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Bibliometric Analysis on Educational Games in Preschool Children's Learning

Herrera Rojas Mirela Zuceti[1], Herrera-Rojas Jessica Juliana[1], Ana Cecilia Sotelo-Núñez[1], Oscar López-Regalado[1], Barrueto-Chunga Luis Enrique[2], Mogollón-Torres Daniel Alberto[3]

[1]Universidad César Vallejos
[2]Universidad Santo Toribio de Mogrovejo
[3]Universidad Nacional Pedro Ruiz Gallo
Email: hrojasmz@ucvvirtual.edu.pe

The study examines the crucial importance of the early years in the cognitive and socio-emotional development of children, focusing on the essential role of educational games in early learning. It analyzes the variety and impact of these games on the acquisition of cognitive, social, and emotional skills in early childhood, aiming to conduct a critical analysis of recent research, identify trends, evaluate effective methodologies, and highlight areas that require further investigation in the field of educational games for preschoolers. To carry out this research, a systematic literature review was conducted, using a comprehensive search on the Web of Science and Scopus platforms, complemented by bibliometric analysis. The search period was limited to studies published between 2018 and 2023, selecting 39 articles that met predefined criteria. The results emphasize the effectiveness of educational games in developing key skills such as problem-solving, creativity, collaboration, and conceptual understanding. The diversity of games suggests the need for adaptable and personalized educational strategies in preschool education. The main conclusion is that educational games are valuable and effective tools for the holistic development of preschool children. However, their use and application require careful, evidence-based approaches tailored to the individual needs of each child. This study highlights the value of incorporating educational games into the preschool curriculum, demonstrating that they are not just entertainment but fundamental pedagogical tools that can significantly enhance learning and development processes in the early years of life.

Keywords: preschool education; cognitive development; early learning; socioemotional skills; bibliometric analysis.

1. Introduction

The article highlights critical importance of the early years in children's cognitive and socioemotional development, underlining the relevance of educational games as fundamental tools in early learning. Based on recent research, it highlights these games not only fulfill an

entertainment function, but also play an essential role in integral development of children (Fernandez, 2023; Rose et al., 2020).

The article, as a systematic review, dives specifically into the field of educational games, exploring their application and effectiveness in preschool learning. In line with current findings, it analyzes the diversity of these games and their impact on the acquisition of cognitive, social and emotional skills during early childhood (Mena et al., 2021); critically examining these studies, identifying trends, effective methodologies and areas that demand further research in the specific context of preschool learning.

Through a rigorous synthesis of the most updated literature, the aim is to provide a comprehensive and updated view on the effectiveness and applicability of educational games in the teaching-learning process during the preschool stage. By compiling and evaluating significant studies from the years 2018 to 2023, we seek to provide a solid guide for educators, parents, and professionals interested in optimizing child development through playful and educational strategies.

There is a lack of comprehensive research on durability of the benefits of using educational play in preschool learning. Are the benefits gained in the short term sustained over time? More study is needed on the persistence and continuity of positive impacts on cognitive and academic development as children progress through formal education, as well as on understanding how educational games can be adapted to meet individual children's needs and how cultural, social, and cognitive diversity may influence the effectiveness of these games; there is little solid research evaluating the actual, measurable impact of these games on specific skills, such as literacy, numeracy, or social skills, as well as their relationship to long-term academic performance; although educational games have been associated with the development of cognitive skills, there is little research on how these games can promote soft skills, such as problem solving, critical thinking, creativity, and collaboration among students, in addition to the categories: educational games in teaching; educational games in learning; use of technology in educational games; inclusion of educational games in the curriculum.

Central questions revolving around academic production on educational games in preschool learning are posed: What is the conceptual evolution of scientific articles in relation to the categories of study between the years 2018 to 2023? and What is the panoramic evolution of the production of scientific articles between the years 2018 to 2023? The following objectives were proposed: to analyze the conceptual contribution according to the categories under study of scientific articles; to identify the evolution of the spectroscopy of references, annual production and Lotka's Law; to describe the citations of authors, graphs of three fields and most cited sources, and to analyze Bradford's law, scientific production by countries and thematic map of the articles that are part of the research.

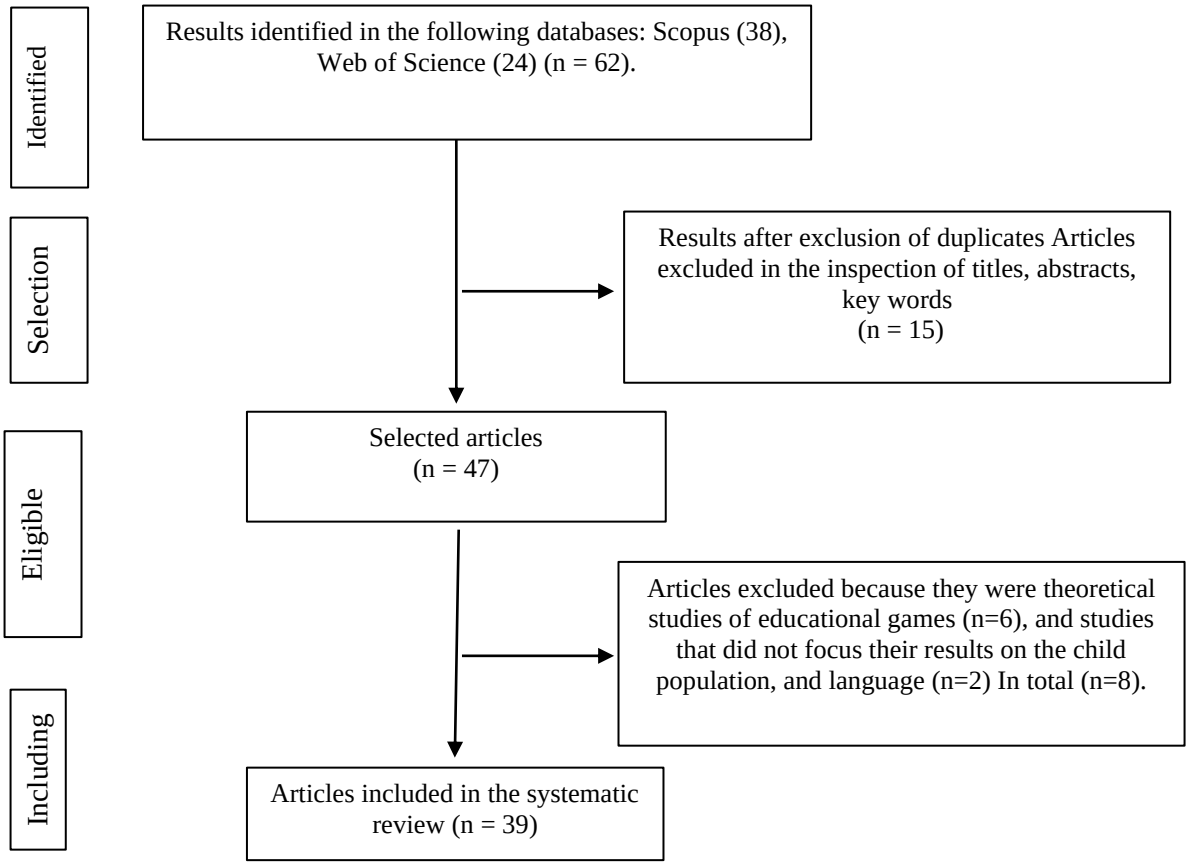
2. Methodology

This is a systematic review, with bibliometric analysis that allows the evaluation of quantitative and qualitative information presented in scientific publications (Arévalo et al., 2021; Ramírez-Montoya & Lugo-Ocando, 2020); it is also a bibliometric analysis, since it uses documents and information (Arévalo et al., 2021).

2.1 Identification and Selection

Once the database had been consulted, the articles were identified and selected according to the PRISMA criteria. Thus, in the identification phase, 62 references were obtained, and when applying the general eligibility criteria, 15 articles that did not meet the established prerequisites were excluded. Thus, the sample was reduced to 47 articles. Finally, after a detailed analysis and applying the criteria: other type of study, participants in other educational stages; a final sample of 39 articles that met all the established criteria was determined.

Figure 1. PRISMA scheme.



2.2 Collection of bibliographic data:

A comprehensive search of relevant literature was conducted in the database: Web of Science and Scopus. The search criteria were set to cover time period from 2018 to 2023 and the keywords: educational games, didactic games, learning, children ((educational AND games) AND (learning) AND (children)

AND (preschool OR enfant OR children)), only articles, relevant to the topic of study, were selected.

Data preprocessing:

The collected bibliographic data were subjected to a preprocessing process. Data cleaning was performed to eliminate duplicates, correct possible errors and ensure consistency in the information collected. In addition, the quality of the metadata was verified and the necessary adjustments were made for their correct interpretation.

2.3 Bibliometric analysis with Bibliometrix:

The Bibliometrix tool in the R statistical programming environment was used to perform the bibliometric analysis. The functionalities provided by the Bibliometrix package were used to calculate basic bibliometric indicators such as distribution of publications over time, citation analysis, co-authorship networks and frequency of key terms. (Aria & Cuccurullo, 2017; Espinosa et al., 2020).

2.4 Validation of results:

To ensure the reliability of the results obtained, additional checks were performed and the findings were contrasted with other relevant literature sources. Sensitivity analyses were carried out to assess the robustness of the conclusions obtained from the bibliometric data.

2.5 Interpretation of findings:

The results of the bibliometric analysis were interpreted in depth, identifying patterns, emerging trends, relationships between authors. The most relevant findings were highlighted and significant connections were established between the different elements analyzed.

3. Results

Qualitative analysis, according to the conceptual contribution according to the following categories

Table 01: Study analysis.

Category: Educational games in education	
AUTHOR, YEAR	CONCLUSIONS
(Li, 2018)	The study focuses on the design of educational games for preschool children, stressing the importance of balancing fun and teaching. It proposes to improve the fusion between attractive elements of the game and the transmission of knowledge, suggesting broader tests to improve its educational effectiveness.
(Holz et al., 2018)	Methodologies such as: "Prosodiya" and "syllable arcs", are being tested in a controlled trial to evaluate their effectiveness in improving the teaching of reading and writing skills in children with difficulties.
(Romero M. et al., 2019)	The co-creation processes evidenced challenges in adapting games to unfamiliar school subcultures, highlighting the importance of aligning local teaching practices.
(Heumos & Kickmeier-Rust, 2020)	Highlights the relevance of appropriate strategies to reduce anxiety in preschoolers through teaching games, given the increasing exposure to media and the fears this can generate in children.
(Aygul & Gurbuz, 2021)	Describes how digital educational games reflect Islamic elements to teach and reinforce religious and moral knowledge through fun. It highlights the importance of monitoring and limiting the use of these games, as they can have negative effects such as digital addiction.
(Rahayu et al., 2022)	The research suggests alternative mathematics teaching using children's curiosity, but requires precise guidance when employing digital games, challenging the creation of adjusted learning strategies and effective classroom management by teachers.
(Thai et al., 2022)	The findings report improvements in "Math Academy," with a focus on activities that develop mathematical teaching in children and are tailored to individual student needs, supporting their implementation in regular educational settings.
(Ugaste, 2023)	The study highlights the connection of three generations to the Soviet era, where in teaching the older ones played outdoors in groups, contrasting with the younger ones who prefer individual and indoor games, evidencing changes in preferences and play opportunities over time.
Category: Educational games in learning	

(Vogt et al., 2018)	The study highlighted the effectiveness of card and board games in developing numeracy skills in early mathematics and emphasized the importance of a guided approach to early mathematics learning.
(Herodotou, 2018)	It is essential to design games that support self-regulation and facilitate learning, with particular attention to how they are integrated into formal educational settings and homes.
(Zaina et al., 2019)	The findings reveal favorable interaction with hand gestures in a computational thinking game for both children and teachers, promoting participants' concentration and engagement. Hand gestures showed potential to enhance communication and learning in intelligent educational environments, encouraging student participation.
(Czauderna & Guardiola, 2019)	It is suggested that the "Game Cycle" methodology closes gaps in the educational game design literature by considering the mechanics of play and learning in their interdependence, achieving a successful union between playing and learning.
(Balaban & Bayindir, 2019)	The "Effects of Digital Games at Early Ages" scale is based on dimensions such as learning, socialization, entertainment, physical and emotional, assessing both positive and negative effects of digital games.
(Gil-Madrona et al., 2020)	It highlights the importance of emotional education programs in Physical Education and strategies to guide learning in the affective domain.
(Coma-Rosello et al., 2020)	The text underlines the importance of improving attention and metacognitive capacity in children with ADHD using adapted games and the guidance of facilitators. It highlights the relevance of designing engaging games and further research to create new games that promote lasting cognitive and motivational skills.
(Delcker & Ifenthaler, 2020)	The design and development of a mobile, game-based instrument capable of collecting reliable, high-quality language data has been completed. It can also function as a tool to help children, legal guardians, and professionals understand children's language development and, furthermore, encourage their progress in language learning.
(Debeer et al., 2021)	The study explores how adaptive digital games improve learning efficiency in early numeracy skills, using log data to model progress and show the positive impact compared to non-adaptive versions of the game.
(Vanbecelaere et al., 2021)	Adaptive and non-adaptive versions of an educational game did not differ in cognitive and non-cognitive learning outcomes, but did differ in temporal efficiency. Adaptive games offer a valuable alternative to cater for differences in children's learning pace.
(Nilsen et al., 2021)	It highlights that it should not be automatically assumed that digital applications offer learning opportunities and that it is crucial to understand how this influences children's learning.
(Pramono et al., 2021)	Thematic learning for children through games on Android facilitates learning on specific topics. These games enable learning anywhere, anytime, but they are not the only form of instruction; content is reinforced with teacher guidance.
(Ylinen et al., 2021)	Games can reduce the influence of perceptual skills on word learning, suggesting particular digital support for those with weaker perceptual skills.
(Heikkilä, 2022)	It highlights the need to understand how gender perceptions influence the evaluation of play modes and suggests that early childhood education staff should consider this to encourage active play in learning that promotes desired ideals in these settings.
(Zammit et al., 2022)	In the game activities, areas for improvement were identified, such as the pace of play and the complexity of some concepts introduced, which can be adjusted to enhance the classroom learning experience.
(Bulut et al., 2022)	The personal design of educational games enhances learning and participants' creative thinking and self-confidence, suggesting that engaging students in this activity could be valuable for their holistic development and interdisciplinary skills.
(Sarfaty & Ben-Eliyahu, 2023)	The study highlights the transfer of self-regulation of learning between areas, proposing daily activities to foster it, which can be valuable in preschool education without the need for additional resources.
(Wang, 2023)	The study analyzes the influence of online typing games on learning motivation, highlighting the importance of student engagement and suggesting future research on the acceptance of different students, the performance-game time relationship, and the improvement of assessment systems in game-based education.
(Romero A. et al., 2023)	The study showed that intervention with the software improved skills related to early manifestations of dyslexia, especially phonological awareness and verbal memory. The software was found to be perceivable, operable, and useful in learning, although improvements were suggested in areas such as feedback and adaptability.
(Vlassis et al., 2023)	The study demonstrated that genuine card and board games are effective in developing arithmetic skills in children, highlighting the importance of a developmentally sensitive approach to fostering mathematical learning at early ages.
Category: Use of technology in educational games	
(Nogry & Varly, 2018)	It is crucial to understand how children adopt technologies and integrate them into their daily lives and social practices, considering the continuities and changes they introduce.

(Abdi & Cavus, 2019)	The study designed an affordable electronic educational toy for preschoolers in developing countries, strengthening English as a second language skills, covering key aspects and being useful for educators and parents in developing nations.
(Tuzun et al., 2019)	It offers a broad description that motivates students in educational computer game contexts.
(Ruiz & Arteaga, 2022)	Results show that the robot facilitates geometric understanding, highlighting circle identification, but also confusions between shapes. It suggests teacher training and the continued use of robots in children's classrooms, proposing the creation of an instrument based on Van Hiele's model for this stage.
(Scholes et al., 2022)	The study analyzes the participatory cultures of children with respect to video games, showing that boys have a greater affinity and digital skills, influencing their emerging identity. It also points out challenges and opportunities to integrate these aspects in educational environments.
(Chen et al., 2023)	The integration of digital technologies can complement formal teaching and personalize the learning experience, strengthening early literacy and technological skills, showing to improve cognitive development, especially in children from disadvantaged backgrounds.
(Tarraga-Sanchez et al., 2023)	The Genially platform was successfully used to achieve the learning objectives and new collaborative tools are expected to reduce development times and promote collaboration among teachers.
(Abbasi et al., 2023)	Educational gaming software not only enhances learning, but also influences other aspects of life.
Category: Inclusion of educational games in the curriculum	
(Chiang et al., 2019)	Highlights the importance of identifying the type of knowledge when designing safety curricula to better understand causal relationships and provide appropriate educational support.
(Laranjeiro, 2021)	The project developed game-based learning applications for preschoolers, applying principles of methodology and curriculum guidelines for preschool education. It integrated key pedagogical areas and followed multimedia recommendations, validating their educational value in tests with educators and preschool children.
(Barman & Kjällander, 2022)	The study emphasizes the need to involve teachers and align digital games with the curriculum for meaningful integration in early childhood education, highlighting co-creation and the use of narratives as crucial aspects for the success of these games.

Analysis:

The Category: Educational games in education.

It is essential to highlight crucial importance of educational games in education, as evidenced by studies in this category. In addition to efficiently balancing fun and teaching, these games address specific educational challenges such as childhood anxiety and managing the use of digital games. Their versatility is highlighted by adapting to diverse school subcultures, implementing flexible strategies, and continually evolving to meet the changing needs of students. This dynamic approach underscores the crucial relevance of educational games as an integral tool in teaching and learning process.

The Category: Educational games in learning.

It underlines the transcendental importance of educational games in learning, as evidenced by the studies found in this category. These studies address the diversity of approaches in the design and implementation of educational games, from the strengthening of mathematical skills to the promotion of self-regulation, adapting to different contexts and needs. The effectiveness of games, whether digital, adaptive or board games, is clearly supported by a variety of research. This fact underscores the need to carefully consider factors such as age, educational environment and children's developmental sensitivity when designing educational games, thus highlighting their essential role in learning process.

The Category: Use of technology in educational games.

It highlights the significant importance of educational games in technological era, supported by several studies. This research addresses the integration of technology into children's lives, from the design of affordable educational toys to the analysis of participatory cultures in video games. Essential aspects include motivation in educational game environments, the usefulness

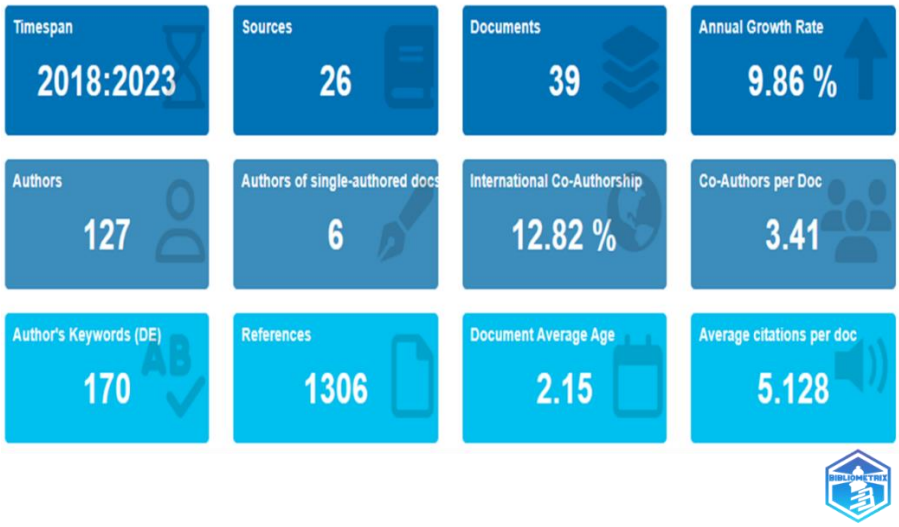
of digital platforms in education, and the global impact of educational games. In addition, the need for teacher training, consideration of gender differences, and personalization of the learning experience through the effective integration of digital technologies are emphasized. This comprehensive approach underlines the fundamental relevance of educational games in the technological context and their transformative potential in educational process.

The Category: Inclusion of educational games in the curriculum.

It emphasizes the central hierarchy of educational games in the curriculum structure, supported by studies on the integration of technologies in early childhood education. The consideration of the necessary knowledge in curriculum design, the application of pedagogical principles in game development and relevance of co-creation emerges as critical aspects. These approaches emphasize the need to adapt to specificities of preschool children's learning, highlighting the importance of effective collaboration between educators and digital game designers to achieve successful implementation in educational environment.

Quantitative analysis

Figure 02: Main Information.



Source: Own elaboration based on bibliometrix data.

Figure 02 shows a series of key statistics summarized in information cards with a dominant blue color scheme.

Time Range: 2018-2023. This range indicates that the data presented have been collected or analyzed over a five-year period.

Sources: 26. The number of sources refers to the databases, journals, or repositories from which analyzed documents were extracted.

Documents: 39. This indicates the total number of documents or publications that have been part of analysis in the time period mentioned.

Annual Growth Rate: 9.86 %. This percentage suggests a sustained growth in number of publications, citations or some other relevant indicator year after year.

Authors: 127. The total number of authors who have contributed to the papers.

Authors of individual papers: 6. This indicates that only six authors have written papers by themselves, with no co-authors.

International Co-authorship: 12.82 %. An indication that approximately one eighth of papers present collaborations between authors from different countries.

Co-authors per paper: 3.41. On average, each paper has been written by approximately three to four co-authors.

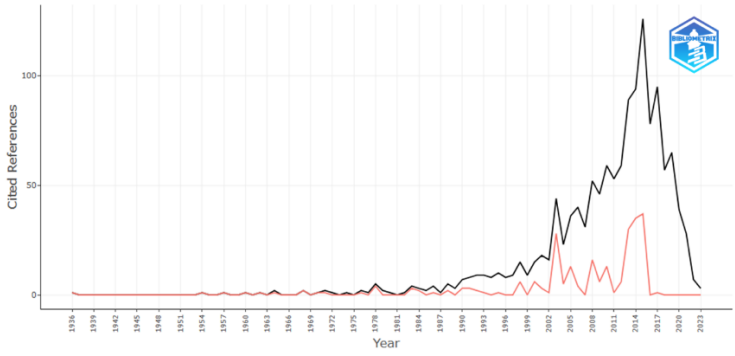
Author Keywords (DE): 170. Refers to number of unique keywords that authors have used in presenting their papers, with "DE" indicating a focus on German-speaking papers or a specific area of study.

References: 1306. The total number of references cited across all papers, suggesting an extensive bibliography.

Average Age of Documents: 2.15. This represents the average age in years of the documents analyzed, indicating that most of the documents are relatively recent.

Average Citations per Document: 5.128. This shows the average number of times each document has been cited, which is an indicator of the relevance or impact of the documents in the academic community. In summary, the interface provides a quick, quantitative overview of scholarly output related to a specific field or dataset over a five-year period. The indicators suggest an active and collaborative body of research with steady growth and significant international participation.

Figure 03: Reference Spectroscopy.



Source: Own elaboration based on bibliometrix data.

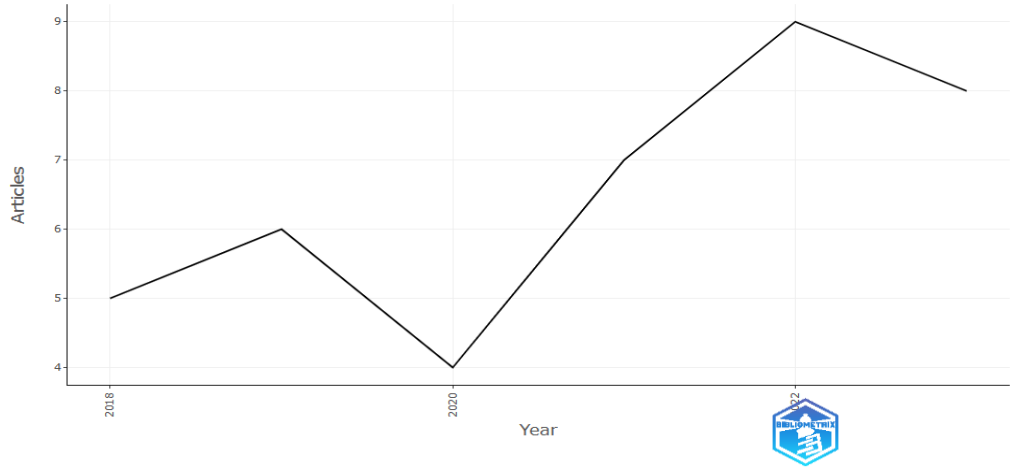
Figure 03 shows a graph entitled "Reference Spectroscopy" representing the number of references cited per year. There are two lines on the graph: a black line and a red line, each representing different data sets or types of cited references.

The graph shows an increasing number of citations over time with a noticeable peak around

2014, followed by a sharp decline. The red line, which has considerably lower values compared to the black line, also shows an increase, although much less pronounced, and a peak around 2014.

The peak in citations indicates an increase in the relevance of a specific topic or the publication of a significant paper in that year that was widely cited. The subsequent decline could be the result of a change in research interests or topic saturation.

Figure 04: Annual scientific production.



Source: Own elaboration based on bibliometrix data.

Figure 04 shows a line graph entitled “Annual Scientific Production”. The Y-axis represents the number of articles and the X-axis represents the years, from 2018 to 2022.

In 2018, the production starts at a level between 6 and 7 articles.

In 2019, there is an increase that brings production to a level around 7 to 8 items.

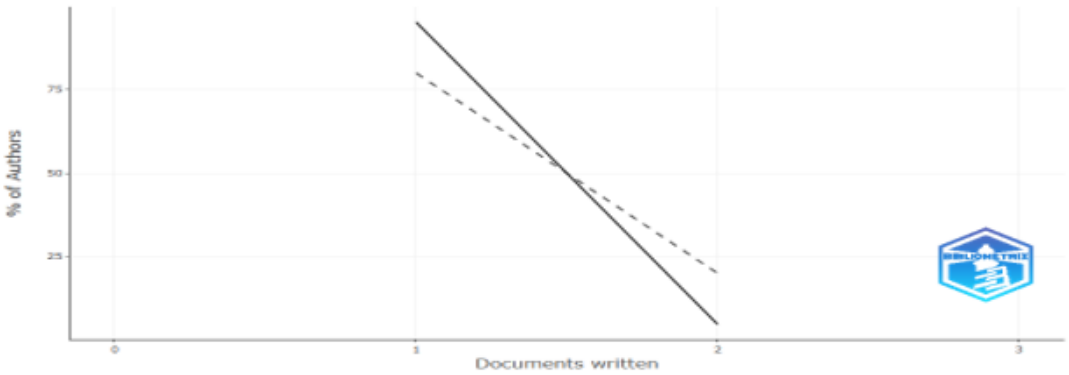
In 2020, there is a drastic drop to a level that is the lowest of the period represented, with less than 5 items. This decrease could be the result of external factors that impacted scientific production, such as the case of the COVID-19 pandemic.

In 2021, there is a significant increase and production soars to more than 9 articles, suggesting a robust recovery and possibly the result of a compensatory effort after the previous year's decline.

By 2022, production drops again, but remains above 2018 and 2020 levels at around 8 items.

In this graph is a visual representation of how external events can significantly influence scientific output. The anomaly in 2020 is particularly notable and could be a starting point for further investigation into the causes of such a decline. In addition, the strong recovery in 2021 could indicate a successful adaptation to the conditions that caused the drop in 2020, such as the shift to digital collaboration and remote access to research due to global mobility constraints.

Figure 05: Productivity of the author through Lotka's Law.



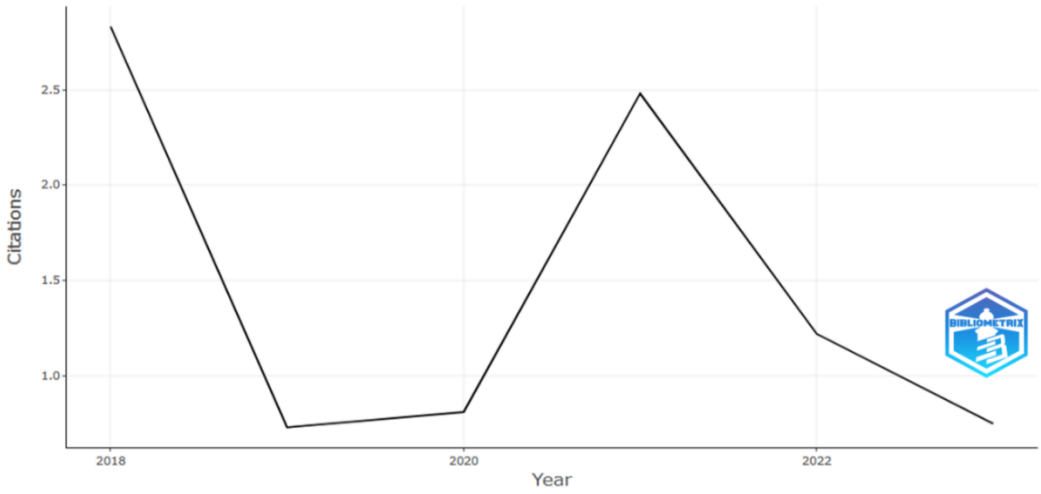
Source: Own elaboration based on bibliometrix data.

Figure 05 shows a graph representing the productivity of authors according to Lotka's Law. According to this law, the number of authors producing n papers is proportional to 1/n^2 of the number of authors writing a paper.

In the graph, the X-axis represents the number of papers written by authors and the Y-axis shows the percentage of authors. The solid black line shows the actual data and the dashed line represents the expected theoretical curve according to Lotka's Law.

It can be seen that most authors have written only one paper, which is common and in line with Lotka's Law, which predicts that there will be many authors with few publications. As the number of papers written by an author increases, the percentage of these authors decreases dramatically, which is also consistent with the law.

Figure 6: Average Citations Per Year.



Source: Own elaboration based on bibliometrix data.

Figure 06 shows a line graph titled "Average citations per year", which represents the average number of citations per article for each year from 2018 to 2022.

2018: The graph starts with a value that is just below 2.5 citations per article, indicating a relatively high start.

2019: There is a marked decrease in the average number of citations per article, reaching a value just above 0.5. This drop could be due to several factors, such as the publication of a larger number of articles with less impact or a change in citation practices.

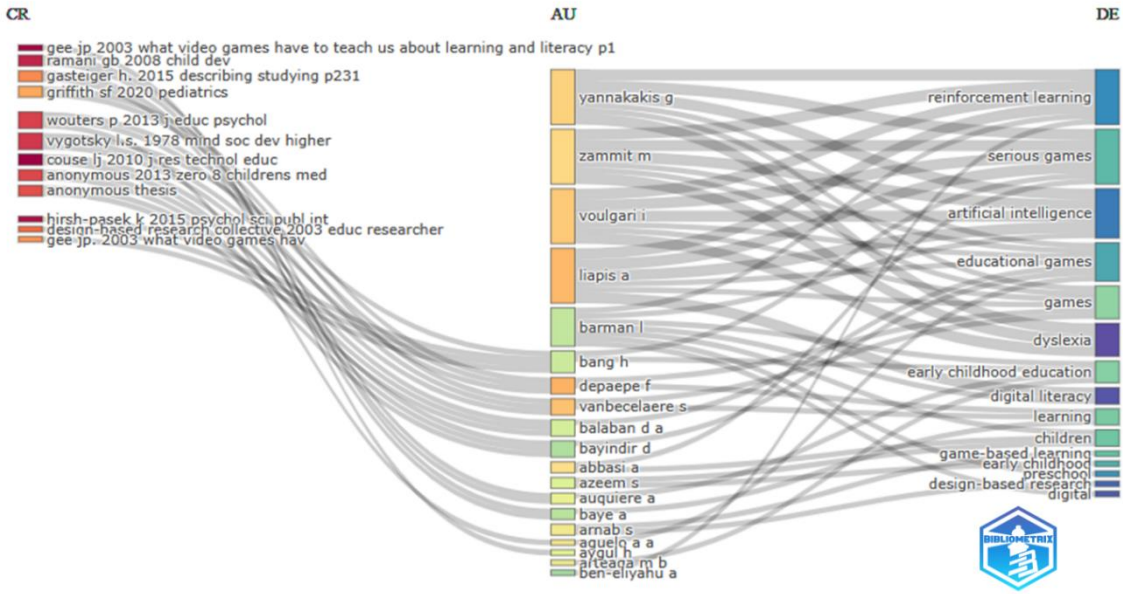
2020: A significant increase is presented, where the average number of citations per article exceeds the initial value of 2018, reaching almost 3 citations per article. This could be interpreted as an improvement in the quality or relevance of the articles published that year, or, alternatively, an effect of the consolidation of research published in previous years that has begun to be recognized and cited.

2021: There is a steep decline again, with the value dropping below 1 citation per article. This pattern of ups and downs could suggest variability in the influence or quality of scientific output from year to year or changes in the topics of interest affecting citation frequency.

2022: The average number of citations continues to decrease, remaining on a downward trend similar to the previous year.

Variability in the average number of citations per year may be indicative of several factors in the field of academic research and publishing. Changes in editorial policy, research visibility, citation behavior in the scientific community or the emergence of new areas of study may influence these numbers.

Figure 07: Three - Field Plot.



Source: Own elaboration based on bibliometrix data.

Figure 07 shows a three-field graph to visualize the relationships between different elements of a set of scientific publications. With this graph, trends and patterns in research can be identified.

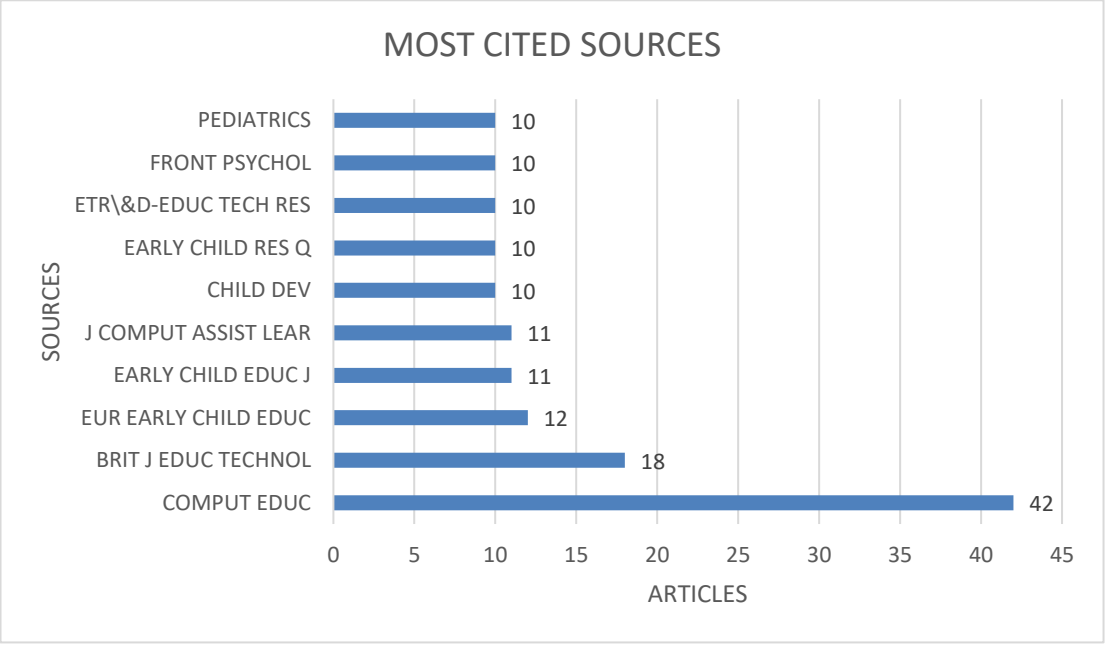
CR (Cited References): On the left side, we have the cited references. These are previous works that have been cited in the analyzed publications. We see a variety of publications dating from 1978 to 2020, suggesting a wide range of influence over time.

AU (Authors): In the center, the names listed are authors of current publications. The diversity of authors suggests a field of study with a wide range of contributing researchers.

DE (Descriptors): On the right side, descriptor terms or keywords are shown that are associated with the current publications. The terms range from "reinforcement learning" to "digital literacy," indicating a concentration of research on topics in learning, games, and educational technology.

The lines connecting the three fields show the relationships between cited references, authors and keywords. For example, we can infer that certain authors have contributed significantly in areas such as "serious games" or "game-based learning", as there are many connections pointing to these terms. The density of lines to certain descriptors also indicates areas of major focus or current interest in the scientific community.

Figure 08: Most Cited Sources.



Source: Own elaboration based on bibliometrix data.

Figure 08 shows a bar chart entitled "Most Cited Sources", which details the most cited sources and the number of articles from each that were cited. The Y-axis shows the sources, which are the titles of academic journals, and the X-axis shows the number of articles cited.

Analysis of the sources presented:

"Comput Educ" is the most cited source with a total of 42 articles, standing out significantly from the rest. This indicates that it is a highly influential journal in the relevant field of study.

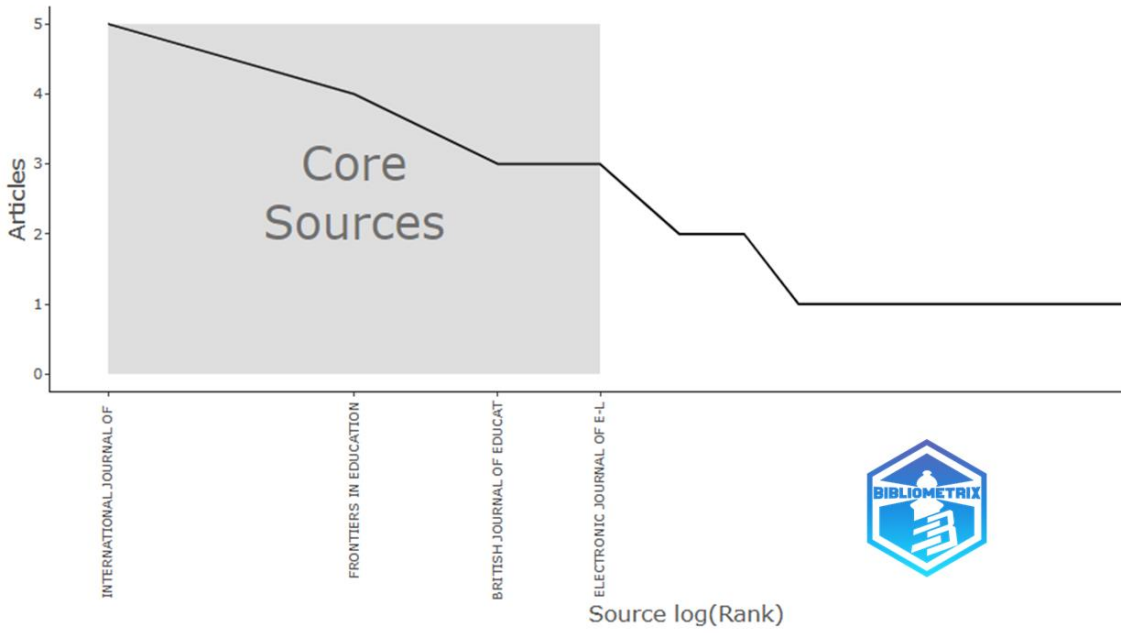
"Brit J Educ Technol" has 18 cited articles, placing it as the second most cited source and suggesting that it is also highly relevant in the field.

The journals "Eur Early Child Educ", "Early Child Educ J" and "J Comput Assist Lear" have 12, 11 and 11 cited articles respectively, indicating a major influence on research related to early education and educational technology.

"Child Dev", 'Early Child Res Q', 'ETR&D-EDUC Tech Res' and 'Front Psychol' each have 10 cited articles, making them frequently referenced sources in the dataset.

The journal "Pediatrics" also has 10 cited articles, which may reflect its relevance to research that crosses the fields of child health and education.

Figure 09: Main Sources according to Bradford's Law.



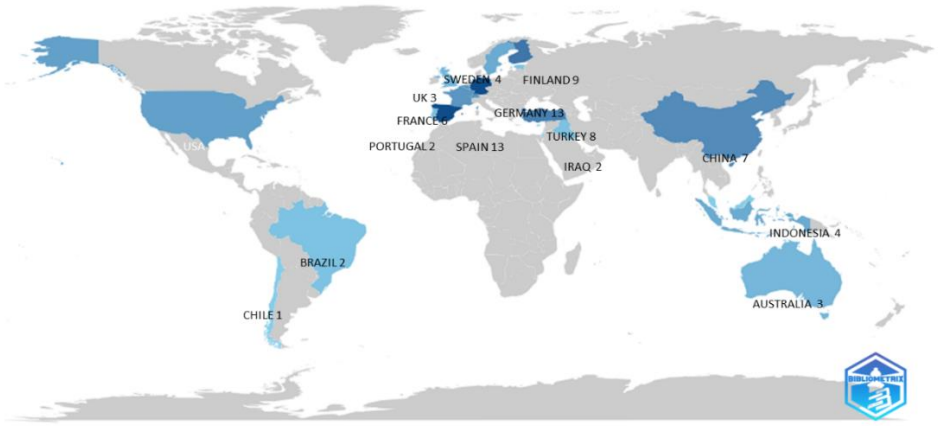
Source: Own elaboration based on bibliometrix data.

Figure 09 depicts a graph representing the "Core Sources according to Bradford's Law." The shaded area labeled "Core Sources" indicates the journals with the highest citation frequency within the field of study, thereby suggesting that they are the most influential or relevant. The curve begins at a relatively high level and then declines, indicating that a small number of journals have a considerable number of articles, while the majority of journals have a progressively smaller number of articles. This is a typical pattern following Bradford's Law.

Notable journals that can be identified in the graph include the International Journal of

Emerging Technologies in Learning, the Frontiers in Education journal, the British Journal of Educational Technology, and the Electronic Journal of E-Learning. As one moves to the right on the x-axis, the number of articles decreases in accordance with the predictions of Bradford's Law. This indicates the presence of a core set of journals that concentrate the majority of relevant publications, followed by a progressive decrease in the number of publications in other journals.

Figure 10: Scientific production of the countries.

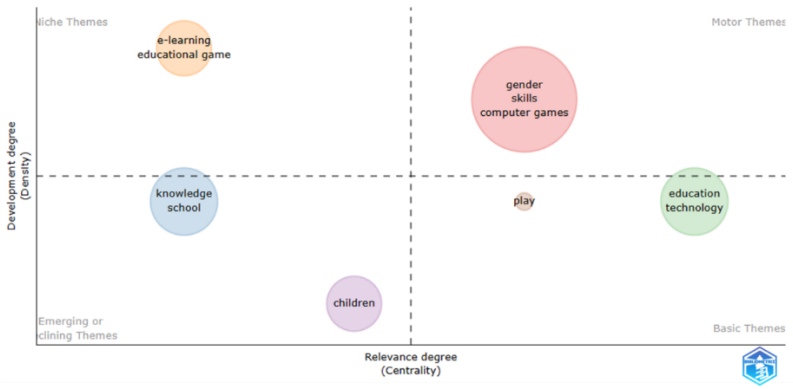


Source: Own elaboration based on bibliometrix data.

Figure 10 shows a map entitled “Scientific production of countries”, which represents the scientific production of several countries. Countries colored in different shades of blue indicate scientific output, in terms of number of publications or citations in a given field or data set.

The darker shade of blue represents higher scientific output, while lighter shades indicate lower levels of output. Countries that are not colored may have no data available or no significant output in the data set analyzed.

Figure 11: Thematic Map.



Source: Own elaboration based on bibliometrix data.

Figure 11 shows a Thematic Map, which classifies themes into four quadrants based on two dimensions: density (or degree of development) and centrality (or relevance).

Niche Themes: In the top left quadrant, we have topics are well developed, but less central, such as "e-learning" and "educational game." These themes are specialized and probably well studied in specific contexts.

Motor Themes: The upper right quadrant shows themes that are both developed and central, indicated by the words "gender", "skills" and "computer games". These are key themes that drive research in this field and are central to the structure of the dataset.

Emerging or declining themes: In the lower left quadrant, we see themes such as "knowledge" and "school", which are less developed and less central. These could be emerging or declining themes within the field of study.

Basic Themes: In the lower right quadrant, "education" and "technology" appear as basic themes with high centrality but less developed within the data set. These themes are fundamental to the discipline and may represent growing areas of research.

The size of each bubble indicates the number of papers or the intensity of research related to each topic. The topic "children" is presented as a smaller bubble, suggesting that it is an emerging or declining topic with less development and centrality.

4. Discussion

The systematic review analyzes 39 articles, highlighting the importance of integrating educational games into preschool curriculum for comprehensive development. Games go beyond entertainment, supporting playful learning theory that emphasizes effectiveness in developing key skills such as problem solving and creativity (Rahayu et al., 2022; Sarfaty & Ben-Eliyahu, 2023). Its relevance in early education lays the foundation for future learning.

The diversity in games and approaches points to the lack of a one-size-fits-all approach, urging educators to be selective and adaptive in integrating games according to specific needs and contexts (Zaina et al., 2019). Despite promising results, the need for more research persists, especially in comparing digital and physical games in terms of educational impact (Bulut et al., 2022; Laranjeiro, 2021). For educators, it highlights the need to strategically integrate educational games, while for developers, it highlights importance of designing based on sound pedagogical principles (Abdi & Cavus, 2019; Li, 2018).

5. Conclusions

In conclusion, specific categories such as "Educational games in teaching" emphasize their essentiality to balance fun and learning, contributing to the holistic development of children (both cognitively and emotionally). "Educational games in learning" highlights their research-backed effectiveness and their essential role as a motivational and formative tool in learning. "Use of technology in educational games" highlights relevance of didactic digital tools in today's education. "Inclusion of educational games in curriculum" highlights the importance of integrating games organically into curriculum for specific educational objectives.

Analyzing the evolution of reference spectroscopy, annual production and Lotka's Law reveals a growing richness in theoretical base and an uneven distribution of scientific production. The citations form scientific communities around specific topics, with graphs of three fields evidencing interdisciplinarity. Bradford's Law confirms the concentration in specific journals, and scientific production by country identifies leaders in the contribution to field, with the thematic map showing diversity of approaches in different regions.

The review of academic production on preschool educational games between 2018 and 2023 highlights a conceptual evolution towards more adaptive approaches, reflecting incorporation of contemporary technologies and theories. The uneven distribution of scientific output, the influence of key sources, the concentration in specific journals, and the variability in output by country underscore the global dynamics of research in this field. These findings provide a solid foundation for future research and guide decision-making in design and implementation of preschool educational games.

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