Generale, P., Suor, S., Benincasa, O., Corresponding, N., Suor, S., Benincasa, O., & Corresponding, N. (2019). Nuevos horizontes de la Pedagogía contemporánea 1. 6981, 451–463. https://doi.org/10.13128/ssf-10833

Harris, C. (2021). The role of "Rich Tasks" an interdisciplinary and digital approach to learning post-COVID-19. Pixel-Bit, Revista de Medios y Educación, 61, 99–130. https://doi.org/10.12795/PIXELBIT.88209

Jamila, E. haini. (2020). Implementing a Flipped Classroom Structure in Engineering Education to Improve the Soft Skills. Journal of Engineering Education Transformations, 33(3), 75–83.

Martínez-Garcés, J., & Garcés-Fuenmayor, J. (2020). Competencias digitales docentes y el reto de la educación virtual derivado de la covid-19. Educación y Humanismo, 22(39), 1–16. https://doi.org/10.17081/eduhum.22.39.4114

Mehmet, Ş., & Hidayet, D. (2018). Critical Thinking and Transformative Learning. Journal of Innovation in Psychology, Education and Didactics, 22(1), 103–114.

Montenegro, O. J. (2020). La calidad en la docencia universitaria. Una aproximación desde la percepción de los estudiantes. Educación, 29(56), 116–145.

Moreno, B., Muñoz, M., Cuellar, J., Domancic, S., & Villanueva, J. (2018). Revisiones Sistemáticas: definición y nociones básicas Systematic Reviews: definition and basic notions. Revista Clínica PIRO, 11(3), 184–186. https://doi.org/10.4067/S0719-01072018000300184

Mshayisa, V. V., & Basitere, M. (2021). Flipped laboratory classes: Student performance and perceptions in undergraduate food science and technology. Journal of Food Science Education, 20(4), 208–220. https://doi.org/10.1111/1541-4329.12235

Mulle, V. (2018). El desempeño docente en las universidades nacionales de la argentina: un análisis a partir de las evaluaciones institucionales externas. The academic career and the management of periodic assessment of teaching performance in national universities of Ar. RAES, 10(17), 27–40.

Pérez-Escoda, A., Lena-Acebo, F. J., & García-Ruiz, R. (2021). Digital competences for smart learning during COVID-19 in higher education students from Spain and Latin America. Digital Education Review, 40, 122–140. https://doi.org/10.1344/der.2021.40.122-140

Potzsch, H. (2019). Alfabetización digital crítica: tecnología en la educación más allá. Triple C, 17(2), 221–240.

Qablan, F., Sahin, M., & Hashim, H. (2019). Critical Thinking in Education: The Case in Palestine. TIJER: Turquoise Ise International Journal of Educational Research and Social Studies, 1(1), 20–27.

Rahman, M. (2019). Century Skill "Problem Solving": Defining the concept. Asian Journal of Interdisciplinary Research, 2(1), 71–81.

Robillos, R. J. (2022). Impact of LoiLooNote Digital Mapping on University Students' Oral Presentation Skills and Critical Thinking Dispositions. International Journal of Instruction, 15(2), 501–518. https://doi.org/10.29333/iji.2022.15228a

Rodríguez-Hoyos, C., Fueyo Gutiérrez, A., & Hevia Artime, I. (2021). Competencias digitales del profesorado para innovar en la docencia universitaria. Pixel-Bit, Revista de Medios y Educación, 61, 71–97. https://doi.org/10.12795/pixelbit.86305

Sánchez Campos, P. A. (2016). Tomas de decisiones de consumidores y conservadurismo en Costa Rica. Tendencias, 15(2), 1–23.

Sánchez Trujillo, M. D. L. Á., & Rodríguez Flores, A. E. (2021). Competencia digital en docentes de Ciencias de la Salud de una universidad privada de Lima. Educación Médica Superior, 35(1), e2060. http://www.ems.sld.cu/index.php/ems/article/view/2060

Sirgnano, F.M, & Moddalena, S. (2019). inteligencia colectiva, metacognición y cultura digital. Nuevos horizontes de la Pedagogía contemporánea. Studi Sulla Formazione, 22, 451–463. https://doi.org/10.13128/ssf-10833

Suyo-Vega JA, Meneses-La-Riva ME, Fernández-Bedoya VH, Ocupa-Cabrera HG, Alvarado-Suyo SA, da Costa Polonia A, Miotto AI and Gago-Chávez JdJS (2022) University teachers' self-perception of digital research competencies. A qualitative study conducted in Peru. Front. Educ. 7: https://doi.org10.3389/feduc.2022.1004967

Suárez-Guerrero, C., Ros-Garrido, A., & Lizandra, J. (2021). Aproximación a la competencia digital docente en la formación profesional. Revista de Educación a Distancia, 21(67). https://doi.org/10.6018/RED.431821

Toheri, Winarso, W., & Haqq, A. A. (2020). Where exactly for enhance critical and creative thinking: The use of problem posing or contextual learning. European Journal of Educational Research, 9(2), 877–887. https://doi.org/10.12973/eu-jer.9.2.877

Torres Barzabal, M. L., Martínez Gimeno, A., Jaén Martínez, A., & Hermosilla Rodríguez, J. M. (2022). La percepción del profesorado de la Universidad Pablo de Olavide sobre su Competencia Digital Docente. Pixel-Bit, Revista de Medios y Educación, 63, 35–64. https://doi.org/10.12795/pixelbit.91943

Urrutia, G., & Bonfill, X. (2010). Declaración PRISMA: una propuesta para mejorar la publicación de revisiones sistemáticas y metaanálisis. In Medicina Clínica (Vol. 135, Issue 11, pp. 507–511). http://es.cochrane.org/sites/es.cochrane.org/files/public/uploads/PRISMA_Spanish.pdf