



Digital Age Education: A Bibliometric Review of Digital Natives Across Two Decades

- Educação na era digital: revisão bibliométrica dos nativos digitais em duas décadas
- Educación en la Era Digital: Revisión Bibliométrica de los Nativos Digitales en Dos Décadas

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Abstract

Digital natives are a generation that grew up using technology as their main means of communication. Despite the relevance of the topic, there is still a lack of comprehensive bibliometric studies linking the concept of digital natives to the educational context. This work analyzes academic production on *digital natives* in education between 2001 and 2023, highlighting recent trends. Data from the Scopus database and the VOSviewer software were used for bibliometric analysis. Authors such as Bennett, Antón-Sancho, and Fernández-Arias stood out, and the most cited article was "Digital Natives, Digital Immigrants Part 1" by Prensky (2001), a central reference in the field. The research identified five main thematic lines: computational education, social networks, digital age, educational training, mobile technologies, and e-learning. The most relevant terms for future investigations include digital competence, smartphone, application, gamification, educational technology, and digital age. The study stands as a reference in bibliometric studies on digital natives in the educational context, emphasizing the importance of future research on teaching technologies and the role of citation networks and emerging subthemes. Finally, it highlights the need for educational institutions to adapt their methodologies to the digital age, promoting innovative practices aligned with contemporary demands.

Keywords

education; educational technology; digital literacy; educational research; bibliometrics; digital natives

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Resumo

Os nativos digitais formam uma geração que cresceu utilizando tecnologia como principal meio de comunicação. Apesar da relevância do tema, ainda faltam estudos bibliométricos abrangentes que relacionem o conceito de *nativos digitais* ao contexto educacional. Este trabalho analisa a produção acadêmica sobre nativos digitais na educação entre 2001 e 2023, destacando tendências recentes. Foram utilizados dados da base Scopus e o software VOSviewer para análise bibliométrica. Autores como Bennett, Antón-Sancho e Fernández-Arias se destacaram, e o artigo mais citado foi “Nativos Digitais, Imigrantes Digitais Parte 1”, de Prensky (2001), referência central na área. A pesquisa identificou cinco principais linhas temáticas: educação computacional, redes sociais, era digital, formação educacional, tecnologias móveis e e-learning. Entre os termos mais relevantes para futuras investigações estão competência digital, smartphone, aplicativo, gamificação, tecnologia educacional e era digital. O estudo se consolida como referência nos estudos bibliométricos sobre nativos digitais no contexto educacional, o que ressalta a importância de pesquisas futuras sobre tecnologias de ensino e o papel das redes de citação e subtemas emergentes. Por fim, destaca-se a necessidade de instituições educacionais adaptarem suas metodologias à era digital, promovendo práticas inovadoras e alinhadas às demandas contemporâneas.

Palavras-chave

educação; tecnologia educacional; competência digital; pesquisa educacional; bibliometria; nativos digitais

Resumen

Los nativos digitales forman una generación que creció utilizando la tecnología como principal medio de comunicación. A pesar de la relevancia del tema, aún faltan estudios bibliométricos integrales que relacionen el concepto de *nativos digitales* con el contexto educativo. Este trabajo analiza la producción académica sobre nativos digitales en la educación entre 2001 y 2023, destacando tendencias recientes. Se utilizaron datos de la base Scopus y el programa VOSviewer para el análisis bibliométrico. Autores como Bennett, Antón-Sancho y Fernández-Arias se destacaron, y el artículo más citado fue “Nativos Digitales, Inmigrantes Digitales Parte 1” de Prensky (2001), referencia central en el área. La investigación identificó cinco líneas temáticas principales: educación computacional, redes sociales, era digital, formación educativa, tecnologías móviles y e-learning. Entre los términos más relevantes para futuras investigaciones están competencia digital, smartphone, aplicación, gamificación, tecnología educativa y era digital. El estudio se consolida como referencia en estudios bibliométricos sobre nativos digitales en el contexto educativo, lo que resalta la importancia de futuras investigaciones sobre tecnologías de enseñanza y el papel de las redes de citación y subtemas emergentes. Finalmente, destaca la necesidad de que las instituciones educativas adapten sus metodologías a la era digital, promoviendo prácticas innovadoras y alineadas con las demandas contemporáneas.

Palabras clave

educación; tecnología educativa; competencia digital; investigación educativa; bibliometría; nativos digitales

Introduction

The field of education has been facing scenarios of technological changes that shape contemporary society. The widespread adoption and accessibility of technological resources, particularly the pervasive use of the internet across diverse domains ranging from leisure to professional pursuits, have led individuals to be increasingly reliant on developing digital competencies (Pedaste *et al.*, 2023). A teacher's digital competence is an important condition for educational technologies to be implemented effectively (Saltos-Rivas *et al.*, 2023). However, adjustments in digital education with pedagogical or professional components are still scarce (Tzafilkou *et al.*, 2023).

Several authors (Babu *et al.*, 2023; Moya & Camacho, 2021; Zheltukhina *et al.*, 2023) underscore that young individuals exhibit a pronounced inclination toward active learning methodologies that incorporate technology. Furthermore, youths recognize educational institutions as environments conducive to their cognitive growth. However, they also acknowledge the potential incorporation of alternative teaching methodologies and pedagogical practices, such as videos, animations, and games, to improve the facilitation of learning within the school environment (Moreira, 2022). To incorporate these digital elements into the teaching process for young individuals, teachers must first have the opportunity to familiarize themselves with digital learning technologies so that they can use them effectively in the teaching environment (Müller & Leyer, 2023).

The term *digital natives* became widely recognized through the studies conducted by Marc Prensky, wherein the author addresses how individuals of this generation have been immersed in digital technologies since birth, employing digital language even within the classroom (Prensky, 2001a, 2001b). This

generation is accustomed to using virtual and interactive platforms in their daily lives (Nguyen *et al.*, 2022), and they seek knowledge through various technological platforms (Beltrán-Flandoli *et al.*, 2023; Fernández-Sánchez *et al.*, 2023; Mospan, 2023). Considering the ease of access and utilization of digital resources among individuals belonging to this generation, it can be inferred that pedagogical methods should, in their design, not only incorporate these resources but do so critically and creatively, igniting the interest of learners and fostering their engagement (Moreira, 2022).

According to our research, more than 45% of papers published in journals on the topic have been concentrated in the last six years when analyzing papers indexed in the Scopus database. Using the same database as a reference, we found that only 4 papers employed a bibliometric review on *digital natives*, indicating a scarcity in the literature on the subject, and none linking to the educational context of this generation. In this way, we understand that bibliometric studies that map the educational context of *digital natives* still lack further research to advance the state of the art.

Through identifying key studies, prominent authors, co-citation networks, standout journals, prolific and contemporary terms, as well as trends related to *digital natives* in the educational context, we seek to address the following research questions:

RQ1: What insights does bibliometric analysis offer for mapping studies related to *digital natives* in the educational context?

RQ2: What insights does bibliometric analysis provide regarding the evolution of literature on *digital natives* in the educational context?

RQ3: What are the main research gaps and trends for future studies on *digital natives* in the educational context?

Thus, this study aims to analyze the scholarly production in literature related to *digital natives* in the educational context, spanning from 2001 to 2023, highlighting recent trends in the education of the 21st-century generation. Considering the significance of researching a generation born in the digital age, characterized by an immediacy in information retrieval and activity development, as well as possessing extensive access to information through the mediation of technological resources and devices (Li & Zhu, 2023), this study conducted a bibliometric analysis on 624 scientific papers surrounding the topic and its evolution over time in the Scopus database.

This research updates, enriches, and expands the literature on *digital natives*, filling a gap identified in bibliometric research (Chen *et al.*, 2022; Churiyaha *et al.*, 2022; Dastane & Haba, 2023; Mirakyan & Berezka, 2022). Remarkably, these prior analyses did not address the educational context of *digital natives* from the inception of the term in 2001 until 2023. In one such study (Dastane & Haba, 2023) the top five keywords with the strongest connections to other terms were identified: students; e-learning; teaching; engineering education; and education. These keywords are inherently tied to the educational context, further showcasing the potential to bridge the educational environment with the theme of *digital natives*. Notably, no bibliometric study has made such an integration before. Additionally, Dastane and Haba (2023) encourage authors to conduct research on this generation with an educational focus, thereby amplifying new discoveries in the literature about *digital natives*.

The present paper has four sections. The subsequent section presents the state of the art of literature concerning the educational context of Digital Natives. Section three details the methodology employed in the study, and section four presents the study's findings, addressing the research questions raised (RQ1, RQ2, and RQ3). Finally, conclusions are presented, followed by future research directions, practical, and societal implications.

Theoretical Framework

The generational group of *digital natives*, also known as Generation Z, is immersed in digital technologies and constitutes a generation born between the periods of 1995 to 2010 (Andrea *et al.*, 2016; Bassiouni & Hackley, 2014; Berkup, 2014; Ilin & Shestova, 2014; Koksai, 2019; Pérez-Escoda *et al.*, 2016). Although this timeframe is not universally agreed upon among researchers studying the *digital natives'* generation (Andrea *et al.*, 2016), the literature suggests that individuals who share the same historical and cultural experiences, possess similar characteristic traits, and share values, and economic and political experiences, are grouped within the same generational cohort (Andrea *et al.*, 2016; Berkup, 2014; Koksai, 2019; Mannheim, 1952).

Digital natives are hyperconnected, as they were born into contexts where digital technologies, especially the internet, were readily accessible and pervasive in their everyday lives for various leisure, entertainment, work, and study activities (Arifah *et al.*, 2021). Individuals of this generation also share the common trait of

being more immediate and responsive in their behaviors, utilizing technological resources and devices to fulfill their needs (Li & Zhu, 2023).

Despite the significant changes that the educational environment has undergone, particularly during and after the COVID-19 pandemic, it is pertinent to analyze the challenges posed by this model of mediation through digital resources to enhance the interaction between educators and learners (Alon *et al.*, 2023). Therefore, a closer examination is necessary to understand how, why, and through which tools the younger generation is engaged in learning via digital media (Kesharwani, 2020; Tran *et al.*, 2020).

Teachers have encountered a series of challenges in adapting their traditional teaching methods to online learning platforms and rely on training provided by educational institutions on these platforms (De Gioannis *et al.*, 2023). The school, as an institution, and its professionals, encompassing not only educators but also administrators and other educational advisors, must consider the new learning needs of the recent generations, as well as the variations in skill acquisition found within these same groups (Bozkurt *et al.*, 2022; Evans & Robertson, 2020; Tran *et al.*, 2020).

Research Method

The methodology proposed for this study is grounded in literature review and the application of bibliometric procedures, aiming to conduct a bibliographic survey and quantify the international literature on *digital natives* in the educational context from 2001 to 2023, highlighting the most recent trends in this subject during the 21st century.

Bibliometric research in databases has been utilized by authors in academia to produce quantitative data comparisons (AlRyalat *et al.*, 2019; De Groote & Raszewski, 2012) in academic papers (Li *et al.*, 2010; Li & Zhu, 2023). In this study, bibliometrics are also

employed to analyze citation and co-citation data (Jacso, 2005; Thelwall, 2018), the most prolific institutions (Aswathy & Gopikuttan, 2015; Bilir *et al.*, 2015) and academic journals publishing in the field of study (Liu *et al.*, 2021; Singh *et al.*, 2021). Bibliometrics enable a global understanding of international databases, such as Scopus, allowing for the categorization and analysis of their scientific contributions (Khurana *et al.*, 2022).

The initial sample for this study was obtained through a search in the Scopus database, using the following descriptors: “digital native” AND “educ*”, resulting in 1.222 papers. It is important to highlight that Scopus is the largest database for abstract and citation literature for peer-reviewed publications (Zanjirchi *et al.*, 2019). Therefore, as a selection criterion, the sample did not include books, papers published in conferences, or any other documents that were not papers exclusively published in journals, resulting in a final sample of 624 papers. Journals undergo a rigorous evaluation and review process, which lends greater credibility to the published papers (Singh *et al.*, 2022). Through peer review, manuscripts are critically assessed by experts to ensure their scientific quality and rigor before publication.

From this selection, the VOSviewer tool (Singh *et al.*, 2022; Van Eck & Waltman, 2010) was utilized, which facilitates the visualization of search results obtained from Scopus through a structure of histories and relationships (Börner *et al.*, 2007; van Eck & Waltman, 2010). Specifically, this structure enables the identification of connections among publications, authors, citations, and keywords, helping to reveal the development and interrelated nature of knowledge within a research field. The acquired data involve key countries, papers by authors, citation and co-citation networks, journals where the works were published, and trends in the main terms identified in the literature concerning *digital natives* in the educational context.

The present study was divided into four stages:

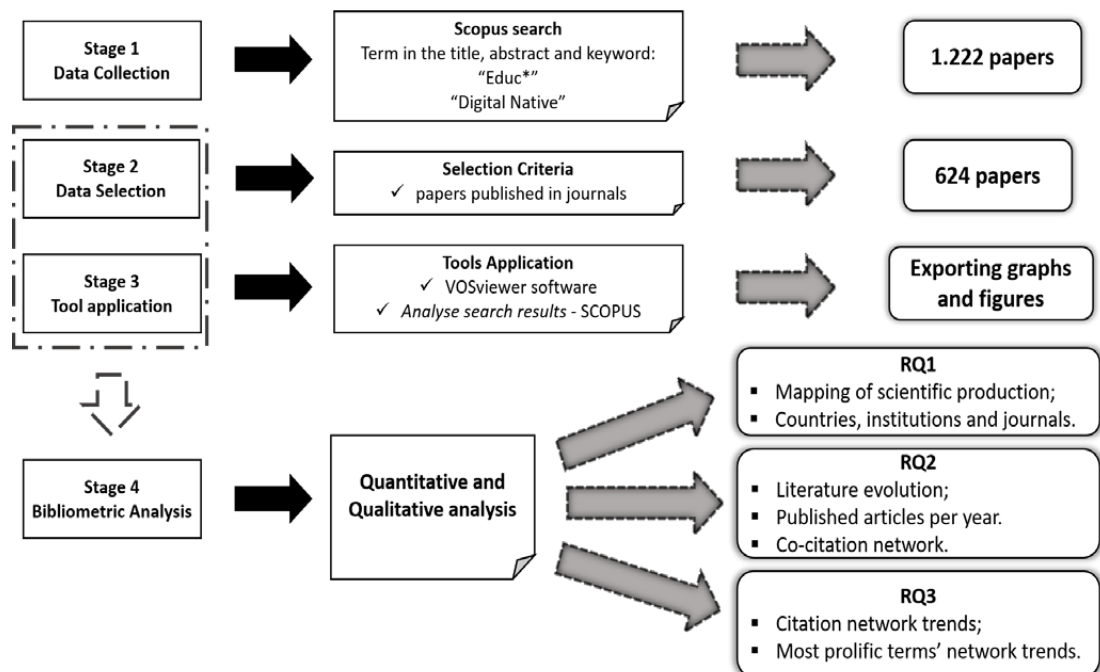
Stage 1 – Data collection: In an initial search in the Scopus database, the search terms “educ*” AND “digital native” were employed to search titles, abstracts, and keywords of the researched papers, resulting in a total of 1.222 papers.

Stage 2 – Data selection: In this stage, to select papers that had undergone a rigorous peer-review process, our sample included only those papers published in journals, thereby eliminating conference papers, books, preprints, and other papers not exclusively published in journals, resulting in a total of 624 papers.

Stage 3 – Tools application: The VOSviewer software and the analyze search results tool from Scopus were utilized to export the graphs and figures pertaining to our research.

Stage 4 – Bibliometric and quantitative/network analysis: Finally, using data from the last two stages mentioned above, a bibliometric analysis was conducted based on quantitative and network data to address RQ1, RQ2, and RQ3. From the data in this Stage 4, it was possible to provide a current overview of research on *digital natives* in the educational context and to suggest trends and new perspectives for studies in this field. Figure 1 illustrates the proposed methodology stages and the main outcomes of each research stage.

Figure 1
Research stages



Source. Own elaboration.

Results and Discussion

Through a preliminary search for articles published in journals within the Scopus database involving bibliometric research on *digital natives*, only 4 papers were found (Table 1). This review was conducted for publications from 2001 to 2023, using the terms “digital native” AND “bibliomet*”. This search highlighted the prominence of the subject through bibliometric studies, as all the papers were published within the last two years (2022-2023). While the educational dimension of digital natives has been extensively addressed in the literature, no bibliometric study was found that comprehensively mapped the intellectual development and research trends of this field.

Table 1

Bibliometric papers indexed in Scopus

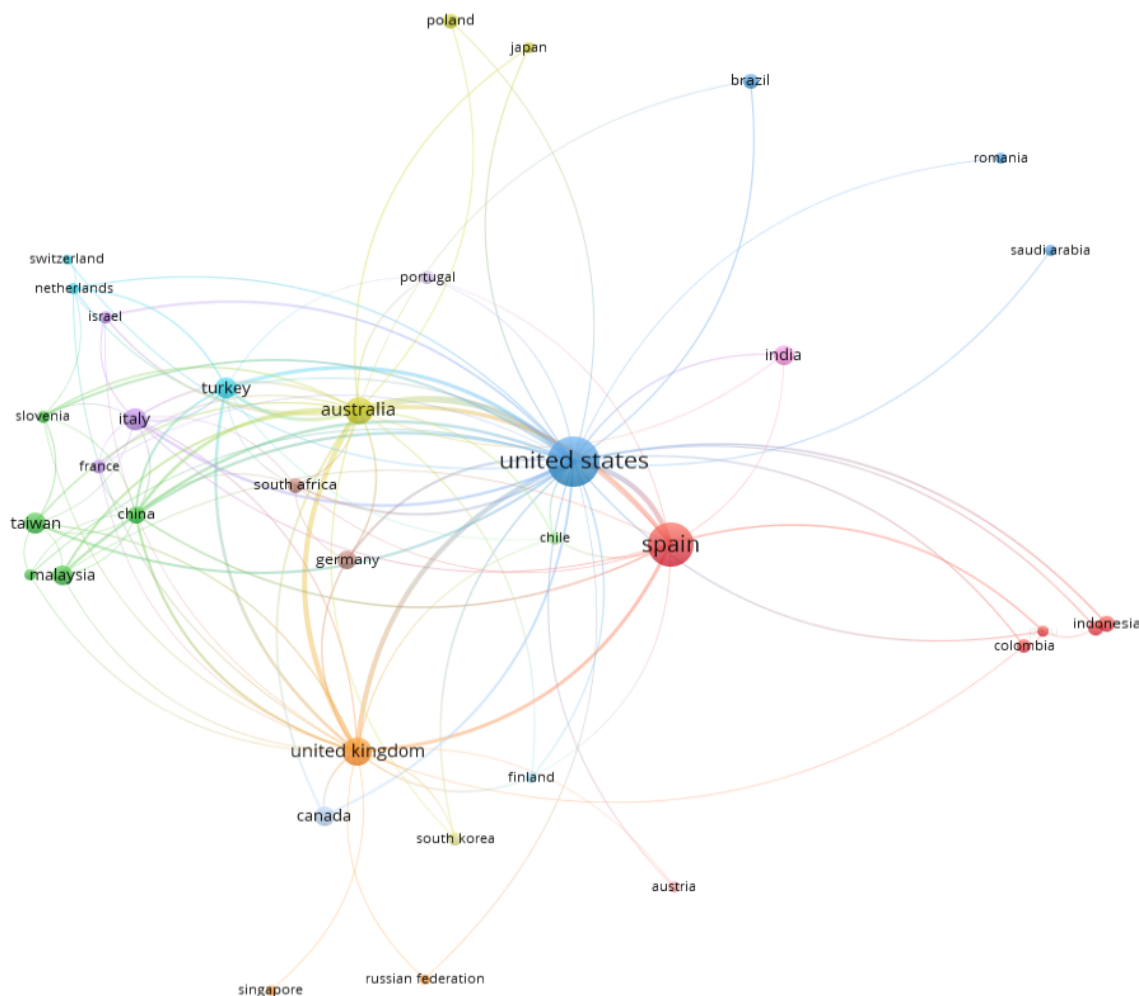
Authors	Source	Title	Purpose and Methodology	Results
Churiyaha et al. (2022)	<i>World Journal on Educational Technology: Current Issues</i>	Mobile learning uses in vocational high school: A bibliometric analysis.	Purpose: to conduct a thorough bibliometric analysis of the literature on mobile learning in vocational high schools. Methodology: articles were obtained from the Scopus database, as many as 121 articles were studied in this study, out of 132 articles discovered between 2015-2020. After managing the database, the researcher used VOSviewer software to classify and visualize co-authorship, co-accuracy, and citation.	Keywords relating to research on the utilization of mobile learning in vocational high schools are becoming more prevalent each year. The level of collaboration between writers across countries is relatively low where there is almost no collaboration between writers from different countries.
Dastane & Haba (2023)	<i>FIIB Business Review</i>	The Landscape of Digital Natives Research: A Bibliometric and Science Mapping Analysis.	Purpose: to provide a panoramic view of the research undertaken so far in the field of digital natives to highlight important trends, examine the intellectual structure and provide recommendations for future research. Methodology: The study uses 983 publications from the Scopus database to analyses the productivity, impact and research performance of nations, journals, authors, and institutions using indicators such as impact factor, h-index and citation counts.	There are few studies in the field of business and management that focus on digital natives. The research then delves into five major issues in the literature on digital natives: education (including students and learners), social media, technology, information systems, and digital immigration.

Chen et al. (2022)	<i>Australasian Journal of Educational Technology</i>	Research issues of the top 100 cited articles on information literacy in higher education published from 2011 to 2020: A systematic review and co-citation network analysis.	Purpose: to explore the research trends and potential research issues in the top 100 most frequently cited articles on information literacy in higher education published from 2011 to 2020. Methodology: to a systematic review, this study employed bibliometric methods, including co-citation network analysis.	Four main research streams in the field of information literacy in higher education were identified: (a) the relationships among students' information literacy beliefs, competencies, attitudes and behavior; (b) teachers', librarians', and students' perspectives on information literacy; (c) the relationship between students' information literacy and epistemic beliefs; and (d) the web search behavior of digital natives.
Mirakyan & Berezka (2022)	<i>Communications in Computer and Information Science</i>	Management and COVID-19: Digital Shift to Remote Work and Remote Management.	Purpose: to provide an understanding of remote management, its challenges and opportunities faced in remote working by digital natives, young undergraduate students. Methodology: this study employed bibliometric analysis with VOSviewer in 2018–2021 and an exploratory study of the opinion of undergraduate students regarding modern management practices.	The authors identify key benefits and challenges of remote management for the employees, employers and organizations. The respondents consider that remote work format is a driver of positive and negative organizational change that impact different organizational aspects – decision making, communication, conflict, organizational culture, leadership, and motivation.

Source. Own elaboration.

Among the four studies mentioned earlier, three are indexed in scientific journals, and one is a part of a book chapter. Only one study was identified that employed a bibliometric approach to examine the evolution of the digital native literature since the introduction of the concept in 2001. However, this study did not focus on the educational context of digital natives, a crucial aspect for proposing future directions in the teaching and learning process of this generation.

Aiming to address the first research question: RQ1: What insights does bibliometric analysis offer for mapping studies related to *digital natives* in the educational context? Figure 2 depicts a network of the most prolific countries in our analysis, covering the period from 2001 to 2023. Employing the full counting method of countries through VOSviewer software, a total of 98 countries were identified, using a minimum of five documents per country, resulting in a network of 35 countries.

Figure 2*Most prolific countries*

Source. Own elaboration.

The most prolific countries in our analyses are the United States and Spain, with over 200 publications combined. They are followed by the United Kingdom and Australia, in that order of production. Notably, the United States, Australia, and the United Kingdom have the highest numbers of citations when compared to other countries, indicating that they are prominent locations for institutions widely cited in this thematic field.

When we compare these results with the findings of Dastane and Haba (2023), we observe a consonance between the most prolific

countries concerning the topic of *digital natives* when contextualized in the educational scenario. In other words, the previously mentioned countries remain among the most active nations in producing scientific papers about *digital natives*.

Table 2 presents the number of documents belonging to the institutions extracted from the Scopus database through the analyze search results tool, illustrating the top seven affiliated institutions involved in publications in our analyses.

Table 2*Most prolific affiliated institutions*

Affiliated institutions	Documents
Universidad Complutense de Madrid	8
Anadolu Üniversitesi	7
Universidad Internacional de La Rioja	7
Universidad de Sevilla	6
Universitat d'Alacant	5
University of Wollongong	5
Universidad de Granada	5

Source. Own elaboration.

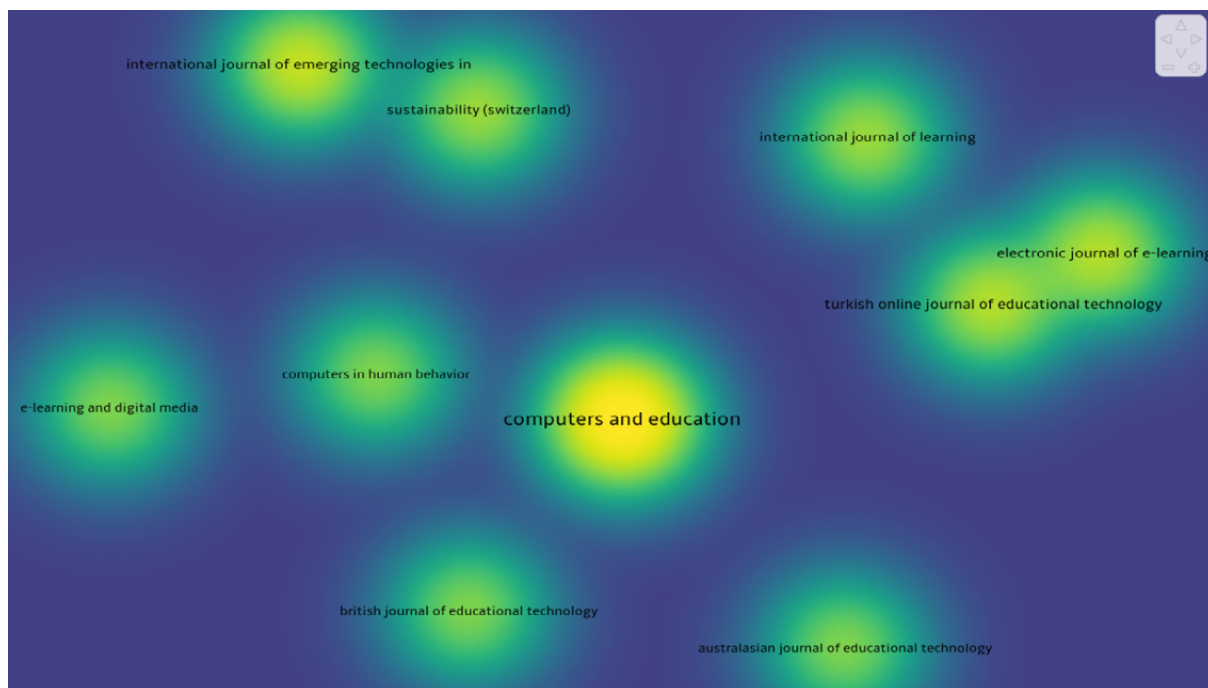
The institutions that have published the most about *digital natives* in our analyses are Universidad Complutense de Madrid (Spain) and Anadolu Üniversitesi (Turkey) / Universidad Internacional de La Rioja (Spain) with eight and seven documents respectively. It is worth noting that, in the study by Dastane and Haba (2023), Universidad Complutense de Madrid (Spain) stood out as the primary institution in terms of producing papers on digital natives in the educational context.

When we compare these data with Table 3, we notice that some of the most cited authors on the topic, such as Antón-Sancho and Fernandez-Arias, are affiliated with Spanish universities. These institutions, in turn, constitute a portion of the top ten universities prominently engaged in producing works about our field of study. This observation is accentuated by the fact that Spain ranks as the second most prolific country in this area and holds the fourth position in terms of the number of citations.

In Figure 3, a map of the primary journals researched in the Scopus database from the period between 2001 and 2023 is presented. Utilizing the VOSviewer software in density visualization mode, a total of 431 journals were identified, using a minimum of five documents as a threshold, resulting in the top ten prominent journals.

Figure 3

Most prolific journals



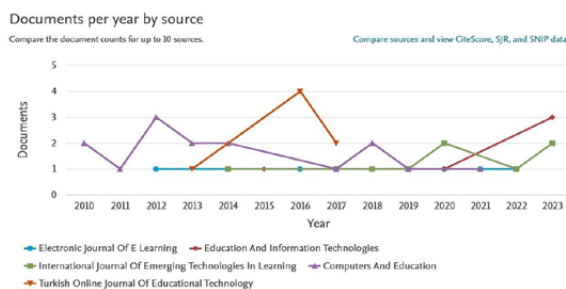
Source. Own elaboration.

It can be observed that the most prolific journal in the field is *Computers & Education* with 15 publications, being the most cited (2.572 times) by other scientific journals in the sample. Journals with fewer citations, yet holding significance in the research field, include *International Journal of Emerging Technologies* with nine publications; *Electronic Journal of e-Learning* and *Turkish Online Journal of Educational Technology* with seven publications each. When analyzing recent studies on *digital natives*, we observe that the journal *Computers & Education* has also proven to be relevant (Altinpulluk & Yildirim, 2023; Dastane & Haba, 2023; Hebebeci & Nilay, 2023). However, these studies did not explore the correlation between *digital natives* and their educational context.

In Figure 4, we present a graph extracted through the analyze search results tool from the Scopus database, which demonstrates the top five most prolific journals per year, from 2010 to 2023.

Figure 4

Journals published per year

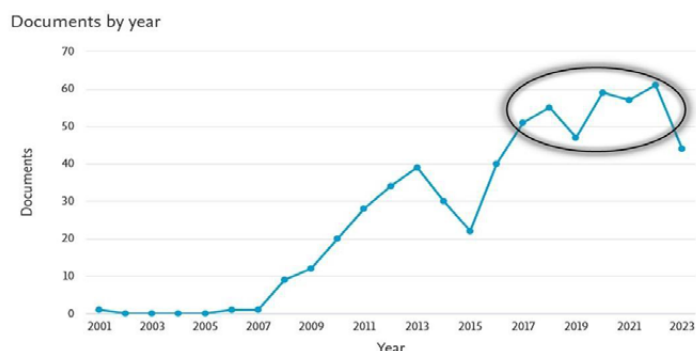


Source. Own elaboration.

The analysis of journals advances the studies of Dastane and Haba (2023) by pointing out other important journals (*Electronic Journal of e-learning*; *Education and Information Technologies*; *International Journal of Emerging Technologies in Learning*; *Turkish Online Journal of Education Technology*) for the literature on the topic of *digital natives*, in addition to the previously mentioned *Computers & Education* highlighted by the authors.

Aiming to address the second research question: RQ2: What insights does bibliometric analysis provide regarding the evolution of literature on *digital natives* in the educational context? Figure 5 presents a graph, extracted from the Scopus database using the analyze search results tool, which illustrates the number of papers published in journals from 2001 to 2023.

Figure 5
Papers published per year



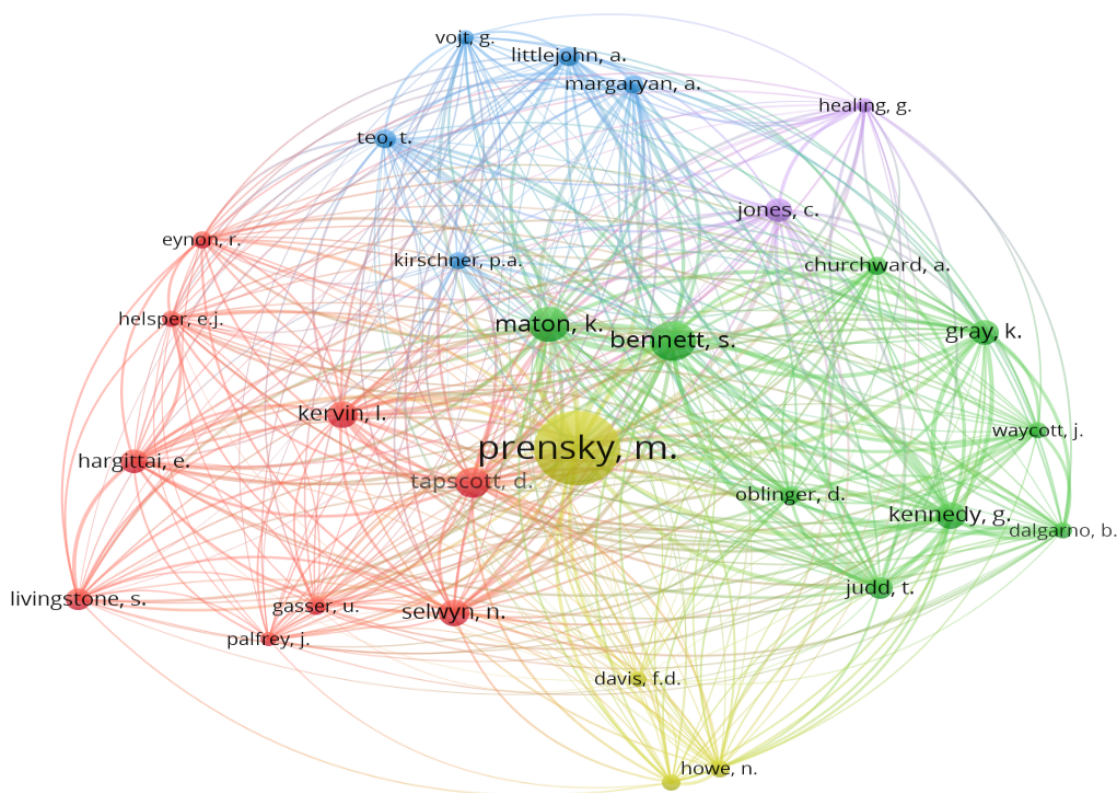
Source. Own elaboration.

It can be observed that the graph was constructed from 2001, the year when the theme of *digital natives* became known in literature through (Prensky, 2001a, 2001b). From this, we can infer that it presents itself as a relatively new topic in educational literature. We notice a steady increase in the number of publications, with over 45 % of the papers published in the last six years, from 2018 to 2023, with the year 2022 being the most prolific with 61 publications.

These recent years, rich in terms of production related to the theme of this research, should be analyzed in conjunction with the network of citation trends among authors. The interpretation of the publication trend in recent years should also be related to the trend of search terms related to the educational context of *digital natives*, to observe paths to be pursued in future studies.

Figure 6 presents a co-citation network map, which represents authors who have collaborated on publishing their works between 2001 and 2023 in the Scopus S database. Using the total counting method in the VOSviewer software, a total of 30.781 co-citations were found, with a minimum of 40 documents per author for cluster interconnection. This resulted in a network of 29 authors, forming five clusters of scientific production.

Figure 6
Co-citation network



Source. Own elaboration.

It can be observed that each cluster is “led” by seminal authors in their specific subarea, with the main theme being *digital natives* in their educational context. Five main clusters have been identified:

A) Yellow Cluster – led by Prensky, the primary author responsible for the term *digital natives*. He is the most cited author on the topic, and the authors in this cluster are interconnected to various aspects of *digital natives*. This cluster reveals that this generation has been steeped in digital technologies from infancy, utilizing digital language in all areas related to them (Prensky, 2001a, 2001b).

B) Green Cluster – led by Bennett, the authors in this cluster are interconnected with topics related to *computational education* and *self-regulated learning*. This cluster highlights

the urgent need for a reform of traditional education to align with the sophisticated technical skills and learning preferences of digital natives (Bennett et al., 2008).

C) Red Cluster – led by Tapscott, the authors in this cluster are interconnected with topics related to *social networks* and the *digital age*. This cluster addresses the digital technologies used by the net generation and the education of these young individuals in the digital age (Selwyn, 2009).

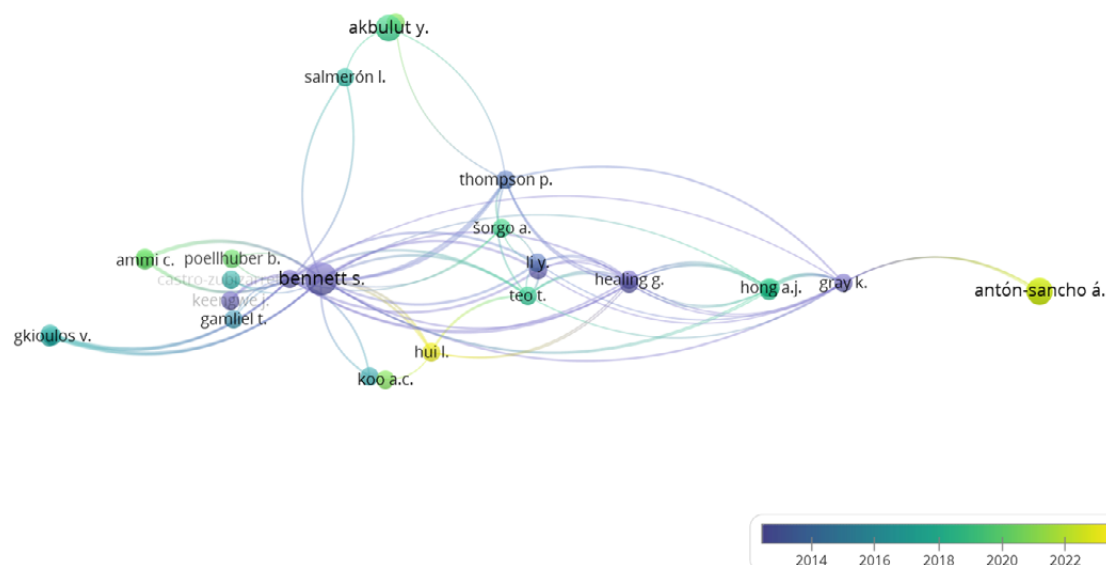
D) Blue Cluster – led by Margaryan, the authors in this cluster are interconnected with topics related to *educational training* and *work environment*. This cluster raises the question about the use of technologies by students who were born in a digital world and the concern of teachers of this generation regarding learning

(Teo, 2013), as not all born in this era exhibit predispositions against traditional teaching methodologies adopted in the classroom (Margaryan *et al.*, 2011).

E) Purple Cluster – led by Jones, the authors in this cluster are interconnected with topics related to *mobile technologies* and *e-learning*. This cluster explores the context that despite individuals from the *digital natives'* generation extensively using mobile technologies, educational institutions should be concerned with the differences and peculiarities within the same generational group (Jones *et al.*, 2010).

Regarding the third question, RQ3: What are the main research gaps and trends for future studies on *digital natives* in the educational context? In Figure 7, a map of the author citation network trend between the years 2013 to 2023 is presented, using the Scopus database. A total of 604 authors were identified, with a minimum of two documents per author, resulting in a network of 21 authors.

Figure 7
Citation Network



Source. Own elaboration.

In this network, new citation trends from authors like Antón-Sancho, Ammi, and Poellhuber are observed. They share a common focus on areas such as Information and Communication Technology (ICT), Internet of Things (IoT), and Massive Open Online Courses (MOOCs). Thus, we can infer that these topics should be explored in future studies involving the educational context of *digital natives*.

On the other hand, Bennett, despite being the most prolific author in the field (Table 2), does not appear as a trend in the citation network. This might be due to her research orientation being more centered on less recent terms related to *digital natives'* education, such as self-regulated learning and self-control. These areas should be carefully explored by future studies aiming to analyze the educational context of *digital natives*.

Table 3 presents the number of documents authored by authors extracted from the Scopus database through the analyze search results tool, based on bibliographic data of the most prolific authors from the sample between 2001 and 2023. Out of a total of 604 authors, the top seven are displayed:

Table 3
Papers published by author

Authors	Documents
Antón-Sancho	4
Bennett	4
Fernández-Arias	4
Aboobaker	3
Akbulut	3
Hui	3
Vergara	3

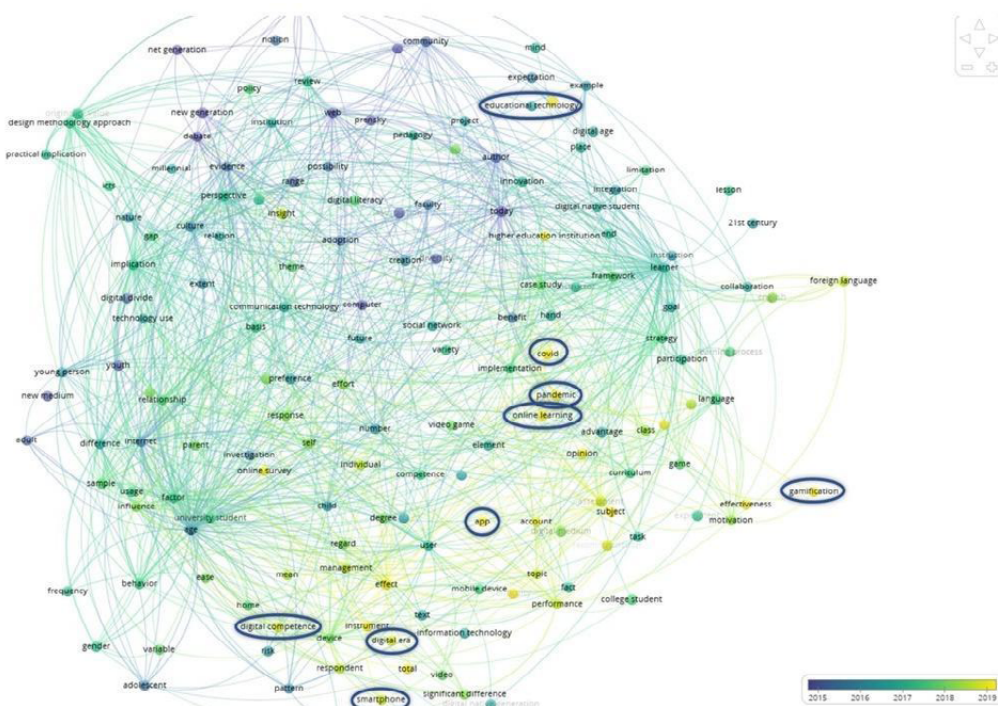
Source. Own elaboration.

Among the authors mentioned in Figure 7, we observe an intersection with the authors in Table 3, with some considerations: Bennett is

the second most cited author (2.201 citations), only behind Prensky, who does not appear in this citation network. Bennett has a significant citation network with other authors and is the most prolific contributor in the field of this research. Fernández-Arias is one of the more productive authors in the field, researching topics in the areas of education and online learning. Antón-Sancho and Akbulut, apart from being authors with numerous publications in the field, also appear as citation trendsetters, researching topics in the areas of educational research and computer science.

Figure 8 presents a map depicting the trend of the occurrence network of key terms from papers researched in the Scopus database during the period from 2001 to 2023. The binary term count method from the VOSviewer software was employed. Starting from a total of 12.373 terms, a minimum of 13 occurrences of a single term was set, resulting in a network of the top 166 most recent key terms found in the papers.

Figure 8
Most prolific terms



Source. Own elaboration.

The main terms identified in recent studies involving the topic of *digital natives* in the educational context (highlighted in yellow in the figure) were *covid* with 25 occurrences; *digital competence* and *pandemic* with 20 occurrences; *smartphone* with 19 occurrences; *app* with 17 occurrences; *gamification*, *educational technology*, *digital era* and *online learning* with 15 occurrences.

We can observe that the primary occurrences of the terms identified in Figure 8 are related to technology or the technological environment linked to the COVID-19 pandemic, which brought digitalization into the educational context of individuals. This period also sparked discussions about digital and technological transformation (Mirakyan & Berezka, 2022; Pedaste *et al.*, 2023), consistent with the findings of this research. *Digital competence* stands out as one of the most cited terms in recent studies, as evident in the works of Tzafilkou *et al.* (2023) and Saltos-Rivas *et al.* (2023), highlighting it as an essential skill for the 21st-century teacher. We also observe a link between the co-citation network (Figure 6) and the terms categorized by areas identified in the trend of the citation network (Figure 7), where the main clusters of authors and terms are related to learning through technologies, which align with the trends highlighted in Figure 8.

Conclusions

This research aimed to analyze the scholarly production in literature related to *digital natives* in the educational context, spanning from 2001 to 2023, and highlighting recent trends in the education of the 21st-century generation. Five clusters highlighting research avenues on the educational context of *digital natives* presented the following themes: *computational education*; *self-regulated learning*; *social networks*; *digital age*; *educational training*; *work environment*; *mobile technologies* and *e-learning*. The terms identified as potential research strands in the mentioned research field were *covid*, *digital competence*, *pandemic*, *smartphone*, *app*, *gamification*, *educational technology*, *digital era*, and *online learning*.

This study also presented a limitation in using only one software for bibliometric analysis of a specific database. Considering that VOSviewer allows broader interpretations of a single database, future research is encouraged to utilize multiple databases with the aid of complementary software. Only papers published in journals were included in this study, and while it is believed that these papers uphold a higher scientific rigor in their publications, papers from conferences, books, and other sources may provide additional insights into the educational context of *digital natives*.

This paper serves as a reference for bibliometric studies concerning the educational context of *digital natives*, given the scarcity of bibliometric studies on this field in literature. It conducts an analysis of bibliographic production, discusses the current landscape, and highlights trends in scientific output on the subject, shedding light on the field of technologies in the teaching and learning process of these individuals. This prominence is particularly notable during and after the COVID-19 pandemic, which brought about significant changes to learning in the digital age.

Future Research Directions, Practical and Societal Implications

We emphasize the importance of this study for future research agendas that focus on the teaching and learning process of the *digital natives'* generation. It is essential to address technological platforms in the educational environment, especially those geared toward digital instruction, and to explore both classic sources in literature and new researchers delving into the teaching of the new generations. Understanding appropriate teaching methodologies for the *digital natives'* world has become essential for school administrators, enabling them to manage policies for staff training in the digital age. In a job market that increasingly integrates technology into its administrative processes, having well-trained employees from educational institutions that align their curriculum with digital demands has become crucial for the success of companies. This research also provides as a starting point for future studies aiming to delve deeper into the literature about *digital natives*, with the intention of aiding the development of methodologies that align with the new expectations of the digital age. Moreover, it complements the learning of a generation deeply immersed in technology.

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