Systematic Review on Virtual Pedagogical Models in University Contexts, Years 2011 to 2021

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Virtual pedagogical models for education refers to the various practices of instruction in a learning environment where teacher and student are separated by time or space, or both. The objective of this study was to systematize scientific evidence on virtual educational models for university contexts between 2011 and 2021. The method used corresponds to a systemic review, the data bases Scopus, Eric, ProQuest, Gale Academic OneFile, and Ebsco Host were explored, and then rigorous inclusion and exclusion criteria for the study were used. 31 records were identified that responded to the previously posed investigation questions. The results, which were divided into three major categories (pedagogical models, technological tools, and approach and instruments), were further analyzed and discussed.

Keywords: virtual education, learning environment, pedagogical model, technological tool, university context

INTRODUCTION

Teachers of all levels and modality levels are regularly updated, not only in knowledge and abilities, but also in virtual environments, in order to utilize them in their teaching activities. Teachers' approaches are in the process of transitioning to virtuality, which is supported by tools and platforms, posing a challenge to all educational community players, especially for teachers that are in charge of digital natives (Vitvitskaya et al., 2022). Education is a component of lifelong learning, and it is now a component of the triangle of man, society, and technology (Dandara, 2014), so learning strategies for students should be developed and implemented (Esteves Pairazamán et al., 2019; Suyo Vega et al., 2019).

It is necessary to gather the experiences and identify the achievements and shortcomings while generating the systematic study on virtual methods used by university teachers. Systematization responds to the 3Rs, Review research in periods of time, Rectify the errors found, and Reimpulse learning (Expósito Unday & González Valoro, 2017). Several systematic reviews indicate the importance of the subject, among them we have those of (García-Chitiva & Suárez-Guerrero, 2019) who developed a bibliometric analysis

on virtual learning environments with a vertiginous growing trend, among their conclusions they highlight on university collaborative learning being necessary the methodological implementation with collaborative tools.

In Spain, (Aguilar Forero & Cifuentes Álvarez, 2019), conducted a systematic review on education, activism, and digital technologies, distinguishing between formal and informal education. As a result, they advocate for differentiation in knowledge creation. Similarly, in Spain, scientific production on professional training and blended learning was studied in the Web of Science database, indicating that there is a surge in the scientific community (Moreno Guerrero, 2019). Similarly, given the goal in boosting scientific production in Costa Rica, research on the necessity of systematization was done, concluding that it is a learning process in which each experience must be shared. Systematization opens up a world of possibilities and research challenges, bolstering university work and enhancing academic instruction (Jara Holliday, 2019).

In Chile, (Varas-Meza et al., 2020) researched the elements that drive the growth of virtual education at the university level, finding that the determinants include economical, sociopolitical, sociocultural, and socio-technological. They came to the conclusion that the university plays a leadership role in society by being a factor in the change of virtual education.

In Spain, (Crisol-Moya et al., 2020) did a comprehensive study of virtual education for all, a concept that refers to all forms of virtual education in higher education. The researchers came to the conclusion that it is critical to know the student body, give adaptable didactics, and maintain continual motivation. The move from face-to-face to virtual creates anxiety in the teaching staff since the student population does not perceive virtuality highly (Gómez-Hurtado et al., 2020).

In Peru, (Suyo-Vega et al., 2021) developed a systematic review on Virtual Methodology from 2010 to 2020, in the Scopus, Eric and Ebsco databases. The goal was to develop a virtual technique that could be repeated in a university setting. They came to the conclusion that it is vital to research and refine a technique that helps the teaching process, recognizing successes and challenges in order to reproduce them in diverse situations. Likewise, in Scotland, (Regmi & Jones, 2021) developed a systematic review and meta-analysis on the effect of E-Learning in science teaching, concluding that E-Learning facilitates the learning process and delivery mechanisms, where the various strategies are included by changing the teaching practice.

Through the literature, the term Virtual Methodology is identified as Synchronous Method, Asynchronous Method, B-Learning Method, procedure, virtual strategy, virtual technique, e-learning, e-learning, online teaching, virtual training and the term university as higher education, higher studies, university studies, university education, higher level, advanced studies or university career.

As a result of the worldwide COVID-19 outbreak, many businesses had to innovate (Espinoza-Sánchez et al., 2022; Fernández-Bedoya et al., 2021; Frare & Beuren, 2021). This also happened in the educational field: new teaching approaches, tactics, and processes arose, with the goal of transitioning from the face-to-face environment to the virtual one. Creating a virtual learning environment for university students, allowing more autonomy and less reliance on professors (Hinojo & Fernández, 2012). As a result, the dominance of digitization in the world prompts a rethinking in academic environments (Llorens Largo, 2014).

Through the review, the potentiality of the PACIE methodology, whose initials stand for Presence, Outreach, Training, Interaction and E-Learning, is rescued. The Presentation phase refers to the visual impact; the Outreach to the stage of information organization; the Training phase is where teachers are updated to be creative; in the interaction phase, doubts are solved with the student body; and the last phase corresponds to learning by doing, it is the phase that promotes cooperative learning using virtual tools (Oñate, 2009), this methodology strengthens collaborative work which is positively perceived by the student body (Basantes et al., 2018).

The Flipped Classroom is another pedagogical model that incorporates five phases: planning where the syllabus is generated, resource design where the materials that will be hosted in various virtual spaces are generated, digital class where the teacher's presence is essential, workshop stage where evidence will be collected, and finally evaluation where students become aware of what they have learned using

technological resources. This model encourages the student body to be independent and the teachers to take a stand in favor of ongoing training (Basso-Aránguiz et al., 2018; Fritz et al., 2019).

The BIM methodology, whose acronym stands for Building Information Modeling, allows the development of an infrastructure in a virtual space, i.e. it assists both the faculty and the student body of architecture, in the development of virtual prototypes, the difficulty encountered is that there are few professionals with training in use and applicability, as it helps to improve in construction processes, sustainability in building, experience develops (Alvarez & Ripoll-Meyer, 2020).

Likewise, the degree of presence, generates the types of E-learning, and from this the different devices that are used can be deduced.

a) B-Learning, which stands for Blended Learning or Mixed Learning, which includes activities both in the face-to-face or distance learning model, based on improving learning outcomes and reducing teacher-related costs (Gisbert Cervera et al., 2017).
b) M-Learning which stands for Mobile Learning or Mobile Learning, which includes mobile devices and tablets. Virtual courses are developed through mobile devices created significant advances, since the object is permanently with the user who can review content at any time (Rodrigo-Cano et al., 2020).
c) U-Learning or Ubiquitous Learning, that is to say that it is accessible at any time and place, it is not limited to training received through computer or mobile, this concept transcends them and incorporates them to any place, context, medium and through any technological device (Ramirez Villegas et al., 2018).

Finally, it is necessary to indicate that interaction is highly complex (Duart Montoliu & Osorio Gómez, 2011) or a weakness in virtual education. In Spain, research was conducted on the evaluation of both face-to-face and online methodologies at university, concluding that interaction is the main problem between faculty and students in the virtual modality (Cantabella et al., 2020). Likewise, it is necessary that strategies are developed as part of the virtual methodology, in this way the teaching staff reaches an innovative level contributing to their professional work (Martínez-Garcés & Garcés-Fuenmayor, 2020).

From the above, there is evidence of gaps on active methodologies used by teachers at the university level in the process of transition from face-to-face to virtual (Suyo-Vega, Meneses-La-Riva, Fernández-Bedoya, Alarcón-Martínez, et al., 2022; Suyo-Vega, Meneses-La-Riva, Fernández-Bedoya, Ocupa-Cabrera, et al., 2022), thus the interest arises in conducting a systematic review (Kitchenham, 2004). The objective of this study was to systematize scientific evidence on virtual educational models between 2011 and 2021 to answer the following questions: What are the pedagogical models used by teachers in virtual teaching? What tools are the most used? Finally, what are the instruments used by teachers in virtual classes?

MATERIALS AND METHODS

The scientific articles were analysed in order to deepen the thematic approached avoiding the grey literature (Ayuso García & Martínez Navarro, 2004) in the following databases available in the virtual library of the Universidad César Vallejo (Peru): Scopus, Eric, Proquest, Gale Academic OneFile and Ebsco Host.

Scopus among other databases is characterized by relevance, sense and pertinence in research; considered as accurate, updated, reliable, secure, complete, verifiable, accessible and understandable which makes it a powerful tool for scientific research (Espinoza Freire, 2020), besides that it is used by 32% of researchers (Paker, 2014). Likewise, in the Educational Resources Information Center database, for its acronym in English Eric, which is characterized by being exhaustive, accurate although it covers few journals but they are the most important (Salvador Oliván et al., 1999). Other databases analysed were Proquest, Gale Academic OneFile and finally Ebsco Host, since they are considered leaders in providing information services, with access to relevant scientific content in all areas of knowledge (Quintero Mendoza, 2019). The search for articles was performed through concepts and synonyms, as shown in Table 1.

TABLE 1
VARIABLE AND SYNONYMS USED IN THE SEARCH

Variable	Synonym
Virtual methodology	Synchronous method, asynchronous method, b-learning method, virtual strategy, virtual technique, e-learning, online teaching, virtual training.

After analyzing and reviewing the synonyms for each keyword, specific search equations were elaborated for each database, using the Boolean operators "AND" and "OR."

The operator "OR," as a link between the synonymous terms of the concepts Virtual Methodology and Higher Education, as shown in Table 1, for example "e-learning" OR "online teaching" OR "virtual technique," works for the interior of each component, i.e., for the synonyms of the concept Virtual Methodology. In the same way it happened for the second concept Higher education, some consider it as "Higher education" OR "higher studies" OR "higher level" OR "university career." But, to relate the concepts is done through the Boolean operator "AND," for example, Virtual methodology AND Higher education (Moraga C et al., 2014), generating the search equations.

The equations were ("Synchronous method" OR "Asynchronous method" OR "B-Learning method" OR "virtual procedure" OR "virtual strategy" OR "virtual technique" OR "e-learning" OR "online teaching" OR "virtual training") AND ("Higher education" OR "higher studies" OR "university studies" OR "university education" OR "higher level" OR "advanced studies" OR "university career") in Spanish only for the Ebsco Host database, for the other databases it was in English language, as follows: "Synchronous method" OR "Asynchronous method" OR "B-Learning method" OR "virtual procedure" OR "virtual strategy" OR "virtual technique" OR "e-learning" OR "e-learning" OR "online teaching" OR "virtual training" AND "higher education" OR "higher studies" OR "university studies" OR "university education" OR "higher level" OR "advanced studies" OR "university degree."

Parentheses, to search for all equivalent words; and quotation marks for the literal search or exact phrase (Equipo Ivàlua, 2020).

The methodology developed had inclusion and exclusion criteria that helped to screen relevant research. Screening is the initial step in any systematic review (Vega-Arce & Núñez-Ulloa, 2017) and has the function of selecting a few from among many to provide objective and balanced information (Aguado, 2008). Generally, these criteria are found together as a duality, but it is necessary to understand the criteria established in exclusion, to see the importance of inclusion as the unity of difference.

Inclusion criteria:

- The research was developed under the quantitative, qualitative or mixed approach.
- The research was exclusively developed at the higher education level.
- The area developed was social sciences, i.e., the content was related to education, law, economics, and pedagogy.
- The article was peer-reviewed.
- The article was published between January 2011 and March 2021.

Exclusion criteria:

- The research did not mention methodologies or processes.
- Duplicate articles, in various databases.
- Articles that had publisher restrictions.
- Abstracts.

At the beginning of the article selection process, a large number of results were identified from the databases, so additional criteria were established.

Articles were selected in four phases or moments (Vega-Arce & Núñez-Ulloa, 2017).

a) Identification: The search equations were written and 405 094 articles were identified, corresponding to the Scopus, Eric, Proquest, Gale OneFile and Ebsco Host databases.

b) Selection: Then they were selected, by temporality, i.e., from 2011 to 2021, thematic area in social sciences and scientific article, leaving 30 259.
c) Eligibility: Then, full articles in PDF format were selected, although articles were downloaded, there were also restrictions by the editor and 24,068 were eligible.
d) Inclusion: A total of 192 articles related to the topic were randomly included and 31 were left for analysis according to the proposed objectives, which were thoroughly reviewed to answer the guiding questions. These phases are shown in Table 2.

TABLE 2
IDENTIFICATION, INCLUSION, ELIGIBILITY AND INCLUSION OF RECORDS

Database	1. Identification	2. Inclusion	3. Eligibility	4. Inclusion
Scopus	9 159	698	29	11
Eric	25	3	3	2
Proquest	144 573	28 686	24 012	11
Gale Academic Onefile	251 331	869	21	4
Ebsco Host	6	3	3	3
Total	**405 094**	**30 259**	**24 068**	**31**

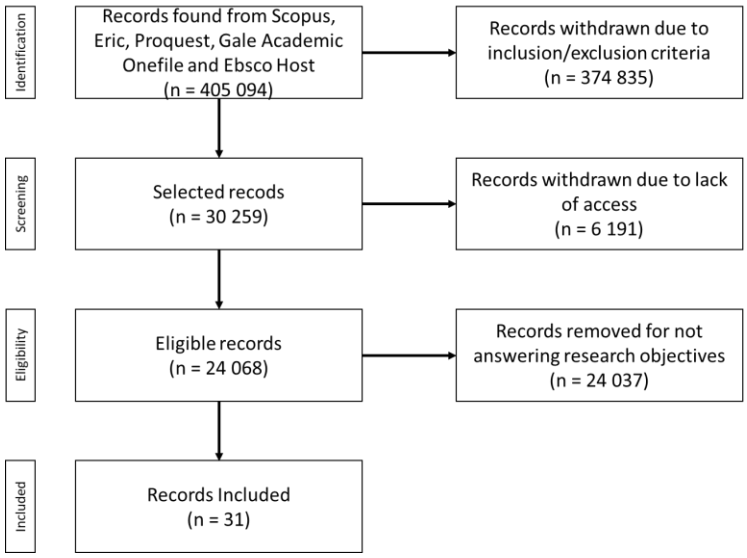
Research that did not include higher education were excluded, as well as those that, despite having the information, did not have access to the complete article in Portable Document Format or PDF format.

Each researcher read the selected articles in order to analyze, compare and discuss the information and establish results and conclusions

Table 2 identifies on the upper horizontal axis the phases that were developed for the selection of scientific articles. And on the lateral vertical axis, the Scopus, Eric, Proquest, Gale Academic Onefile and Ebsco Host databases. The intersections of rows with columns show the number of articles that were analysed.

The description at each stage is shown in the flow chart (Petticrew & Roberts, 2006), called Preferred Reporting Items for Systematic reviews and Meta-Analyses, known as Prisma (Liberati et al., 2009) (see Figure 1).

FIGURE 1
PRISMA FLOW CHART



RESULTS

The thirty-one articles identified were analyzed and discussed in depth. Table 3 shows authors, years, countries, titles, keywords, approaches, samples, methods, tools and instruments on virtual methodology. The identification of authors is important to know and distinguish among so many those who have contributed in a special way to the research (Higgins JPT & Green, 2012). The titles of the studies are presented as they are also important (Urrútia & Bonfill, 2010), together with the keywords that have guided the research and the countries where they were developed and the methodology they used (Cumpston et al., 2019), in addition to other characteristic aspects of the research, such as the technological tool explored.

It was also possible to identify the variables explored, results obtained, conclusions drawn and recommendations made by each of the authors (see Table 4).

TABLE 3
ARTICLES SELECTED FOR ANALYSIS, LISTED BY NUMBER, AUTHOR, COUNTRY, TITTLE, KEYWORDS, APPROACH, METHOD OR PEDAGOGICAL TOOLS, AND INSTRUMENTS AND/OR TECHNIQUES

Number	Author	Country	Tittle	Keywords	Approach	Method or pedagogical model	Technological tools	Instruments and/or techniques
1	(Muñoz et al., 2011)	Spain and Chile	Competencias en los procesos de enseñanza aprendizaje virtual y semipresencial	Skills, teacher training, blended learning, e-learning, European higher education area, digital platform	Qualitative	E-Learning and B-Learning	Moodle	Questionnaire
2	(Nobre et al., 2019)	Portugal	Tabla DK eLearning: optimización de la práctica docente en un ambiente online	Didactic transposition, didactics of e-learning, teaching-learning process, virtual environment, e-learning	Qualitative	Didactic transposition model	Table DK e-Learning	Qualitative and quantitative table
3	(Aznar Díaz et al., 2019)	Spain	Digital competence of an E-learning tutor: An emerging model of good teaching practices in ICT	Digital competence, e-learning, good teaching practices, knowledge representation	Mixed	Individualized methodology	E-mail, online chat, and phone calls	Interview
4	(Hernández-Ramos & Belmonte, 2020)	Spain	Evaluación del empleo de Kahoot! en la enseñanza superior	Information and communication technologies, higher education, e-learning, teacher	Quantitative	Game methodology	Kahoot, and smartphone	Electronic questionnaire

			presencial y no presencial	training, gamification				
5	(Pazos et al., 2020)	Spain	Digital transformation of university teaching in communication during the covid-19 emergency in Spain	University, coronavirus, covid-19, Spain, new technologies, communication sciences, e-learning training	Quantitative	Not precise	Moodle, Blackboard Collaborate, Teams, Skype, WhatsApp, WebEx, Google Meet, and Hangouts	Electronic questionnaire
6	(Delgado-García et al., 2018)	Spain	Moodle y Facebook como herramientas virtuales didácticas de mediación de aprendizajes: opinión de profesores y alumnos universitarios	Educational technology, e learning, social networks, higher education, educational resources	Mixed	Not precise	Facebook, and Moodle	Interviews and questionnaires
7	(Esquicha Medina, 2018)	Chile	Aprendizaje basado en tareas en un entorno virtual de aprendizaje para el desarrollo de producción escrita en alemán, niveles a1 y a2 MCER, en la Educación Superior	Educational integration of technologies, virtual learning environments, task- based learning, German as a foreign language, development of writing skills	Qualitative	Task Based Learning Methodology	Whiteboard, Google Docs, and Zoho Writer	Not precise
8	(Berrío-Zapata & Rojas-	Colombia	La brecha digital universitaria: La apropiación de las	Digital divide, graduate education,	Quantitative	Holistic Methodology, and Technology Acceptance Model	TIC, Internet, and computing	Survey

	Hernández, 2014)		TIC en estudiantes de educación superior en Bogotá	technology appropriation, literacy, discourse, technological education, critical analysis				
9	(Ríos Ariza et al., 2018)	Chile	Valoración de competencias TIC del profesorado universitario: un caso en Chile	ICT, competences, higher education	Quantitative	Survey Methodology	E-Learning platforms, Word, and Spreadsheets	Questionnaire
10	(Pineda Hoyos & Tamayo Cano, 2016)	Colombia	E-moderación y e-actividades: implementación de un taller para desarrollar habilidades de enseñanza en línea de profesores en ejercicio	E-moderation, e-moderator, e-tivity, foreign language teaching, higher education, online course, teacher's professional development	Mixed	Salmon Model	E-moderating, e-tivities, and Moodle	Checklist
11	(Santillán Aguire et al., 2019)	Ecuador	Tecnologías del Aprendizaje y el Conocimiento: uso de las Redes Sociales en la Educación Universitaria de Ecuador	Learning and communication technologies, social networks, higher education	Quantitative	Not precise	Blog, wikis, LinkedIn, Podcast, Twitter, and Facebook	In-depth interview
12	(Fritz et al., 2019)	Chile	Chemistry in Context for engineering students at UCT: Transformation	Active learning flipped classroom guided inquiry autonomous work ICT	Quantitative	Active Learning MethodologyF, lipped Classroom, and Guided Inquiry	Youtube, and Moodle	Essay tests, and online questionnaires

			from a villain to a princess					
13	(Ramirez-Anormaliza et al., 2017)	Ecuador	Aceptación y uso de los sistemas e-learning por estudiantes de grado de ecuador: El caso de una universidad estatal	E-learning, TAM, PLS, SEM, structural equation models, partial least squares	Quantitative	Technology Acceptance Model (TAM)	E-Learning, and Moodle	E-mail questionnaire
14	(Portuguez Castro & Gómez Zermeño, 2020)	Mexico	Challenge based learning: Innovative pedagogy for sustainability through e-learning in higher education.	Challenge-based learning, education in sustainability, e-learning, educational innovation, higher education, sustainable development goals	Qualitative	Challenge-based learning	Moodle	Discussion forums, questionnaires, observation guides, and evaluation rubrics
15	(González Isasi & Medina Morales, 2018)	Mexico	Uso de dispositivos móviles como herramientas para aprender use of mobile devices as tools for learning	Electronic learning, technology uses in education, m-learning, higher education	Qualitative	Multiple Case Methodology	Mobile devices	Individual interviews using chat rooms
16	(Castillo-Cuesta, 2020)	Ecuador	Using Digital Games for Enhancing EFL Grammar and Vocabulary in Higher Education.	Digital games, grammar, vocabulary, EFL writing, higher education	Mixed	Blended methodology, and Digital games	Educaplay, and Canvas	Questionnaire, and rubrics through Survey Monkey

17	(Villanueva, 2020)	Ecuador	What undergraduate students from tecnologico de monterrey, state of Mexico campus, learn within digital environments: Differences by gender, and use of digital media, and social media.	Digital media, e-learning, campus state of Mexico, millennials, social media, higher education, educational innovation	Quantitative	E-learning theory	Digital media	Interviews, and surveys
18	(Tejedor et al., 2020)	Spain, Italy and Ecuador	Educación en tiempos de pandemia: reflexiones de alumnos y profesores sobre la enseñanza virtual universitaria en España, Italia y Ecuador	Educational technology, higher education, public education, educational process, student adaptation, distance education, virtual learning	Mixed	Descriptive, exploratory and explanatory methodology	Google Forms	Online surveys
19	(Del Carmen Mireles et al., 2018)	Spain	Equipment, educational level, uses of mobile phone of doctoral students from pedagogic experimental Libertador university.	Higher education, postgraduate, e-learning, m-learning, multivariate analysis	Quantitative	Quantitative and descriptive methodology	Smartphones	Surveys through login platforms.
20	(Cabrera-Solano, 2020)	Ecuador	The use of digital portfolios to enhance English	Digital portfolios, EFL speaking, free	Mixed	Not precise	Google drive, video files, and audio files	Questionnaire

			as a foreign language speaking skill in higher education.	storage services, higher education, smartphones				
21	(González Guerrero et al., 2012)	Colombia	Formación del docente en contextos b-Learning: implicaciones tecnológicas, investigativas y humanísticas.	Teacher competences, teacher training, training in b-learning, use of ICTS, teacher research	Mixed	Competences in b-Learning contexts	Portfolio, wikis, and collaborative work platforms	Documentary analysis
22	(Zacarias Flores & Salgado Suárez, 2020)	Mexico	Tecnologías digitales; Pandemia; Educación media superior y superior; Enseñanza presencial; Enseñanza virtual; Enseñanza en línea	Digital technologies, pandemic, higher education and high school, classroom teaching, virtual teaching, online teaching	Mixed	Not precise	Facebook, WhatsApp, e-mail, and Google Drive	Mixed online questionnaire
23	(López et al., 2019)	Spain	El uso académico del ordenador portátil y del smartphone en estudiantes universitarios españoles e iberoamericanos	Ubiquitous learning, higher education, technological innovation, educational research, m-learning	Quantitative	Not precise	Smartphone, and laptop	Questionnaire
24	(Hudson et al., 2020)	South Africa	The potential of a simulated workplace environment for	Covid-19, clinical practice, virtual environment for	Qualitative	Virtual Environment for Training in Radiotherapy (VERT)	Clinical Platform	E-mail quiz

			emergency remote teaching	radiotherapy training, radiation therapy				
25	(Cate & Albright, 2015)	United States	-	No data.	Quantitative	Veterans on Campus (VOC)	Not precise	E-mail, mailbox flyer, or poster
26	(Palacios Osma et al., 2017)	Colombia	Modelo de gestión de servicios ITIL para E-learning	ITIL, management model, e-learning, virtual education, process	Qualitative	Management model for virtual education	Not precise	Not precise
27	(Chibás-Ortíz et al., 2014)	Brazil	Gestión de la creatividad en entornos virtuales de aprendizaje colaborativos: Un proyecto corporativo de EAD	Creativity, innovation, collaborative learning, virtual environments, creative educational management, project management, DL	Mixed	Educommunicational-creative	Moodle, e-mail, Skype, and webcam	Questionnaire
28	(Duarte-Herrera et al., 2019)	Colombia and Mexico	Estrategias disposicionales y aprendizajes significativos en el aula virtual	Educational strategies, distance education, teaching, motivation, educational practices	Qualitative	Dispositional Strategies	Not precise	Chat, videos, and quiz
29	(Alenezi, 2018)	Saudi Arabia		No data.	Qualitative	Learning Management System	E mail, and Google Drive	Questionnaire
30	(Yousef et al., 2015)	Germany	Barriers to participation in Learning	Massive open online courses, Moocs,	Qualitative	Technology-Enhanced Learning (TEL)	Not precise	Questionnaire

			Management Systems in Saudi Arabian universities	stakeholder analysis, clustering, lifelong learning				
31	(Sprenger & Schwaninger, 2021)	Switzerland	Análisis de clúster de perspectivas de participantes en MOOC	E-learning, digital learning technologies, technology acceptance, perceived ease of use, perceived usefulness, behavioral intention, classroom response system, classroom chat, e-lectures, mobile virtual reality	Quantitative	Technology Acceptance Model (TAM)	Smartphone, and laptop	Questionnaire

TABLE 4
ARTICLES SELECTED FOR ANALYSIS, LISTED BY NUMBER, AUTHOR, VARIABLE EXPLORED, RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

Number	Author	Variable explored	Results	Conclusions	Recommendations
1	(Muñoz et al., 2011)	Not precise	The main tools used are e-mail and web pages. Although there are several tools, only 10% use web-quests and 10% use wiki.	Strengthening of competencies in virtual IT contexts and the use of didactic methodologies for e-Learning and B-learning.	Not precise
2	(Nobre et al., 2019)	Content knowledge, pedagogical knowledge, and technological knowledge	The table Didactic knowledge (DK), should be adapted to the online contents of the social or exact sciences, since all of them can be adapted to the didactic transposition.	The DK table allows teachers to reflect, criticize and optimize in a virtual space.	Not precise
3	(Aznar Díaz et al., 2019)	Empathy, organization, and patience	Experience as an emerging Model of good teaching practices in ICT.	The private company constitutes an employment opportunity for education professionals.	To broaden the sample for future reseach.
4	(Hernández-Ramos & Belmonte, 2020)	Valuation of Kahoot!as an educational resource in higher education, assessment of the game-based methodology, and overall assessment of the future teacher	51.58% of students consider that Kahoot! facilitates self-evaluation, but there is doubt about the improvement of academic results.	University students in non-attendance mode value the use of Kahoot! as opposed to traditional learning.	To research on factors that influence the use of Kahoot!
5	(Pazos et al., 2020)	Identification of resources and platforms, assessment of the quality of teaching in its virtual modality, identification of	One out of 10 students used platforms such as blogs or sites and Zoom, and a lower percentage used Skype, WhatsApp, WebEx, Google Meet or Hangouts.	University students recognize the pedagogical work of the teaching staff, who not only transmit knowledge but also keep in touch	To research on the dynamics of teacher adaptation to virtual environments.

		undergraduate studies		and solve any doubts they may have.	
6	(Delgado-García et al., 2018)	Initial, technical and pedagogical training, assessment of the use of tools as a didactic medium, a dense network of collaborations, and accessibility and uses	The conception of teachers and students as a key support for the transfer of virtual tools to university classrooms.	The relevance in the use of tools and a change in the structure and training of teachers.	To research on student autonomy, interaction among peers and with teachers, and new methodological conceptions.
7	(Esquicha Medina, 2018)	Not precise	The use of virtual Learning Environments allows university students to practice vocabulary and grammatical structures.	Task-based learning achieves greater autonomy on the part of students.	Not precise
8	(Berrío-Zapata & Rojas-Hernández, 2014)	Endogenous, technology acceptance model, expectation model, exogenous, PEST analysis, and systemic competitiveness analysis matrix	All respondents agree that ICTs are useful, although there are conceptualization problems. Students have access to ICTs, but do not develop their usefulness.	The social sphere must change if ICTs are to be smart technologies.	To contrast the results with a larger population. To rethink the definition of productive impact related to ICT.
9	(Ríos Ariza et al., 2018)	Not precise	The teaching staff recognizes that they have a lower level of ICT competence than the importance of ICT, showing the need for training.	Teachers are more proficient in technological aspects than in pedagogical ones, the vulnerable point being evaluation.	To deepen research on didactic aspects of ICTs.
10	(Pineda Hoyos & Tamayo Cano, 2016)	E-modernization, e-activity, access and motivation, on-line socialization, information	The participants understand the processes of online education.	The student body outlined strategies and activities to apply in the stages proposed in Salmon's model.	To deepen the concepts and notions of e-moderation and e-activity.

		exchange, knowledge building, development			
11	(Santillán Aguire et al., 2019)	Value of social networks, technological competencies of teachers, multifunctional uses, knowledge socialization, real time communication, usefulness of technological communication, and adaptation and flexibility of technological advances	Not precise	Emerging technologies based on social networks are beneficial for learning, which is becoming increasingly digitalized.	To use classrooms open to globalization.
12	(Fritz et al., 2019)	Flipped Classroom, guided inquiry, and laboratory	Students who adopted the Flipped Classroom strategy and Guided Inquiry have a high probability of achieving the objectives.	Thanks to the use of the strategies, knowledge was transferred to the students and fed back virtually.	Not precise
13	(Ramirez-Anormaliza et al., 2017)	Perceived usefulness, perceived ease of use, intention to use, current use of the system, TAM2, and TAM3	Satisfaction influences the use of e-Learning systems	The students' expectations are that the e-learning system improves the acquisition of knowledge.	Universities should investigate the individual differences of students who use technological tools to maximize benefits.
14	(Portuguez Castro & Gómez Zermeño, 2020)	Not precise	Students generated sustainable entrepreneurial ideas aimed at solving problems	CBL is an innovative pedagogy, in multidisciplinary studies with specific challenges that are addressed collaboratively.	To design other courses to develop prototype solution projects. To research with larger sample sizes.
15	(González Isasi & Medina Morales, 2018)	Portability of mobile technology, access to e-learning platform, and	Students participated and completed their assignments. Positive and negative perceptions about e-Learning platform were observed.	The students showed wide acceptance for the technology, being useful to develop their tasks in	To research on the contribution of mobile technology in a specific area or discipline, including

		achievement of learning goals using mobile	Students expressed feelings and perceptions of high self-efficacy.	different spaces and time.	comparative research.
16	(Castillo-Cuesta, 2020)	Cloze activities, digital games, crosswords, matching tasks, and decoding sentences	Digital games improve grammar, use of modals, gerunds and infinitives, expanding their knowledge and vocabulary.	The use of Digital games helped students to improve their grammatical and vocabulary knowledge.	Not precise
17	(Villanueva, 2020)	Not precise	Cell phones are used to search for information quickly and academically.	Information consulted on Facebook and social networks are preferred by students.	The use of digital media technologies by the generational movement called millennials is questionable.
18	(Tejedor et al., 2020)	Not precise	The majority of the student body evaluated negatively the transition to the virtual world, since it increases the teaching load.	Teachers have to innovate, reflect and transform their didactic proposals.	It is necessary to promote critical and reflective thinking linked to the strategic management of ICT.
19	(Del Carmen Mireles et al., 2018)	Not precise	14% of the sample uses technology very little. 98% did not have an educational level in m-Learning. Teachers do not know in depth the use of ICT, and in particular.	Teachers do not know in depth the use of ICT	To create and organize projects using e-Learning and m-learning. To contribute with research to strengthen research lines in e-learning and m-learning.
20	(Cabrera-Solano, 2020)	Not precise	The use of Digital portfolios is motivating to improve oral skills.	Most of the students had a neutral position On the use of Digital portfolios.	To develop research on the use of digital portfolios.
21	(González Guerrero et al., 2012)	Pedagogical training, technological training, technical training, tutorial training, research training, instructional design training, communication training, ICT	A proposal oriented to the Development of competencies is outlined to address the B-Learning modality in higher education.	Multiple shortcomings persist in b-Learning scenarios.	Not precise

		training, and evaluation training			
22	(Zacarias Flores & Salgado Suárez, 2020)	Not precise	One group of the faculty considered that face-to-face work is better, another group that they are useful for work and another group expressed the inevitability of the transition.	teachers were not trained in the use of technologies and only used Digital tools as a communication resource.	To research on the students' point of view on the transition.
23	(López et al., 2019)	Laptop and cell phone habits and usage, functions, and benefits in learning processes	The laptop is superior in terms of satisfaction, benefits and importance. Valuation of the cell phone or Smartphone with entertainment and communication function.	The students value the laptop for the elaboration of work, study, information search, use of e-mail and group work.	To deepen studies on mobile devices to identify potentialities and favor collaborative work with ICT.
24	(Hudson et al., 2020)	Levels of epistemic semantic gravity	Virtual Environments could be incorporated into distance Learning to enhance learning.	Virtual simulated work Environments offer a partial substitution.	To research on the role of the simulated work environment.
25	(Cate & Albright, 2015)	Attitudes, behaviours, cultural competence, media effectiveness, demographics	Online virtual Environments generate situations that in reality would be more stressful.	Online training reduces airfare costs.	To research on the same topic with randomized control groups. To research on how technology can help in the different treatments.
26	(Palacios Osma et al., 2017)	Pedagogical, communicative, technological, and administrative	The proposed Model adapts to the requirements of educational programs in virtual methodology.	Practices can be adapted to the requirements of education programs in virtual methodology.	For the consolidation of this model based on a virtual methodology IT is necessary to develop the processes and the establishment of indicators.
27	(Chibás-Ortíz et al., 2014)	Flexibility, originality, problem solving, and acceptance of challenges	The quality and quantity of the work developed by the students who were in the group that developed the educommunication-creative Methodology was qualified as highly creative.	A work methodology was examined with indicators of flexibility, originality, problem solving and acceptance of challenges that can be used in other	To design courses on distance education and various management paradigms.

				virtual learning environments.	
28	(Duarte-Herrera et al., 2019)	Strategies, motivation and emotions, and virtual environment design and implementation	The teacher's task must be organized, systematized, designed, planned, implemented and evaluated, but with the intention of	The use of Strategies allows Learning through synchronous and asynchronous communication.	Not precise
29	(Alenezi, 2018)	Computer literacy skills, and experiences with LMS	92% of the student body had a positive attitude towards the use of the LMS.	A barrier to the use of LMS was inadequate technical support from universities. Negative attitude towards technology. Inadequate training on LMS platforms.	University institutions should consider Learning management systems to improve student performance.
30	(Yousef et al., 2015)	Blended Learning, flexibility, high quality content, instructional design, learning methodologies, lifelong learning, networked learning, learner-centered learning	The group with the highest number of participants is lifelong learning (49), followed by instructional design and learning methodologies (27), high quality content (21), networked learning (19), flexibility (14), openness (12), blended learning (9) and	Clustering creates a meaningful vision for the community of MOOC participants.	To research specific criteria for designing hybrid MOOCs.
31	(Sprenger & Schwaninger, 2021)	Not precise	The student body favourably evaluated All the tools with the exception of Mobile virtual Reality.	Students indicated that the mobile virtual reality sequences were too time consuming and involved technical problems which could have negatively affected their acceptance of the technology.	To replicate these findings using covariance-based modelling and investigate technology acceptance model factors.

DISCUSSION

The findings from the systemic review may be divided into three categories: (a) Pedagogical models, (b) Technological tools, and (c) Approach and instruments. Each one of them was examined by various researchers identified in this systematic review, as detailed below:

Pedagogical Models

In Colombia, the Holistic Methodology was proposed, which consists of the triangulation of endogenous and exogenous indicators, whose theoretical approach is the Technology Acceptance Model, which is generally used to predict the use of Information and Communication Technologies, therefore, the authors suggest redefining productive impact (Berrío-Zapata & Rojas-Hernández, 2014). Likewise, other authors proposed the Salmon Model, which consists of the five stages of Scalability: Access and Motivation, Online Socialization, Information Exchange and Knowledge Construction and Development, reaffirming that as one scales or advances in each step there is greater intercommunication and interactivity achieving greater learning (Pineda Hoyos & Tamayo Cano, 2016).

In Chile, the Task-Based Learning pedagogical model was proposed, which consists of the development of written production with the task being the fundamental axis, generating autonomous learning on the part of the student body, in addition it can be replicated in various academic contexts (Esquicha Medina, 2018). Another methodology proposed was the Active Learning Methodology, which consists of the implementation of the Flipped Classroom with the support of ICTs, achieving autonomy and permanent feedback in the students (Fritz et al., 2019).

In Spain, the Individualized Methodology was proposed, whose process consists of knowing the student's reasons for taking the courses in this modality and finally this method is based on three skills: empathy, organization and patience. Concluding that good practices in e-learning training generate an emerging model (Aznar Díaz et al., 2019). Another methodology proposed was the Game Methodology, using Kahoot as a didactic resource and that the student body considered the activities developed to be adequate and motivating compared to traditional ones (Hernández-Ramos & Belmonte, 2020).

In Ecuador, the Technology Acceptance Model (TAM) was proposed, which consists of predicting and using e-learning systems among students. Concluding that it is the task of universities to be concerned about technological designs and individual differences of the student body (Ramirez-Anormaliza et al., 2017). Likewise, the Digital Games Methodology was proposed and used with the purpose of improving the grammar and vocabulary of English or another foreign language. They developed cloze activities, digital games, crossword puzzles, and matching, decoding and interactive maps. They concluded that this methodology improves students' grammar and knowledge (Castillo-Cuesta, 2020).

In Mexico, researchers proposed Challenge-Based Learning, whose challenge consisted of solving a real case, collected data from various sources and provided a solution with a sustainable approach and business proposals; this activity was developed within an E-Learning subject, initiating a new teaching and learning methodology that solves problems of various instances that lead to a construction of education and sustainability (Portuguez Castro & Gómez Zermeño, 2020).

The findings on methodologies reaffirm that the use of platforms and tools are important, but they do not define a didactic or make a difference. In all cases they require a didactic design and process to favor learning. Therefore, a good organization and mediation of teachers updated in technological topics will promote meaningful learning. Likewise, (Oñate, 2009) believes that the updating of teachers is a fundamental element to provide solutions to students' questions. Another concordant position is that of (Basso-Aránguiz et al., 2018), who highlight the role of teachers and their permanent updating to establish links with the student body, being necessary to deepen the methodological processes as expressed by (Suyo-Vega et al., 2021).

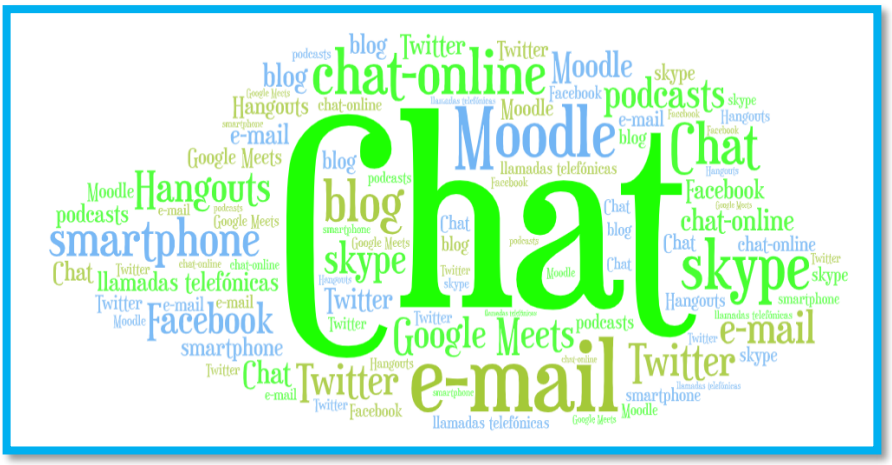
Technological Tools

Online learning or E-Learning is a teaching model that uses the Internet and technology. The findings give details of the modalities used in B-Learning, M-Learning and U-Learning. The most used academic

platforms are: Moodle (Muñoz et al., 2011; Nobre et al., 2019), Blackboard Collaborate (Pazos et al., 2020). Likewise, online tools such as Google Form (Tejedor et al., 2020), Google Drive (Zacarias Flores & Salgado Suárez, 2020), and Canvas (Castillo-Cuesta, 2020). Over the years, it has become evident that various platforms have evolved and have positioned themselves in universities.

The scientific evidence on platforms and technological tools is diverse, and there is confusion in the classification. Figure 2 shows the variety of tools and platforms used in the selected articles. According to these findings, it is necessary to classify them by teaching modality, a concept that coincides with (Aguilar Forero & Cifuentes Álvarez, 2019) who state that it is necessary to distinguish formal and non-formal education. Likewise, this classification will be necessary to guide university professors towards inclusive education since the student body requires specialized attention, being necessary to know technological tools to provide better attention using flexible didactic strategies and permanent motivation as stated by (Crisol-Moya et al., 2020), Without leaving aside the position of (García-Chitiva & Suárez-Guerrero, 2019), who state that it is necessary to implement teaching with collaborative tools, a position that coincides with (Basantes et al., 2018).

FIGURE 2
VARIETY OF TOOLS AND PLATFORMS USED IN THE SELECTED ARTICLES



Approach and Instruments

Research has been developed under qualitative (32%), quantitative (39%) and mixed (29%) approaches, with several instruments and/or techniques applied, such as:

- Qualitative approach: observation table (Nobre et al., 2019), questionnaire (Muñoz et al., 2011), in-depth interview (Santillán Aguire et al., 2019).
- Quantitative approach: electronic questionnaire (Del Carmen Mireles et al., 2018; Fritz et al., 2019; Hernández-Ramos & Belmonte, 2020; López et al., 2019; Pazos et al., 2020; Ramirez-Anormaliza et al., 2017; Ríos Ariza et al., 2018; Villanueva, 2020).
- Mixed Approach: interview (Aznar Díaz et al., 2019), interviews and questionnaires (Delgado-García et al., 2018), online surveys (Tejedor et al., 2020), questionnaire and rubrics (Castillo-Cuesta, 2020).

The findings show that to collect information regardless of the approach, various electronic media, such as cell phone or email, have been used to apply the instruments. The students who were interviewed or who applied an instrument received the information and accepted the informed consent to participate in the research virtually. This way of applying instruments through mobile devices marks the beginning of a new way of researching and continuing with the collection of relevant information, as expressed by (Rodrigo-

Cano et al., 2020). But, it is not the only achievement, researching through this modality also reduces costs as stated by (Gisbert Cervera et al., 2017), saving time and office material.

CONCLUSION

Because they perform various functions and employ various strategies in their academic work, university professors play an essential role in society. The performance of a teacher is seen via the achievement of professional competencies and the personal development of a university student. In this sense, the teacher's role as a guide in the learning process is to use various methods of imparting knowledge with the help of technological tools, which means new functions and/or modes of instruction within the university framework.

The findings of this systematic review show that the categories that stand out in the university environment are (a) pedagogical models, (b) technological tools, and (c) approach and instruments. As a support tool, technology necessitates ongoing training for teachers and students in order to achieve innovative learning outcomes that distinguish the path of being creative, dynamic, and interactive. To accomplish so, each method must be associated with a specific goal, as well as include freely available tools. Finally, there is a need to include virtual methodology, which includes models, tools, and platforms, among other things, into university curricula and classroom sessions.

In the case of pedagogical models, the methods of holistic learning, task-based learning, active learning, individualization, game-based learning, technology acceptance, game-based learning, and task-based learning are described in detail, with the need to deepen and broaden the information.

When it comes to technological tools used in research, there are many different names for them. Some are referred to as platforms, virtual tools, online tools, learning models, or e-learning platforms. Identification and grouping based on platforms, tools, social networks, and learning modes is required. This is the point of flexibility for defining the tools to be used.

The research instruments are questionnaires in their various forms, including open, closed, and multiple-choice questions using Google tools such as Google Drive, Google Forms, and electronic mail. According to the findings, interviews were conducted using various platforms and interview guides. Furthermore, various instruments that were used and grouped by focus are examined (quantitative, qualitative and mixed). Some people think of the term "mixed" as "hybrid." However, it is important to note that the variety of instruments does not depend on the focus, since it has been demonstrated that both qualitative researches using statistical analysis and quantitative research use interview guides.

Finally, working on virtual education from a holistic perspective is required in a university setting, and this must meet the requirements of the new virtual education model. The university education mode is appealing because it lowers costs and benefits students who participate in a variety of activities in order to complete their university education and achieve personal and professional goals.

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