

# Latin American Scientific Production on Educational Technology in Scopus, 2010-2019

Ronald M Hernández<sup>1\*</sup>, Juan José Flores-Cueto<sup>2</sup>, Rafael Garay-Argandoña<sup>2</sup>, Renzo Felipe Carranza Esteban<sup>1</sup>, Oscar Mamani-Benito<sup>3</sup>, Josué Edison Turpo Chaparro<sup>3</sup> and Michael White<sup>4</sup>

<sup>1</sup>Universidad San Ignacio de Loyola, Lima, Perú

<sup>2</sup>Unidad de Virtualización Académica, Universidad de San Martín de Porres, Lima, Perú

<sup>3</sup>Escuela de Posgrado, Universidad Peruana Unión, Lima, Perú

<sup>4</sup>Universidad Peruana Unión, Lima, Perú

\*Correspondence to: Ronald M. Hernández, Universidad San Ignacio de Loyola, Lima, Perú, Email: rhernandezv@usil.edu.pe

## Abstract

The study describes the characteristics of publications on educational technology written by authors with affiliation to Latin American institutions, in journals indexed to Scopus during the period 2010-2019. A descriptive and retrospective analysis of 2,165 articles is performed. Latin American scientific production represents 4.9% of world production. Brazil is the country with the highest production, followed by Mexico and Colombia. A large percentage of articles have been published by *Ceur Workshop Proceedings* (United States) as conference proceedings, followed by journals such as *Lecture Notes in Computer Science* (Germany) and *Turkish Online Journal Of Educational Technology* (Turkey). Furthermore, 8.5% of the authors are mainly affiliated with the University of São Paulo - USP, followed by the Federal University of Rio Grande do Sul (3.6%) and the Federal University of Ceará (3.0%). Finally, E-Learning is the study variable that is most researched, regarding educational technology with 20.9%. Therefore, it is necessary to strengthen and stimulate the generation and dissemination of scientific studies by Latin American researchers.

**Keywords:** Latin American; Scientific Production; Educational Technology; E-Learning

## Introduction

In Latin America, education as an object of research continues to be a complex phenomenon, which throughout history, as well as social inequalities and economic deficiencies, has generated the same dissatisfaction in terms of teaching and learning needs (Escribano, 2017). Currently, with the development of technology and information, great transformations have been promoted, including education (Leahy, Holland, & Ward, 2019), so educational institutions have been adapting to this changing scenario as a result of the inclusion of technological systems, resources and strategies (Gray, Diezel, & Steel, 2019).

In a more practical sense, educational technology is understood as any technological medium or resource used as an active component in the learning development process (Ledo & Cruz, 2009), which in a more technical sense implies the fact of incorporating Information and Communication Technologies (ICTs) in the educational process; which, in the environment in which we live is crucial for personalized training (Schmid & Petko, 2019). In this regard, today more than ever the adoption of these tools and resources in training centers is vital if we want to train professionals in all fields of knowledge to meet the demands and needs of society (López, Hernandez-Rangel, Mejía, & Cerano, 2019). However, their integration also implies an arduous process that seeks to innovate the education process and make learning more flexible, individualized and collaborative (López et al, 2019), of course without leaving aside the teacher's capacity, which is vital for integrating it into the classroom (Darling-Aduana & Heinrich, 2018); therefore, the effects it produces in terms of academic performance and behaviour in the classroom are more than interesting and positive (Shi, 2019), especially in the university environment (Bond, Buntins, Bedenlier, Zawacki-Richter, & Kerres, 2020).

In Latin America, the few reports on educational research, educational technology, and health biotechnology show a progressive and significant increase in some countries (Cabrera, 2020; Ferrada, Diaz-Levicoy, Salgado-Orellana, & Puraivan, 2019; Leon-de la O, Thorsteinsdóttir, & Calderón-Salinas, 2018; Murillo & Martínez-

Garrido, 2019); and like other areas of knowledge in this part of the world, Brazil is recognized for its contribution with a 2.36% of publications to Latin American production (Castro-Rodríguez et al, 2019) which between 2010 and 2019 contributed about 5% to world production (Fischman & Ott, 2018; Leon-de la O et al., 2018). However, despite progress as a region, we are still far from comparing ourselves to developed countries. In this regard, one of the reasons might make sense to assume that in this part of the world we still have unresolved problems; this is demonstrated by a study on competitiveness of higher education in four Latin American countries: Argentina, Brazil, Chile and Mexico, which showed serious weaknesses in terms of quality of the higher education system (Lopez, 2016).

In Peru we are not oblivious to this problem, since according to Asmat, Borja, Bernuy, Lizarzaburu, and Morillo (2019) the generation and application of scientific knowledge in the area of Information and Communication Technologies (ICTs) in recent years has also proven to be low compared to the rest of the countries in the region and the world. In view of this, and of what was discussed above, the objective of this research is to describe the scientific production of Latin American countries on the subject of educational technology, based on the publications indexed in Scopus since 2010-2019.

## Method

The retrospective descriptive study considered as a unit of analysis 2165 articles on educational technology, in journals indexed in Scopus, during the period 2010 to 2019 and whose authorship mentions affiliations of Latin American institutions. All types of publication were included in the analysis (see Table 1). In order to search for articles, key words related to educational technology were used in the "Title", "abstract" and "keywords", and it was also considered that they should be included in the controlled vocabulary Thesaurus, such as: "Educational technology", "Programmed instruction", "Educational computing", "Computer assisted instruction", "Educational video", "Educational television", "Electronic learning", "Mlearning", "Online learning", "Mobile learning", "Virtual learning", "Computer assisted learning",

*“Computer assisted teaching”, “Computer managed instruction”.* Learning packages, self-instructional packages and learning kits. We evaluated the frequency of publications per year, author affiliation, section, types and thematic areas of publication and research variables. Each of the publications found was reviewed by choosing those that met the criteria for educational technology research, and each of the documents was examined through a content analysis.

## Results

World production of educational technology is represented by 43,389 (forty-three thousand three hundred and eighty-nine) articles published in the period studied. Latin America represents 4.9% of this production, represented by 2165 articles (see Table 2).

Of the 2165 articles identified in the period studied and according to the inclusion criteria, a sustained increase in publications can be observed since 2015, with 2017 being the year with the highest scientific production (see figure 1).

Brazil is the Latin American country that contributes the most scientific production, representing 2.36% of world production, followed by Mexico, Colombia, Chile and Ecuador with more than 100 publications. There are 05 Latin American countries that have less than 10 publications on educational technology in the period studied (see Table 3).

The authors found 159 Latin American institutions that have been indicated as affiliations, among which the following stand out among the first four: Universidade de São Paulo - USP (n=183); Universidade Federal do Rio Grande do Sul (n=79); Universidade Federal do Ceara (n=64); Universidade Federal de Santa Catarina (n=63), all from Brazil. Finally, we found 130 institutions that have reported less than 20 articles (see table 4).

The Latin American scientific production has been published in 164 types of publications (including journals and conference proceedings). The Ceur Workshop Proceedings stands out, with 103 publications in conference proceedings format and Lecture Notes In Computer Science, a journal with 88 publications. The Revista Brasileira De Enfermagem, is the first Latin American journal with the largest number of publications on educational technology (n=36), followed by the journal Espacios (Venezuela) with 31 publications. There are 148 types of publication that have less than 19 published articles (see table 5).

According to the thematic area of publication types we found that Computer Science is the area with the highest number of publications with 34.4%, followed by Social Science with 26.8%. In addition, the

**Table 1.** Types of contribution of publications on educational technology

Type of contribution	f
Articles	1074
Conference proceedings	926
Reviews	72
Book chapters	65
Notes	10
Letters to the Editor	6
Other section type	12

**Table 2.** Latin American scientific production of educational technology compared with world production

	f	%
World production	43389	100
Latin American production	2165	4.9

**Table 3.** Articles published on educational technology in Latin American countries

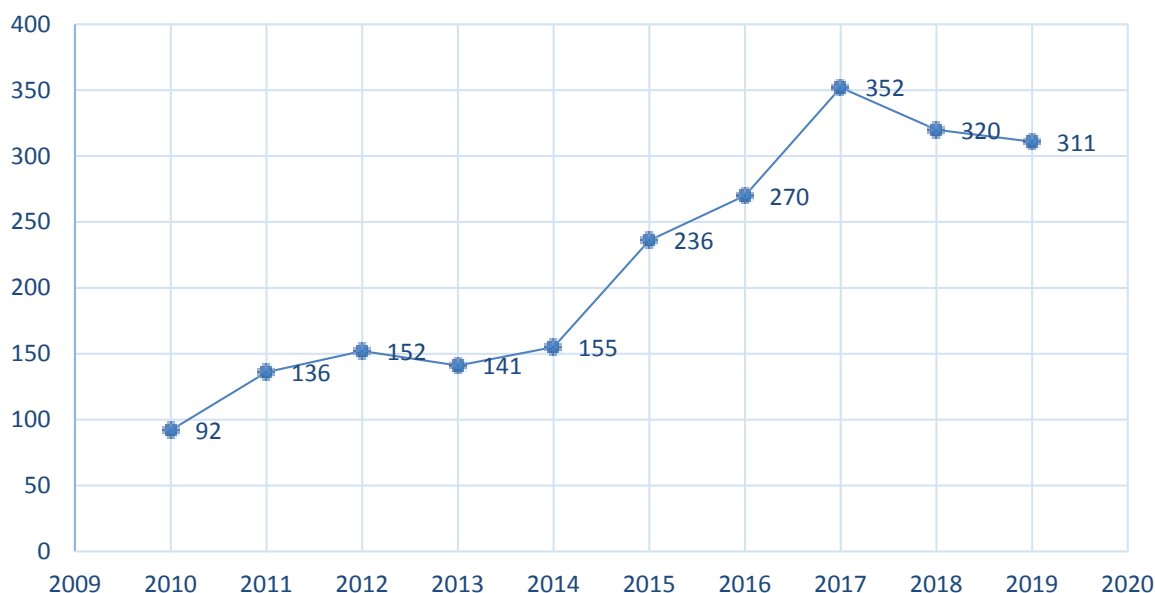
Country	f	% global contribution
Brazil	1025	2.36
México	284	0.65
Colombia	276	0.64
Chile	160	0.37
Ecuador	131	0.30
Argentina	77	0.18
Perú	43	0.10
Guatemala	29	0.07
Cuba	27	0.06
Trinidad and Tobago	20	0.05
Venezuela	19	0.04
Costa Rica	16	0.04
Uruguay	15	0.03
Jamaica	13	0.03
Panamá	12	0.03
Puerto Rico	8	0.02
Dominican Republic	4	0.01
Nicaragua	3	0.01
Honduras	2	0.00
El Salvador	1	0.00

**Table 5.** Types of publications with Latin American authorship on education technology

Afiliación	Country	Articles	%
University of São Paulo - USP	Brazil	183	8.5
Federal University of Rio Grande do Sul	Brazil	79	3.6
Ceara Federal University	Brazil	64	3.0
Federal University of Santa Catarina	Brazil	63	2.9
Monterrey Technologist	México	56	2.6
Federal University of Pernambuco	Brazil	54	2.5
State University of Campinas	Brazil	51	2.4
National University of Colombia	Colombia	51	2.4
Federal University of Rio de Janeiro	Brazil	35	1.6
University of Chile	Chile	34	1.6
Pontific University Católic of Chile	Chile	34	1.6
UNESP-Universidade Estadual Paulista	Brazil	32	1.5
Federal University of Parana	Brazil	32	1.5
Federal University of Rio Grande do Norte	Brazil	31	1.4
Federal University of Minas Gerais	Brazil	30	1.4
National Autonomous University of Mexico	México	29	1.3
Federal University of Sao Paulo	Brazil	27	1.2
University of Brasilia	Brazil	27	1.2
Santa Maria Federal University	Brazil	27	1.2
Federal Institute of Education, Science and Technology of Ceará, Fortaleza	Brazil	26	1.2
Fluminense Federal University	Brazil	25	1.2
Private Technical University of Loja	Brazil	25	1.2
Federal University of Paraiba	Ecuador	24	1.1
Ceara State University	Brazil	22	1.0
University of Cauca	Colombia	22	1.0
Federal University of Sao Carlos	Brazil	21	1.0
Federal Rural University of Pernambuco	Brazil	20	0.9
Federal University of Alagoas	Brazil	20	0.9
Federal University of Piaui	Brazil	20	0.9
Latin American institutions with less than 20 publications		1001	46.2

**Table 5.** Types of publications with Latin American authorship on education technology

Título	Type of publication	Country	H Index	n
Ceur Workshop Proceedings	Conferences and proceedings	United States	42	103
Lecture Notes In Computer Science	Journal	Alemania	324	88
Turkish Online Journal Of Educational Technology	Journal	Turkey	28	76
Proceedings Frontiers In Education Conference Fie	Conferences and proceedings	United States	35	49
ACM International Conference Proceeding Series	C Conferences and proceedings	United States	98	46
Communications In Computer And Information Science	Journal	Germany	40	46
De Enfermagem Brazilian Magazine	Journal	Brazil	18	36
Iberian Conference On Information Systems And Technologies Cisti	Conferences and proceedings	United States	12	35
Spaces	Journal	Venezuela	12	31
De Enfermagem Latin American Magazine	Journal	Brazil	30	28
Journal Da Escola De Enfermagem	Journal	Brazil	25	27
Advances In Intelligent Systems And Computing	Journal	Germany	25	23
Studies In Health Technology And Informatics	Journal	Holland	53	21
Acta Paulista De Enfermagem	Journal	Brazil	18	19
Digital Education Review	Journal	Spain	9	19
IEEE Latin America Transactions	Conferences and proceedings	United States	19	19
Titles with less than 19 publications				1499



**Figure 1.** Evolution of Latin American scientific production on educational technology, 2010 - 2018.

areas of Decision Sciences, Business, Arts and Humanities, Psychology, Health Professions and Multidisciplinary have a percentage of less than 5% (see figure 2).

Taking into account the review of the titles, keywords and summary of the articles found, we have that E-Learning is the study variable with the highest number of publications with 20.9%, followed by Educational Technology and Computer Aided Instruction with 15.8% and 12.8% respectively. The variables with the least amount of publications are Problem-Based Learning and Educational Software with 0.6% each (see figure 3).

## Discussion

The evaluation of scientific production in educational technologies represents one of the most important topics to be analyzed nowadays (Asmat, Borja, Bernuy, Lizarzaburu, & Morillo, 2019). Educational technology has become a central aspect of higher education, inherently affecting all aspects of the student experience (Bond, Buntins, Bedenlier,

Zawacki-Richter, & Kerres, 2020).

Latin American scientific production on educational technology at Scopus is low, however, a growth is observed that is not sustained, but rather reached its highest value in 2017 and then decreased, which is also shown in other research (Cabrera Ramos, 2020) and very similar to the documents found at Scopus on technology and engineering, which reported an increase from 1.5% in 2010 to 26.2% in 2017, followed by a decrease to 16.9% in 2018, of the total documents found between 2010 and 2018. (Ferrada et al., 2019).

The results found confirm previous findings, Latin America's scientific production on educational technology between 2010 and 2019 represents 4.9% of the world production, very similar to the report of total Latin American production which as a whole is 5% of the world scientific production (Fischman & Ott, 2018; Leon-de La O., Thorsteinsdottir, & Calderon-Salinas, 2018). This poor production in educational technology has also been reported in similar bibliometric studies (Cabrera Ramos, 2020).

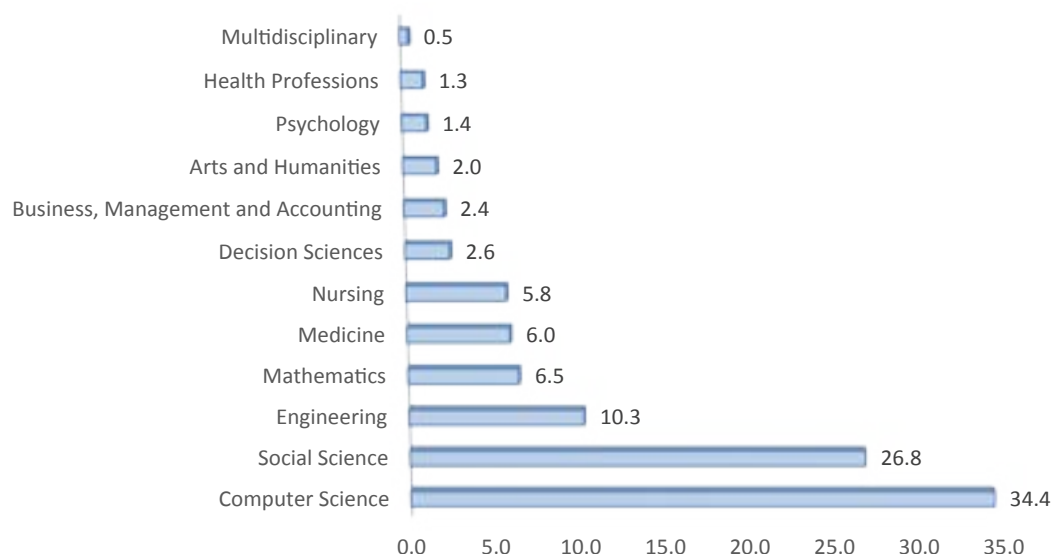


Figure 2. Comparative of thematic area of the journals where educational technology was published.

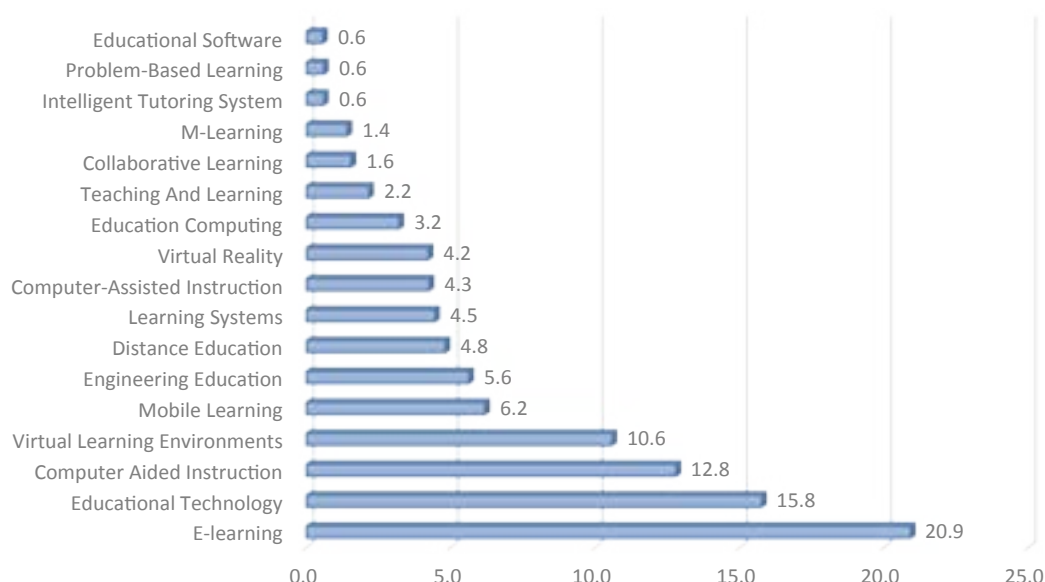


Figure 3. Comparison of published research variables on educational technology

The report shows Brazil as the country that contributes the highest percentage, 2.36%, followed by Mexico, Chile and Colombia. This significant Brazilian production is also observed in other scientific areas (Castro-Rodríguez et al., 2019), which may be due to the fact that Brazil has a higher investment in science and a greater number of researchers per area in Latin America (Leon-de La O. et al., 2018). The case of Ecuador deserves a separate mention, since it has more than 100 articles in this area, which is similar to the total scientific production between 2006 and 2015, reporting an increase in production of 5.16 times. The total production in 2006 was 313 documents, while in 2015 the number increased to 1,605 (Castillo & Powell, 2019).

Among the institutions that show an important production in educational technology belong in their great majority to Brazil, this data is similar to what is reported in other areas such as patents and scientific production of laboratories, where Brazil between 2000 and 2015 showed a growth of 1.14% to 2.42% (Dias & Kannebley, 2019). Throughout Latin America, the majority of institutions published less than 20 articles in educational technology, similarly reported in the area

of educational research between 2014 and 2016, giving the indicator of very low production, less than 20 articles (Murillo & Martínez-Garrido, 2019).

Educational technologies require a series of aspects that Latin America is not yet prepared to provide, so these technologies show weaknesses in the education and university system and a technological gap that needs to be addressed (Fainholc, 2016). Likewise, the data obtained in this research is related to educational technology inclusion for Latin America, where priority should be given to increasing the number of computers connected to the Internet and constantly improving Internet connectivity (Almenara & Ortiz, 2019).

Another important data is the type of publication, which taking into account the area of educational technology that belongs to the engineering field, are the Proceedings or minutes of conferences that mainly reflect the scientific production in the engineering field (Ferrada et al., 2019; A. M. Rodríguez-García, Trujillo Torres, & Sánchez Rodríguez, 2019), which for some researchers would not be

considered as original publication or that a Web of Science publication would have a triple weight compared to a proceeding (Coccia, 2017).

The thematic results of greater scientific production for Latin America were about E-learning and education technology, similar themes were found in other researches together with gamification and virtual reality (Moreta & Said-Hung, 2020), on the other hand, the theme of e-learning was one of the main topics in magazines of the technological area (Rodríguez Miranda & Bolaños Martín, 2018) and in the case of educational technology, it is shown as a reference topic related to digital competence (A.-M. Rodríguez-García, Raso Sánchez, & Ruiz-Palmero, 2019).

Finally, international recognition of the importance of ICT skills and digital literacy has been increasing, along with growing recognition of their importance for active citizenship (Choi, Glassman, & Cristol, 2017). It is concluded that Latin American scientific production in educational technology 2010-2019 is low. The articles published are mainly proceedings and the highest concentration of institutions are Brazilian. Understanding the Latin American context, there is still a wide digital gap that needs to be filled with adequate educational policies in the management of information technologies, e-learning and educational technologies.

## References

- Almenara, J. C., & Ortiz, R. V. (2019). ITC for inclusion: A look from Latin America [TIC para la inclusión: una mirada desde Latinoamérica]. *Aula Abierta*, 48(2), 139–146. <https://doi.org/10.17811/rife.48.2.2019.139-146>
- Aparecido Dias, A., & Kannebley Junior, S. (2019). Scientific productivity and patenting at the laboratory level: an analysis of Brazilian public research laboratories. *Economics of Innovation and New Technology*, 0(0), 1–21. <https://doi.org/10.1080/10438559.2019.1703347>
- Asmat, N., Borja, C., Bernuy, L., Lizaraburu, D., & Morillo, J. (2019). Estudio bibliométrico de la producción científica sobre TIC en Perú (2010-2017). *Propósitos y Representaciones*, 7(2), 196–209. <https://doi.org/http://dx.doi.org/10.20511/pyr2019.v7n2.309>
- Bond, M., Buntins, K., Bedenlier, S., Zawacki-Richter, O., & Kerres, M. (2020). Mapping research in student engagement and educational technology in higher education: a systematic evidence map. *International Journal of Educational Technology in Higher Education*, 17(1). <https://doi.org/10.1186/s41239-019-0176-8>
- Cabrera Ramos, F. (2020). Producción científica sobre integración de TIC a la Educación Física. Estudio bibliométrico en el periodo 1995-2017. *Retos. Nuevas tendencias en Educación Física, Deporte y Recreación*, 37(1 semestre), 748–754. Recuperado de [www.retos.org](http://www.retos.org)
- Castillo, J., & Powell, M. (2019). Análisis de la producción científica del Ecuador e impacto de la colaboración internacional en el periodo 2006-2015. *Revista española de Documentación Científica*, 42(1), 225. <https://doi.org/10.3989/redc.2019.1.1567>
- Castro-Rodríguez, Y., Corrales-Reyes, I., Roca-Sacramento, C., Romero-Vegas, L., Rodríguez-Romero, M., & Sihuay-Torres, K. (2019). Student participation in dental scientific journals in Latin America and the Caribbean. *Journal of Oral Research*, 8(2), 140–146. <https://doi.org/10.17126/jor.v0i0.772>
- Choi, M., Glassman, M., & Cristol, D. (2017). What it means to be a citizen in the internet age: Development of a reliable and valid digital citizenship scale. *Computers and Education*, 107, 100–112. <https://doi.org/10.1016/j.compedu.2017.01.002>
- Coccia, M. (2017). Diversity of Scientific Outputs for Scientific Fields: Appropriate Indicators for Measuring the Scientific Performance. *SSRN Electronic Journal*, 1(18). <https://doi.org/10.2139/ssrn.2966965>
- Darling-Aduana, J., & Heinrich, C. J. (2018). The role of teacher capacity and instructional practice in the integration of educational technology for emergent bilingual students. *Computers and Education*, 126, 417–432. <https://doi.org/10.1016/j.compedu.2018.08.002>
- Escribano, E. (2017). La educación en América Latina: desarrollo y perspectivas. *Actualidades Investigativas En Educación*, 17(2), 1–23. <https://doi.org/10.15517/aie.v17i1.28147>
- Fainholc, B. (2016). Presente y futuro latinoamericano de la enseñanza y el aprendizaje en entornos virtuales referidos a educación universitaria. *Revista de Educación a Distancia (RED)*, 48(1), 1–22. <https://doi.org/10.6018/red/48/2>
- Ferrada, C., Díaz-Levicoy, Danilo, Salgado-Orellana, Norma, Puraivan, & Eduardo. (2019). Análisis bibliométrico sobre educación STEM Bibliometric analysis on STEM education Contenido. *Espacios*, 40(8), 1–12. Recuperado de <http://www.revistaespacios.com/a19v40n08/a19v40n08p02.pdf>
- Fischman, G. E., & Ott, M. (2018). Access, equity and quality trends in Latin America's public universities. *International Journal of Educational Development*, 58, 86–94. <https://doi.org/10.1016/j.ijedudev.2016.11.002>
- Gray, A. C., Diezel, H., & Steel, A. (2019). The use of learning technologies in complementary medicine education: Results of a student technology survey. *Advances in Integrative Medicine*, 6(4), 174–180. <https://doi.org/10.1016/j.aimed.2019.04.001>
- Leon-de La O., D., Thorsteinsdottir, H., & Calderon-Salinas, J. V. (2018). The rise of health biotechnology research in Latin America: A scientometric analysis of health biotechnology production and impact in Argentina, Brazil, Chile, Colombia, Cuba and Mexico. *PLoS ONE*, 13(2), 1–28. <https://doi.org/10.1371/journal.pone.0191267>
- Leahy, S., Holland, C., & Ward, F. (2019). The digital frontier: Envisioning future technologies impact on the classroom. *Futures*, 113(2), 102422. <https://doi.org/10.1016/j.futures.2019.04.009>
- Ledo, M., & Cruz, C. (2009). Tecnología educativa, medios y recursos de enseñanza-aprendizaje. *Revista Cubana de Educación Médica Superior*, 22(4), 1–10. Retrieved from <http://scielo.sld.cu/pdf/ems/v22n4/ems10408.pdf>
- López, S. (2016). Competitividad de la educación superior en cuatro países de América Latina: perspectiva desde un ranking mundial. *Revista de La Educación Superior*, 45(178), 45–59. <https://doi.org/10.1016/j.resu.2016.02.003>
- López, V., Hernandez-Rangel, E., Mejía, G., & Cerano, J. (2019). Factores que facilitan la adopción de tecnología educativa en escuelas de medicina. *Educacion Medica*, 20(S1), 3–9. <https://doi.org/10.1016/j.edumed.2017.07.006>
- Moreta, C. D. O., & Said-Hung, E. (2020). La producción científica en el estudio de experiencia de usuario en educación: caso Web of Science y Scopus. *Transinformação*, 32(2), 1–12. <https://doi.org/10.1590/2318-0889202032e190003>
- Murillo, J., & Martínez-Garrido, C. (2019). Una Mirada a la investigación educativa en América Latina a partir de sus artículos. *Revista Iberoamericana sobre Calidad, Eficacia y Cambio en Educación*, 17(2), 5–25. Recuperado de <https://doi.org/10.15366/reice2019.17.2.001%0AUna>
- Rodríguez-García, A.M., Raso Sánchez, F., & Ruiz-Palmero, J. (2019). Competencia digital, educación superior y formación del profesorado: un estudio de meta-análisis en la web of science. *Pixel-Bit, Revista de Medios y Educación*, (54), 65–82. <https://doi.org/10.12795/pixelbit.2019.i54.04>
- Rodríguez-García, A. M., Trujillo Torres, J. M., & Sánchez Rodríguez, J. (2019). Impact of scientific productivity on digital competence of future teachers: Bibliometric approach on scopus and web of science. *Revista Complutense de Educación*, 30(2), 623–646. <https://doi.org/10.5209/RCED.58862>
- Rodríguez Miranda, F., & Bolaños Martín, L. (2018). Dieciséis años de RELATEC : estudio bibliométrico de la Revista Latinoamericana de Tecnología Educativa. *RELATEC : revista latinoamericana de tecnología educativa*, 17(2), 57–72. <https://doi.org/10.17398/1695-288X.17.2.57>

26. Schmid, R., & Petko, D. (2019). Does the use of educational technology in personalized learning environments correlate with self-reported digital skills and beliefs of secondary-school students? *Computers and Education*, 136, 75–86. <https://doi.org/10.1016/j.compedu.2019.03.006>
27. Shi, M. (2019). The effects of class size and instructional technology on student learning performance. *International Journal of Management Education*, 17(1), 130–138. <https://doi.org/10.1016/j.ijme.2019.01.004>