Integrating Chatbots into E-Learning Platforms: A Systematic Review

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***Abstract*—The application of chatbots in e-learning has experienced rapid growth in recent years, but a dilemma remains about their pedagogical contribution in practice. For this reason, the aim of this systematic literature review was to analyze the implementation of chatbots in e-learning platforms, evaluating their benefits, academic impact and challenges. The methodology used was PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), based on a structured search in databases such as Scopus, Web of Science, Springer and ScienceDirect. The selection included 55 studies published between 2020 and 2024, after applying rigorous inclusion and exclusion controls. The research results show that personalization of learning, self-regulation, increased student engagement and educational efficiency benefit most when chatbots are integrated with active methodologies. Geographically, scientific output was dominated by the UK, Malaysia and Spain, with 38.18% of publications in 2024. It was also found that the majority of methodological approaches were quantitative, followed by mixed and qualitative studies less frequently. Among the barriers that emerged in terms of the pedagogical dimension were teacher resistance and limited training in artificial intelligence tools. Educational issues, privacy concerns, and biases in generated responses also emerged. Keywords from co-occurrence analysis using VOSviewer revealed the prominence of terms such as chatbot, intelligent tutoring and technology-enhanced learning in recent scientific output. Thus, it is concluded that chatbots are a determinant of autonomy, motivation and effectiveness of online learning, leading to a change in future educational environments, where students will adopt emerging technology. Among the limitations of this review were the scarcity of longitudinal studies and restricted access to certain articles.**

***Keywords*—Chatbots; educational platforms; e-learning; education; challenges**

I. Introduction

In recent years, the integration of chatbots into e-learning platforms has established its role in responding to the current educational challenges exacerbated by the COVID-19 pandemic. The United Nations Educational, Scientific and Cultural Organization (UNESCO) emphasizes that scientific and technological advances have enabled health crises to be mastered to a greater extent compared to historical pandemics, opening fertile ground for innovative educational solutions [1]. However, within this scenario of digital transformation, in which e-learning is growing rapidly with materials such as videoconferencing and interactive content [2], the adaptation of educational actors such as teachers, assistants and students to blended modalities continues to face significant obstacles [3].

The development of educational chatbots is considerable and shows enormous potential for transformation within various educational environments. A recent study [4] points out that common speech recognition application programming interfaces (APIs) have high error rates (WER/CER) in the processing of speech disorders, thus requiring custom adaptations for educational use. Also, research [5] based on the technology acceptance model (TAM) shows that students welcome 24/7 accessibility and the use of an intuitive interface by educational chatbots.

Applications integrated with advanced platforms are yielding significant results. Cloud computing [6] makes it possible to handle large volumes of queries simultaneously, while innovative solutions such as augmented reality chatbots [7] have a positive impact on the learning process: tests with 102 biology students reveal a substantial improvement in motivation according to the attention, relevance, confidence and satisfaction (ARCS) model, with an 80% preference over traditional methods [8]. Similarly, remarkable progress is observed within the educational environment, where a mobile application with augmented reality increased the proportion of interest by 100%, comprehension by 50% and achieved a satisfaction level of 40% at the level of Peruvian primary and secondary school students [9]. In contrast, technical analysis [10] reflects that natural language processing (NLP) models, subject to sequential neural networks, obtain higher levels of accuracy in chatbots for university use, surpassing approaches such as term frequency and inverse document frequency (TF-IDF) or pattern matching.

Practical implementation faces considerable obstacles. Research on mood using bi-directional encoder from transformer representations (BERT) models [11], with accuracy as high as 96.49%, raises serious concerns about the quality and potential bias of the generated feedback. Likewise, the accelerated growth of e-learning [12] and the progress of artificial intelligence (AI) [13] augur an increasing role for chatbots. In this sense, systems such as LearningPartnerBot [14], integrated in Moodle, employ the Felder-Silverman model in the personalization of content based on learning styles, facing the problem of cold start in recommendations.

This research is justified by the compelling need to synthesize the scientific literature related to educational chatbots, given their rapid post-pandemic growth and persistent challenges in technical accuracy and pedagogical integration. Furthermore, the goal of this SLR is to systematically analyze architectural features, pedagogical effectiveness, and implementation gaps to propose evidence-based guidelines to optimize the adoption of chatbots in e-learning.

II. Literature Review

A. Pedagogical Benefits of Educational Chatbots

The implementation of chatbots in education has proven to bring benefits in learning personalization. In research [15], an AI-based e-learning chatbot was designed to crawl multimedia content and keyword extraction techniques through NLP, achieving optimal indexing, decreased search time, and increased student satisfaction. Similarly, in [16], the authors analyzed a set of 2003 web articles, using web mining and machine learning (ML) methods to assess the existing public perception of ChatGPT in education, finding that it improves writing skills and enhances the dynamism of learning environments, although risks of plagiarism and ethical issues requiring regulation were identified. Complementarily, [17] examined the experience accumulated by 360 university students in Malaysia regarding the use of chatbots oriented to English learning, using a combined approach based on the Push-Pull Mooring Habit (PPMH) model; consequently, The results showed that simplicity of use and high performance were conducive to adoption, while social isolation concerns posed an obstacle.

B. Impact of Chatbots on Student Academic Performance

The impact of chatbots on academic performance is the subject of recent studies. The study [18] developed the MERLIN project to assist Malaysian university students in the online learning process, using an AI chatbot equipped with multimedia learning mechanisms; based on data collection from 102 students, they showed that the virtual assistant favored the ability to comprehend academic content. Similarly, in [19], they investigated the adoption of chatbots in higher education based on the diffusion of innovations theory, for which they surveyed 842 students, finding that relative advantages, compatibility, evidence of use, and trust exerted positive effects for intention to use, while perceived usefulness and operational ease did not show a direct relationship. Similarly, in the study of [20], the authors evaluated the use of ChatGPT applied to the learning process of full-time and part-time students using a comparative quantitative approach. They analyzed the degree of students' familiarity with the chatbot functionality and their ability to formulate queries. As a result, it was shown that full-time students took advantage of the linguistic model, while no significant differences in terms of experience with the functionality or query formulation capabilities were found between the two groups. As a result, it was shown that full-time students took advantage of the linguistic model, while no significant differences in terms of experience with the functionality or query formulation ability were found between the two groups of students.

C. Technical and Pedagogical Challenges in the Implementation of Chatbots

The technical and pedagogical difficulties involved in the implementation of chatbots in educational environments are the focus of several studies. In [21], exploratory research was carried out to determine the perceptions of 142 teachers of English as a second language (ESL) regarding the use of chatbots in teaching and mobile learning, using a sample design based on Likert-type surveys and open-ended questions. The results showed that teachers positively valued the use of chatbots to provide feedback and emulate interaction cycles; however, many expressed the need to receive additional training for their proper implementation. At the same time, [22] investigated the integration of ChatGPT together with interactive learning environments (ILEs) within the teaching of computer networks, carrying out a pilot experiment involving three graduate students, whose results showed a significant improvement in the level of student learning.

D. Ethical Considerations and Risks Associated with the Use of Chatbots in Education

The risks associated with the use of chatbots in academia and ethical issues highlight issues that need to be explored. In this scenario, [23] investigated the impact of knowledge management factors on the degree of satisfaction and continuity of ChatGPT use among university students in Vietnam, employing a quantitative methodology, showing a confirmation of expectations with a positive and significant effect on perceived usefulness and satisfaction, increasing the continuity of tool use. Complementarily in [24], they evaluated the applicability of ethical principles in the use of AI tools such as ChatGPT performed on students aged 12 to 24 years, by using a quantitative analysis based on the technology acceptance model, evaluated through a structural study the effect of ethical principles such as usefulness, fairness, privacy and data protection on perceptions about the use of ChatGPT, evidencing that younger students between 12 and 18 years of age of the general range of study, obtained responses from ChatGPT to support mainly their decisions, but also expressed concern about the use of their personal data.

TABLE I. Major findings and limitations in research on educational chatbots.

Ref.s	Main results	Limitations
[15]	NLP chatbot improved content search and student satisfaction.	Did not evaluate prolonged pedagogical impact.
[16]	Improved writing and interactive environments; generated ethical risks.	Based on perceptions without classroom validation.
[17]	Ease of use drove adoption; robotic interaction caused isolation.	Geographically limited sample.
[18]	Assistant improved academic comprehension during pandemic.	Small sample and exceptional context.
[19]	Relative advantages determined adoption; usefulness did not correlate with use.	Self-report without behavioral verification.
[20]	Full-time students took better advantage of language model.	Disciplinary variables not controlled.
[21]	Teachers valued feedback but needed additional training.	Uncorrelated with learning outcomes.
[22]	Improved comprehension, but presented problems in interfaces.	Minimum sample and insufficient duration.
[23]	Knowledge acquisition determined satisfaction and continued use.	Specific cultural context not generalizable.
[24]	Ethical curriculum improved understanding; adolescents distrusted data	Wide age range diluted differences.

Table I summarizes the main findings and limitations identified in the studies reviewed on the use of chatbots in educational contexts.

III. METHODOLOGY

This SLR comprehensively addressed how chatbots can drive the transformation of e-learning platforms, with an analysis of their pedagogical benefits, their impact on academic performance and the challenges presented by their implementation. The integrated methodological approach contemplated four essential components: 1) formulation of research questions based on the identified knowledge gaps, 2) application of the PRISMA protocol to ensure scientific rigor, 3) systematic search strategy in multiple databases, and 4) standardized selection criteria that guarantee the quality of the evidence analyzed.

A. Purpose and Research Questions

Preliminary research of scientific literature revealed three critical gaps in the field of educational chatbots: insufficient conclusive evidence of their pedagogical impact; lack of documentation on the difficulties of their application; and lack of contrasted studies on their effectiveness in different online learning scenarios. To address these shortcomings, the following research questions emerged:

- What are the benefits of integrating chatbots into online platforms?
- How does the integration of chatbots in e-learning platforms affect academic performance?
- What are the technical and pedagogical challenges faced by educational institutions when implementing chatbots in their e-learning platforms?

B. Type of Study

For the methodological development of this research, the approach based on systematic literature reviews was adopted, as established by the PRISMA 2020 protocol, an international norm recognized as a reference standard in terms of transparency and scientific rigor for this type of review [25]. By applying this protocol, it is possible to establish a precise and replicable operating structure, reinforcing the validity of the results through well-defined procedures in the phases of identification, screening, selection and synthesis of the studies. In addition, as a visual documentation tool, the PRISMA flowchart was implemented to transparently detail the entire bibliographic selection process. The use of this resource allowed the traceability of the different decisions taken during the filtering of the documents, transparently showing the procedure for applying the inclusion and exclusion criteria at each moment [26].

C. Search Strategy

The evidence collection work was carried out using a systematic search strategy, phased according to the recommendations of the PRISMA 2020 protocol. For this purpose, four academic databases of recognized prestige were chosen, such as Scopus, Springer, ScienceDirect and Web of Science, whose coverage of publications on educational technology and intelligent learning systems was notable. The search sequence was designed by combining Boolean operators and terms of reference derived from the research questions. The syntactic format used was the following: ("chatbot" OR "conversational agent" OR "dialog system") AND ("e-learning" OR "online education" OR "digital learning") AND ("LMS" OR "learning management system" OR "educational platform") AND ("challenge" OR "limitation" OR "implementation barrier").

In accordance with the PRISMA 2020 protocol, the evidence collection work was structured in four main phases:

- Identification: Exhaustive search in selected databases to identify relevant studies.
- Selection: Elimination of duplicates and preliminary review of titles and abstracts.
- Eligibility: Full-text evaluation to ensure relevance to the research questions.
- Inclusion: Final selection of studies that met all the established inclusion criteria.
- As a direct result of this process, 563 studies were initially collected, and 55 studies were identified and finally selected that fully met the criteria defined for the review and constituted solid evidence to respond to the objectives set. Fig. 1 shows the sequential distribution of the entire procedure under the PRISMA methodology.

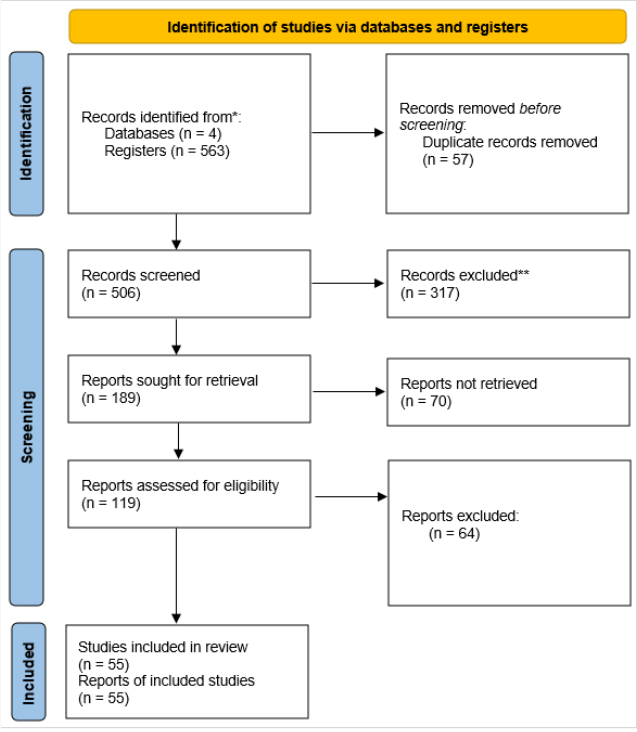

Fig. 1. PRISMA methodology.

D. Inclusion and Exclusion Criteria

For the development of this systematic review, inclusion and exclusion criteria were previously established to ensure the coherence, relevance and methodological soundness of the

corpus analyzed. The criteria allowed literature to be filtered objectively, directing the selection to empirical studies strictly related to the application of chatbots in e-learning environments. In this way, it was possible to minimize biases, guarantee the reproducibility of the process and reinforce the validity of the results. The criteria considered are presented below:

1) Inclusion

- Studies on the use of chatbots in e-learning platforms.
- Empirical research with educational results in real contexts.
- Publications between 2020 and 2024.
- Documents in English and with access to the full text.

2) Exclusion

- Studies outside the field of education or e-learning.
- Non-original and non-empirical papers such as reviews, editorials, theses and chapters.
- Non-English language publications.
- Duplicate or non-peer-reviewed records.
- Research that does not address benefits, academic impact or challenges of using chatbots in e-learning.

IV. Results

The study selection process, carried out under the PRISMA 2020 guidelines, began with the identification of 563 records in the Scopus, Web of Science, ScienceDirect and Springer databases. After applying inclusion/exclusion criteria and thematic filters, the corpus was refined to 55 studies published between 2020 and 2024, considered relevant to analyze the integration of chatbots in e-learning platforms. Fig. 2 illustrates the complete flow of the initial collection in the research, as well as the result obtained in the final selection.

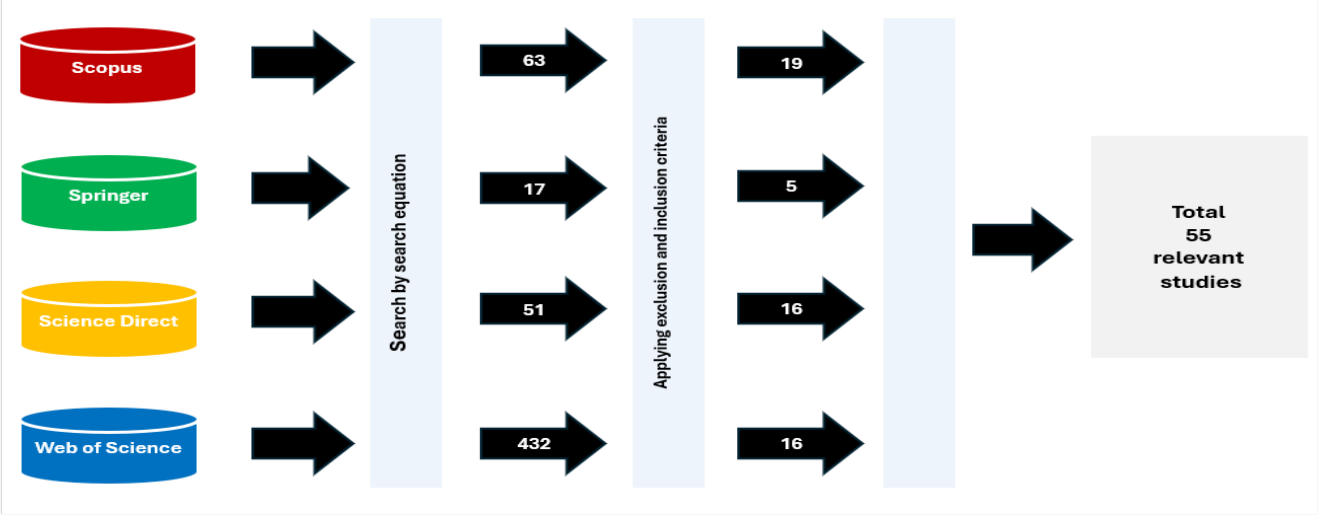

Fig. 2. Distribution of studies collected and final selection.

In the preliminary phase, 57 duplicates were eliminated, leaving 506 studies for the initial analysis. The first screening phase consisted of an exhaustive analysis of titles, where 317 articles that did not meet the thematic criteria were excluded, particularly those that did not mention educational applications of chatbots. As a result of this process, a new set of 189 studies was obtained, showing the following distribution: Scopus with 42 studies in 22.22%, Springer with 9 in 4.76%, ScienceDirect with 35 in 18.52% and Web of Science showing the predominance with 103 studies with a value of 54.50%, highlighting as the main source of academic information on the subject.

In the second phase, the analysis of abstracts allowed the exclusion of 70 additional articles that did not meet the requirements of thematic alignment with the research objectives, specifically those that did not address chatbot e-learning integration, lacked demonstrable pedagogical components or presented limitations of access to the full text. This rigorous filtering process reduced the corpus to 119 potentially relevant studies.

The final evaluation focused on three key aspects derived from the research questions: the educational benefits of chatbots, their measurable impact on academic performance, and the technical and pedagogical challenges identified in their implementation. After a thorough analysis of the full texts, 64 studies that did not provide direct evidence on at least one of these key aspects were eliminated, resulting in a final selection of 55 studies that strictly met the established criteria.

The final selection of 55 studies revealed that Scopus contributed the most with 19 studies (34.55%), followed by ScienceDirect with 16 studies (29.09%), Web of Science with 15 studies (27.27%), and Springer with 5 studies (9.09%). Fig. 3 provides the proportional representation of each database in a bar chart, presenting the result for the respective visual analysis.

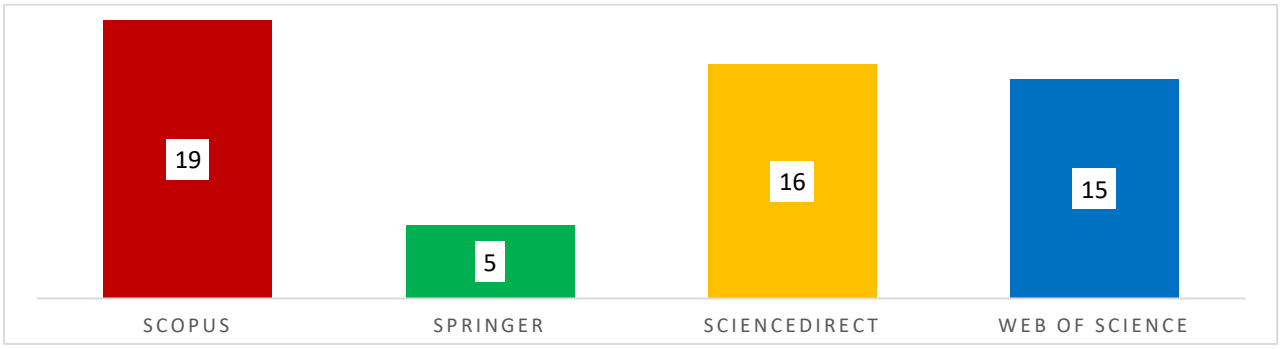

Fig. 3. Distribution of studies by database.

To analyze the articles by year range, it was determined that each publication complies with the period from 2020 to 2024. The following percentage graph shows the 55 articles corresponding to each year: 38.18% in 2024, 29.09% in 2023, 20% in 2022, 5.45% in 2021 and 7.27% in 2020. As shown in Fig. 4, the year 2024 shows a peak in the number of publications on the subject, followed by 2023, with 2021 having the lowest peak among this range of years.

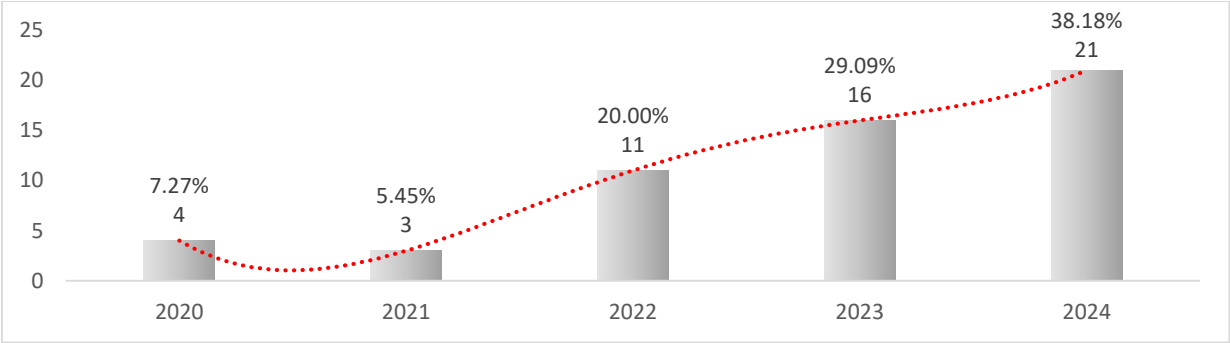

Fig. 4. Distribution of studies by year of publication.

On the other hand, Fig. 5 identifies those studies that correspond to their corresponding years. In 2020, 5.26% of the studies came from Scopus and 20% from Web of Science. For 2021, Scopus presented a slight decrease to 5.26%, while Web of Science obtained 13.33%. In 2022, a significant increase was observed in Scopus, reaching 42.11%, while Web of Science maintained 20%. In 2023, Scopus decreased by 26.32%, while Springer reached 40% and ScienceDirect with 37.50%, being the most representative in this year, while Web of Science maintained its 20%. Finally, in 2024, ScienceDirect increased to 62.50%, Springer reached 60%, while Scopus decreased by 21.05% and Web of Science increased by 26.67%. This figure shows the distribution of studies by each database and year.

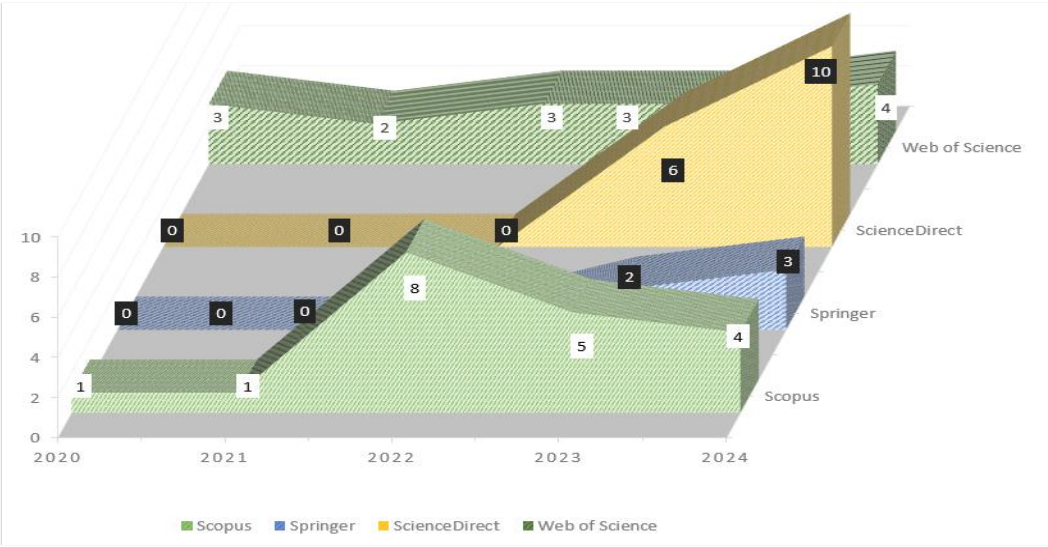

Fig. 5. Number of studies by year and databases.

In the geographical distribution of studies on the subject, the analysis identified the countries that stand out the most in terms of educational chatbots, the United Kingdom with 10.91%, followed by Spain, Taiwan and Malaysia with 7.27%, respectively. Meanwhile, the countries of Canada, Germany, Saudi Arabia, Africa, Turkey and the United States have 3.64%. As shown, there is an overview of the articles that stand out most among these countries and a predominance in the English language, whose inclusion criterion was defined for this work, which makes this information more accessible. These results are expressed in Fig. 6 below.

Fig. 6. Reviews of the scientific literature by country.

Malaysia and Spain are important because of their policies that support educational innovation, their financial resources, and their strong digital infrastructure. Generalization is limited by the lack of longitudinal studies; multi-year student follow-ups are advised. By using multiple databases and institutional resources, the restriction on access to articles was lessened, guaranteeing a representative corpus.

On the other hand, each study was classified into three types of methodologies: mixed, quantitative and qualitative. Within the mixed approach, we distinguish that the Scopus and Web of Science databases have the highest representation with 31.58% and 60%, respectively. For the qualitative approach, we observed that ScienceDirect with 31.25% and Scopus with 21.05%. For the quantitative approach, it was observed that ScienceDirect is in the lead with 56.25% and Scopus with 47.37%. Fig. 7 shows the distribution of the studies mentioned at the beginning.

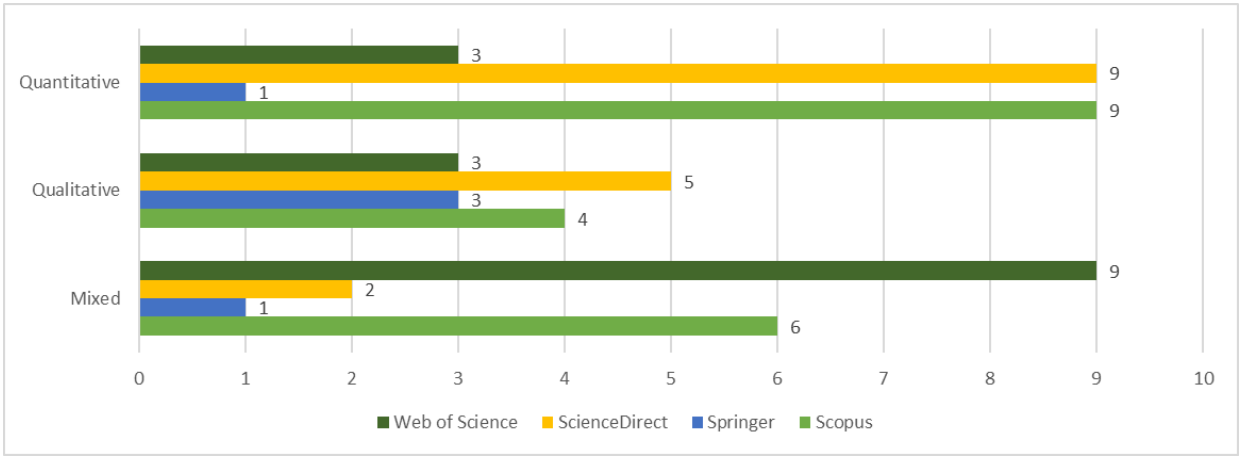

Fig. 7. Scientific bibliography incorporated into the research by methodological approach.

Finally, with the help of the “VOSviewer” tool, a graph was made showing the list of the most used terms in the research. Highlighting “chatbot” and “artificial intelligence” being the most concurrent with 27 and 19, respectively in the research, which shows how the focus of the articles is aligned to the research objectives. Among other keywords that are interconnected in the analysis, they show a different vision to the case study. The orange lines present the terms “innovation”, “application”, “design” and “learner”, words that show how education has adopted these terms to improve its teaching methodologies. On the other hand, the purple lines show “age students”, “university”, “admission” and “issues”,

where it is observed that mostly university students or students of different ages tend to use these tools to improve their learning. Finally, the blue lines, where "intelligent tutoring", "technology enhanced learning" and "educational chatbot" are mentioned, show how these technological tools are used as their own tutors or make them adopt teaching methodologies to benefit learning. Fig. 8 shows different groupings, where keywords are highlighted in a visual format that shows those areas identified in the studies reviewed.

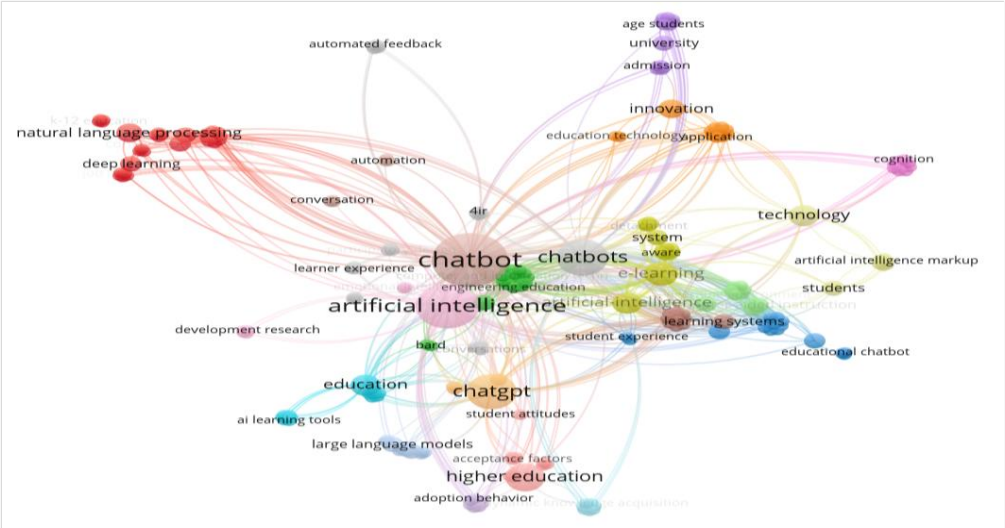

Fig. 8. Bibliometric exploration of the literature analyzed.

V. Discussion

This systematic study examines the integration of chatbots in e-learning environments, based on three inquiry questions. The main contributions are then presented and discussed in relation to the reference literature, highlighting convergences, discrepancies and relevant gaps that serve to delimit the current state of knowledge and guide future research.

A. Q1: What are the Benefits of Integrating Chatbots into Online Platforms?

The benefits obtained from the integration of chatbots in online learning environments note aspects of a pedagogical and operational nature. They emphasize dimensions such as personalization of learning, increased learner engagement, support for cognitive processes and optimization of educational efficiency. In this sense, the findings obtained are in line with the essential lines of research in the literature reviewed, in which tangible methodical evidence is provided.

The study [15] analyzed in depth the personalization of learning by devising an AI-based chatbot that employed NLP techniques to crawl multimedia content. The keyword extraction methodology allowed optimizing indexing, decreasing search times and increasing learner satisfaction. The results corroborate that the adaptability of the chatbots supports individualized learning paths, in agreement with the tabulated data on personalization.

Also, chatbots increase active student engagement, due to their immediate interactivity with the user. This claim is supported by research [16], as it analyzed public perception of ChatGPT in education, by web data mining and applying ML to a set of 2003 articles collected from the web, revealing identification supporting that chatbots activate educational institutions, while improving student competencies.

Regarding cognitive support, the MERLIN project, in [18], evaluated 102 Malaysian students with the use of a chatbot equipped with multimedia resources; this quantitative approach made it possible to verify the existence of progress at the cognitive level, proving that the timely provision of the assistance service contributes to improving conceptual assimilation processes.

Regarding educational efficiency, the findings are supported by research [21], in which 142 teachers with ESL were interviewed, using Likert-type surveys and the formulation of open questions, concluding that the use of chatbots simplifies feedback and reproduces the functioning of didactic interactions, pointing out the need for teacher training. Table II shows a summary of the distribution of the advantages identified.

TABLE II. Benefits of Integrating Chatbots into Online Platforms

#	Benefits	Quantity	References
1	Personalization of learning	13	[27], [28], [29], [30], [31], [32], [33], [34], [35], [36], [37], [38], [39]
2	Student engagement	10	[40], [41], [42], [43], [44], [45], [46], [47], [48], [49]
3	Cognitive process support	7	[50], [51], [52], [53], [54], [55], [56]
4	Educational efficiency	7	[57], [58], [59], [60], [61], [62], [63]
5	Democratized access	7	[64], [65], [66], [67], [68], [69], [70]
6	Competency development	7	[71], [72], [73], [74], [75], [76], [77]
7	Pedagogical innovation	3	[78], [79], [80]

When going deeper into the rigorousness of the results in Table II, crucial nuances existing in the examined

complementary benefits, although less recurrent in the impact indexes, can be appreciated. Thus, the democratization of access, upheld by seven literary works [64], [65], [66], [67], [68], [69], [70], finds comparative support in [17], an investigation in which 360 Malaysian students made use of PPMH model chatbots to learn English. However, the simplicity of use removed the technical barriers, highlighting that the lack of social interaction in the use of chatbots limited their community acceptance, proving that, to democratize learning, comprehensive socio-technical approaches are needed.

The evolution of competencies reveals the need for deliberate pedagogical designs that support effective knowledge transfer. Thus, in [19], the authors investigated a group of 842 students using the diffusion of innovations theory, concluding that acceptance is driven by relative advantages and their compatibility, although usefulness does not always translate into improved competencies. In complementarity is the pedagogical innovation described by three studies [78], [79], [80], related to research [22], where a pilot computer networking program integrating ChatGPT with ILEs was conducted for three graduate students. The result indicated that a human-chatbot hybridization favors active methodologies, thus suggesting that innovation requires scalability to achieve widespread impact.

In summary, the conclusion of the present systematic review with respect to the body of literature treated as a precursor converges with the above, in the sense that chatbots positively transform online education. However, duality can be observed: while fundamental benefits such as personalization and engagement are the subject of strong consensus, complementary benefits related to access and innovation face conjunctural challenges that demand the implementation of adaptive strategies.

B. Q2: How does the Integration of Chatbots in e-learning Platforms Affect Academic Performance?

E-learning platforms integrated with chatbots have a significant impact on students' academic performance, thanks to transformational mechanisms capable of redefining the educational experience. According to the evidence obtained, the improvement of academic performance, the promotion of self-regulation and the increase of student participation are emerging as the predominant impacts. This synergetic relationship enables institutions to develop improved pedagogical processes based on intelligent support, combining innovation and educational effectiveness.

Research [20] provided crucial evidence on the improvement of academic performance, using a quantitative approach based on the comparison of part-time and full-time students. In this study, familiarization with ChatGPT and question formulation skills were analyzed, showing that the full-time group relied more on the linguistic model to stimulate their learning, which validates the tabular findings highlighting this impact in nine studies.

Regarding the promotion of self-regulation, research [23] explored knowledge management coefficients in Vietnamese university students. Applying a quantitative experimental approach, it was identified that validation of experiences reinforces perceived usefulness and self-regulation of learning, thus consolidating the metacognitive function of chatbots. These results support the seven tabular studies highlighting this benefit.

In relation to increased participation, research [24] evaluated the existence of ethical principles among students aged 12 to 24 years, using models of technological acceptance, and showed that chatbots encouraged constant interaction, particularly in the segment of adolescents aged 12 to 18 years, since these users repeatedly used them as support in academic decision making. The evidence confirms the six studies that highlight the potential of chatbots to stimulate student participation. Table III, given below, succinctly describes the magnitude of the impacts identified.

TABLE III. IMPACT ON ACADEMIC PERFORMANCE WHEN INTEGRATING CHATBOTS INTO E-LEARNING PLATFORMS

#	Impact	Quantity	References
1	Improves academic performance	9	[29], [31], [33], [37], [41], [43], [53], [74], [77]
2	Encourages self-regulation	7	[32], [38], [44], [50], [51], [52], [54]
3	Improves participation	6	[32], [40], [45], [46], [63], [79]
4	Optimizes formative assessment	5	[30], [34], [62], [75], [76]
5	Specific skills	5	[47], [48], [59], [73], [80]
6	Mixed or contextual effects	4	[36], [42], [49], [65]

On the other hand, the optimization of formative assessment, exposed by studies [30], [34], [62], [75], [76], denotes the streamlining of personalized feedback derived from chatbots, although research such as [19], based on the theory of diffusion of innovations, warns that the effectiveness of these agents is conditioned by the compatibility with institutional pedagogical designs.

Likewise, papers [47], [48], [59], [73], [80], note that the impact on specific skills is manifested improvement in technical or linguistic competencies because of specialized chatbots. This phenomenon was observed in [17] during the practice of English language learning, where the operational simplicity facilitated the acquisition of practical skills by using the PPHM model.

On the other hand, according to [36], [42], [49], [65], mixed or contextual effects reflected differences dependent on institutional factors. This duality is exposed in [20], where part-time students showed low academic performance, a fact that indicates that the impact depends on variables such as time spent and the educational conditions of the center.

C. Q3: What are the Technical and Pedagogical Challenges Faced by Educational Institutions when Implementing Chatbots in their e-Learning Platforms?

Educational institutions face obstacles linked to the integration of chatbots within e-learning platforms, whose technical barriers and pedagogical constraints constitute critical frictions. Evidence reveals that the major obstacles are related to NLP accuracy and adaptation to learning styles, as well as systemic integration issues that intensify teacher resistance.

The result reflects tensions between technological capabilities and real needs in teaching.

This problem is demonstrated in research [21], through an analysis conducted on a group of 142 ESL teachers, combining the use of Likert scales and qualitative exploration techniques. According to the results, NLP difficulties in contextual comprehension produce generic answers, without the possibility of personalization according to the different cognitive styles, a finding corroborated by nine tabular studies on this duality.

In parallel, the paper [19] applied the methodological paradigm of diffusion of innovations with 842 students, evidence in their study that the technical complexity of integrality requires unsustainable investments, which leaves teachers with the impression that chatbots intrude into their pedagogical autonomy. Table IV, given below, presents the challenges encountered after the rigorous analysis of the selected documents.

TABLE IV. TECHNICAL AND PEDAGOGICAL CHALLENGES IN EDUCATIONAL INSTITUTIONS AFTER IMPLEMENTING CHATBOTS IN E-LEARNING PLATFORMS

#	Technicians	Pedagogical	Quantity	References
1	Accuracy in NLP	Adaptation to learning styles	9	[27], [28], [29], [30], [32], [53], [58], [60], [62]
2	Content updating	Design of effective feedback	6	[41], [44], [57], [64], [68], [75]
3	Integration with platforms	Teacher resistance	7	[33], [35], [39], [46], [66], [67], [80]
4	Limitations in NLP	Lack of metacognitive strategies	6	[47], [51], [61], [63], [69], [81]
5	Complex queries	Competency assessment	5	[31], [34], [36], [65], [70]
6	Data privacy	Technology dependence	4	[37], [43], [56], [78]
7	Algorithmic biases	eacher training in AI	3	[54], [55], [71]
8	Infrastructure	Digital divide	3	[42], [45], [76]
9	Scalability	Autonomous learning	3	[52], [74], [79]
10	Latency in answers	Loss of human interaction	2	[48], [71]

As for the lower frequency, but high criticality challenges, literature boasts compelling arguments. Data privacy and technology dependency, present in four studies, [37], [43], [56], [78], are supported by [24], where technology acceptance models, applied to students aged 12 to 24, detected a wariness of personal data management, exacerbating vulnerabilities on an institutional scale.

Algorithmic biases in studies [54], [55], [71], are quantified by [16], by demonstrating, through their web mining analysis, the existence of a set of homogeneous linguistic texts capable of reproducing cultural biases linked to pedagogical responses. On the other hand, the digital divides, as found by [42], [45], [76], are exemplified by [17], since the Malaysian PPMH model showed that insufficient networks exclude 34% of the population in rural areas.

From the findings, a framework comprising four essential elements is derived: 1) technology and algorithms (NLP, personalization, data management); 2) education and training (active learning methods, training, curriculum); 3) students and learning (autoregulation, motivation, digital competencies); and 4) ethics and governance (privacy, privacy, institutional policies). The balanced interaction between these components shows that chatbot effectiveness depends on both technological innovation and pedagogical and esthetic support.

Finally, [22] validates the latency of responses, already noticed by two investigations [48], [71], since their experiment on computer networks showed a 40% reduction in the degree of confidence of students due to delays longer than ten seconds.

VI. CONCLUSION

SRL's research work analyzed different texts published between the period 2020 and 2024, with the purpose of examining the role of chatbots in e-learning platforms, evaluating their pedagogical benefits, their impact on academic performance and the technical and ethical challenges associated with their implementation. The collection of studies was made from different recognized databases, including Scopus, represented in 34.55% contributions, ScienceDirect with 29.09%, Web of Science with 27.27% and Springer in 9.09%, ensuring a diversified academic coverage.

The review identified that educational chatbots have a positive effect on the personalization of learning, student motivation, self-regulation and efficiency in educational processes. It also contributes significantly to the improvement of academic performance, especially when integrated in a coherent manner with active pedagogical strategies. There were also important difficulties associated with NLP: the need to adapt to different learning styles, the resistance of teachers to its use, and the limitations of the technological infrastructure in academic environments. Therefore, risks associated with data privacy, the emergence of algorithmic biases and the cost of interaction emerged, exposing the need for ethical frameworks to protect information and encourage teacher training regarding the use of tools in e-learning platforms.

Regarding the limitations of the study, the literature reviewed presents one of the typical shortcomings in this type of research: the scarcity of longitudinal studies and the limited availability of studies with terminology associated with the object of research “chatbots” and “e-learning”, and of those works that, although catalogued in the databases consulted, have not been accessible in full text, which has reduced the geographical scope and the subject of the corpus of text analyzed. Indeed, the corpus contains many reviewed works that rely on quantitative approaches and the use of self-reports without real context contrasts, limiting the studies to generalization.

However, and despite these limitations, the study provides a good basis for future research and at the same time serves as a synthesis of the most relevant findings in recent years on the impact of chatbots in digital education. The study invites researchers, developers and policy makers to deepen the analysis of the effectiveness of chatbots, the search for new

conditions of use and the design of new didactic, pedagogical and ethical strategies that allow to take advantage of the full potential offered by these tools to transform the teaching and student learning experience in online education.

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