

Diachronic analysis of Spanish scientific production on teaching methodologies in Primary Education: A scientometric and conceptual perspective (2000–2023)

Francisco José Hernández-Valverde, Mónica Vallejo*

Department of Didactics and School Organization, University of Murcia, 30100 Murcia, Spain *** Corresponding author:** Mónica Vallejo, monicavr@um.es

CITATION

Herández-Valverde FJ, Vallejo M. Diachronic analysis of Spanish scientific production on teaching methodologies in Primary Education: A scientometric and conceptual perspective (2000–2023). Forum for Education Studies. 2024; 2(4): 1568. https://doi.org/10.59400/fes1568

ARTICLE INFO

Received: 26 July 2024 Accepted: 18 October 2024 Available online: 11 November 2024

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Copyright © 2024 by author(s). Forum for Education Studies is published by Academic Publishing Pte. Ltd. This work is licensed under the Creative Commons Attribution (CC BY) license. https://creativecommons.org/licenses/ by/4.0/ **Abstract:** The evaluation of science is essential to ensuring the quality, validity, and reliability of scientific results. Science needs to undergo a review process to ensure the rigorousness of scientific output. This evaluation provides a solid basis for political and economic decisions related to the design and execution of research projects, the establishment of new lines of research, or the identification of areas of specialization. This paper analyses diachronically the Spanish scientific production related to the implementation and development of teaching methodologies in primary education and indexed in the Scopus and Web of Science databases during the period 2000–2023. This analysis is carried out on the one hand, from a scientometric perspective, based on the analysis of indicators such as diachronic production, the journals with the highest scientific productivity, and the most productive institutions, and, on the other hand, from a conceptual perspective, trying to define its relationship with other areas of education. The general results of this study reveal two clear stages: the first, up to 2010, with little scientific production; and the second, from 2011 onwards, characterised by a general growth. The relationship between this field and others such as initial teacher training, ICT, and didactics is also evident.

Keywords: methodology; educational research; Primary Education; papers; Scopus; Web of Science

1. Introduction

The analysis of the social impact of science is a cornerstone in the forging of public policies. A better understanding of how science influences society enables us to promote more effective measures, be they scientific, technological, or social. This in-depth knowledge allows us to discern which strategies are best suited to address contemporary challenges and to direct resources to areas where they can have a significant positive impact. Consequently, the comprehensive assessment of the social impact of science becomes an essential pillar to boost the progress and prosperity of our societies [1–3]. In this sense, information sciences—by developing metrics, techniques, and instruments to measure the production of knowledge and its transformation into goods—offer substantial help for the development of this activity [4,5].

Specifically, in this case, scientometric studies focus on the quantitative analysis of scientific production, using bibliometric indicators to assess the influence and relevance of publications, authors, and journals. This discipline has evolved over time, adopting more sophisticated and multidisciplinary approaches to address key issues in the analysis of the impact of scientific research.

This paper begins with a brief theoretical framework that highlights the relevance of this type of study. Additionally, it provides information about the study's objectives and methodology. In the results section, information is presented on diachronic production, the most productive journals, institutional affiliation, the most productive authors, and thematic network analysis. Finally, the most significant conclusions of the study are presented, and the transfer of these findings to the field of educational research is discussed.

2. Theoretical framework

Research evaluation is a crucial process to determine the quality, relevance, and validity of scientific studies to advance knowledge and contribute to the development of science. Science must be subjected to a certain amount of scrutiny to ensure the rigorousness of scientific production. As Sanz [6] points out, we must place it in the context of Research, Development, and Innovation (R&D&I) and in the educational policies that develop it. This allows us to understand the process of change to which it is continuously exposed, as well as the challenges it faces, and, as Vallejo et al. [7] point out, it has an important impact on the economic, social, and cultural development of countries.

Thus, the evaluation of research can be justified from various perspectives since it allows, among other aspects, making decisions regarding the distribution of economic funds, determining the efficiency and effectiveness of resources, and determining whether it has followed the appropriate scientific standards. In this sense, scientometric studies are essential for the evaluation of scientific production since they make it possible to measure the quantity and quality of scientific publications.

Analysing the societal impact of science is essential for public policymaking. The better the understanding of the effects of science on society, the more effectively various scientific, technological, and social measures can be promoted, facilitating decisions on the appropriate funding of research and innovation activities [8].

Under this idea, this study presents a scientometric analysis of Spanish scientific research on teaching methodologies in primary education, published between 2000–2023 and indexed in the Scopus and Web of Science databases. Primary education is a stage that forms part of basic education in Spain—together with secondary education and intermediate level training cycles, which are compulsory and free of charge. It comprises three cycles of two academic years each and is organised into areas, which will have a global and integrating character [9]. The aim of the stage is to offer pupils a comprehensive education that contributes to the development of their personalities.

As Trillo and De Moya Anegón [10] point out, teaching methodologies is a field of study that should integrate the progress of scientometrics by employing methods and tools that improve the objectivity and precision of research, which facilitates the provision of verifiable data to analyse and evaluate the work of researchers, the degree of scientific collaboration, and its influence on the educational system.

During the period covered by this study (2000–2023), several education laws have been enacted that highlight the absence of a stable and solid education policy, independent of the political changes that have taken place during these years. In this sense, we highlight the Organic Law of 3 May on Education, which repealed the

education laws in force until then—Organic Law on the General Organisation of the Education System and Organic Law on Participation, Evaluation, and Governance of Educational Centres, and which introduced an educational framework based on competences, these being one of the constituent elements of the curriculum, together with teaching methods, objectives, content, and assessment criteria [11].

The introduction of competences in the curriculum was aimed at three main aspects: that pupils should be able to integrate the different learning incorporated into the areas or subjects, that they should be able to relate them to the different contents, and to guide the teaching-learning process through the identification of contents and assessment criteria. In this way, the need for students to acquire a series of competences is understood as a fundamental element in their education within compulsory education. This competence-based approach has continued with the enactment of the latest education law, whose methodological orientations are focused on recognizing students as agents of their own learning [12].

Thus, competence-based teaching or the implementation of the Bologna Plan have been fundamental elements in the change of approach to the teaching process, which implies a transformation in the way learning activities are designed. A more active participation of students in their own learning, teaching that promotes deep and meaningful understanding of curricular contents, or an interdisciplinary approach to learning are examples of the change of approach in the teaching process.

Active methodologies, defined as those in which teaching is based primarily on the activities students carry out to learn, have become essential to promote their participation in their own learning process [13]. There is a current trend to incorporate active methodologies that are more directly aligned with the needs of today's society. These needs demand from students a greater training in relation to problem solving, the development of the capacity for reflection and criticism, and greater autonomy to face real situations, which implies, at the same time, a change in the configuration of educational scenarios, where the teaching task is to guide and orient students in accessing new learning participation in their own learning process [14].

In this area, in addition to research that attempts to analyse teaching methodologies in primary schools or that presents a descriptive study on the different teaching perspectives on good teaching practices in the classroom, we also find some scientometric studies on specific teaching methodologies [15,16]. In this sense, we found a research study on the pedagogical methodology based on the inverted classroom in higher education during the Covid-19 pandemic, a diachronic study that delves into the effectiveness of the combination of e-learning and gamification based on the scientific production indexed in the Web of Science, a scientometric study that analyses the scientific production, published in the Web of Science database, on the pedagogy of knowledge construction, or a systematic review of the production on the service-learning methodology published in Spanish journals included in the Journal Citation Reports and Scimago Jounal & Country Rank [17–20].

However, although there are scientometric studies that specifically analyse scientific production on specific methodologies, no evidence has been found of scientometric studies that examine scientific production related to teaching methodologies in the field of primary education. Therefore, it is considered relevant to carry out specific research on teaching methodologies that will make it possible, among other aspects, to determine the most investigated research topics and the most productive institutions, as well as to determine the quantitative and qualitative growth of this scientific field, as it can provide key information on the pedagogical practices that are being developed in classrooms, contribute to improving the teaching process, and make it possible to determine the impact of research on the educational reality of primary schools.

3. Objectives

The general objective of this chapter is to present an overview of the scientific production on teaching methodologies in the period 2000–2023 through the scientific papers indexed in the Scopus and Web of Science databases.

This general objective can be specified as follows:

- To analyse diachronically the scientific production related to teaching methodologies in the Primary Education stage, covering the period between 2000 and 2023.
- To identify the structure of the thematic network that emerges because of this object of study, that is, to identify those research topics that converge with the topic of teaching methodology.

4. Method

This study would fall within the framework of what are known as review studies. This approach is based on the systematic review of previous studies with the aim of compiling, evaluating, and synthesising the available evidence in an exhaustive and objective manner. To ensure rigorousness in the search of the bibliography comprising the study sample, the standards established by the PRISMA Declaration were followed [21].

In terms of temporality, this is a cohort study in which the aim is to describe the characteristics of the development of scientific production concerning teaching methodologies over a period of twenty-three years. Thus, following the established standards, an advanced search was carried out using the term "primary education" in the title or abstract of the document, limiting the search to the period between 2000 and 2023. Subsequently, we selected those papers that met the inclusion criterion of referring to the study of teaching methodologies at the primary education stage, in addition to scientific production focused on the topic of teaching methodologies for the training of future primary education teachers (higher education). Once the final sample had been configured (135 papers), a database was created in Microsoft Excel in which the scientometric indicators to be analysed were included. These indicators are diachronic production, journal title, institutional affiliation, most productive authors, and thematic network.

For the establishment of the thematic network structure, which allows us to establish those topics with which the teaching methodology topic converges, we used the Gephi programme, an open-source software that allows the visualisation and analysis of networks and the search for patterns based on two matrices: one of nodes and the other of edges. The choice of these databases for the study is mainly due to the wide range of scientific disciplines they cover, their scientific rigour and because they are the most widely used databases in the scientific and academic fields, both in terms of access to information and scientific publications.

5. Results

The results obtained in accordance with the specific objectives proposed from the analysis of the scientometric variables of the scientific production referring to teaching methodologies at the primary education stage are shown below.

5.1. Diachronic production

The scientific production related to teaching methodologies at the primary education stage, indexed in the databases analysed, is made up of a total of 135 papers. Of this total, 88 papers have been indexed in Scopus and 47 in Web of Science. As can be seen in **Table 1**, until 2009 (in the case of Scopus) and 2010 (in the case of Web of Science), no papers were published in this field, after which there was an increase in scientific production.

Year	n		Year	n		Year	п		
	S	W		S	W		S	W	
2000	0	0	2008	0	0	2016	6	6	
2001	0	0	2009	1	0	2017	8	6	
2002	0	0	2010	1	1	2018	8	5	
2003	0	0	2011	4	3	2019	13	5	
2004	0	0	2012	3	0	2020	17	3	
2005	0	0	2013	3	1	2021	10	4	
2006	0	0	2014	4	2	2022	5	5	
2007	0	0	2015	1	5	2023	4	4	

 Table 1. Diachronic production on teaching methodologies.

In the case of Scopus, this growing trend in scientific production reaches its peak in 2020, with 17 papers published. From then on, there is a gradual decrease in production, reaching a stabilisation phase. It can be seen how between 2017 and 2021 a total of 56 papers have been indexed, which is 63.63% of the total number of papers published. In the case of Web of Science, the years with the highest production are 2016 and 2017, with 6 papers.

As can be seen in **Figure 1**, if we take five-year time periods as a reference, with the exception of the four-year period 2020–2023, with respect to the Web of Science database, the period between 2015–2019 is the one with the highest number of publications, with a total of 26 papers, which represents 55.31% of the total.



Figure 1. Diachronic evolution of scientific production (four-year periods).

With respect to the Scopus database, the periods 2015–2019 and 2020–2023 are those with the highest rate of publications, although it is important to note that, in the case of the latter period, this rate is supported by the 27 papers published between 2020 and 2021.

5.2. Journals with the highest productivity

Regarding the journals with the highest productivity, the 138 papers have been published in 82 different journals. Of these, as shown in **Table 2**, 6 papers have been published by the journal Challenges: New Trends in Physical Education, Sports, and Recreation (Retos. Nuevas Tendencias en Educación Física, Deportes y Recreación). Also noteworthy is the presence of the Educational Research Journal (Revista de Investigación Educativa), the Journal of Education (Revista de Educación), and the journal Teaching of Science (Enseñanza de las Ciencias), with 5 papers each. Four publications on teaching methodologies include the journal Eureka and the journal Pedagogical Studies (Estudios pedagógicos).

Journal title	Country	n
Challenges: New Trends in Physical Education, Sports, and Recreation (Retos. Nuevas tendencias en educación física, deporte y recreación)	Spain	10
Educational Research Journal (Revista de Investigación Educativa)	Spain	5
Journal of Education (Revista de Educación)	Spain	5
Teaching of Science (Enseñanza de las Ciencias)	Spain	5
Eureka	Spain	4
Pedagogical Studies (Estudios pedagógicos)	Chile	4
Journal of Media and Education (Pixel-Bit. Revista de Medios y Educación)	Spain	3
Professorate: Journal of Curriculum and Teacher Training (Profesorado. Revista de currículo y formación del profesorado)	Spain	3
Mathematics Education (Educación matemática)	Spain	3

Table 2. Journals with the highest production.

The nine most productive journals have published 42 papers, or 31.11% of the total. In line with Bradford's Law [22], which indicates that if journals are arranged in descending order of productivity on a given topic, we can distinguish a main core of

journals that deal more specifically with it. These nine journals have published more than a quarter of the total number of papers, thus forming the main core of journals devoted more specifically to the topic. This finding can be very useful to efficiently manage resources in the search for information on this topic, as well as to improve information retrieval strategies in scientific and academic contexts.

5.3. Institutional affiliation

In relation to institutional productivity, it is important to note the signature of more than one author on most of the papers. As can be seen in **Table 3**, the University of Murcia (Spain) is the institution with the highest production of papers on teaching methodologies in primary education, with 25 authorships. The presence of the University of Granada (Spain) and the University of Pais Vasco (Spain) also stands out, with 21 and 20 authors, respectively.

Affiliation	Institutional production
University of Murcia	25
University of Granada	21
University of Pais Vasco	20
University of Oviedo	19
University of Cordoba	18
University of Extremadura	15
University of Salamanca	12
University of Valladolid	11
University of Santiago de Compostela	10
University of Valencia	10

Table 3. Participation in the authorship of papers according to affiliation.

It is important to highlight how most of the papers are signed by authors belonging to the university sphere, as opposed to the low presence of teachers linked to primary education centres.

5.4. Most productive authors

About the most productive authors related to the publication of content on methodologies in primary education, Lotka's [23] law and what he calls major producers—those authors with the most publications, regardless of the position they occupy in the paper, in the case of co-authorship—have been taken as a reference for their analysis. In this way, we would like to highlight the presence of Veronica Marín Díaz, linked to the University of Cordoba (Spain), author of four papers, and Antonio J. Franco Mariscal, from the University of Malaga (Spain), Ramón Cózar Gutiérrez, from the University of Castilla la Mancha (Spain), and Ramón Gutiérrez Fresneda, from the University of Alicante (Spain), with three publications. After that, we find several authors with at least two publications.

Regarding the authors, it should be noted that most of the articles were published by at least two authors. Thus, only 13.33% of the articles were written by a single author. This confirms that collaboration is the most common form of scientific production.

It is also interesting to highlight, in relation to the analysis of the most productive authors, the fact that most of the authors who have published a scientific paper on teaching methodologies at the primary education stage belong to the university sphere, and there are hardly any publications with the participation of teachers linked to primary education centres.

5.5. Thematic network analysis

As far as their linkage to other topics or categories is concerned, as shown in **Figure 2**, it is determined by the presence of papers dealing with teaching methodologies in reference to other elements of education.



Figure 2. Thematic network category teaching methodologies.

In the figure, a close relationship can be observed between the main research topics, namely teaching methodologies and the initial training of teachers. This finding highlights the relevance of methodological innovation practices developed in the training of future primary education teachers. Scientific production in this field has grown considerably, driven by the changes introduced by the European Higher Education Area (EHEA), which has promoted new forms of teaching and learning in universities. It is worth noting that the majority of the analysed articles come from the university environment, further emphasising the importance of this domain in generating pedagogical knowledge.

Additionally, a strong interrelationship is observed between Information and Communication Technologies (ICT) and various specific didactics. Particularly notable are the didactics of mathematics, natural sciences, and physical education. These conceptual correlations suggest a growing body of scientific research addressing the teaching and learning of mathematics, natural sciences, and physical education content in Primary Education, with ICT serving as an added value to these methodological proposals [24,25]. These articles support the thesis that the use of ICT not only transforms the teaching-learning process but also fosters the creation of more interactive and personalised learning environments, thereby contributing to the improvement of students' academic performance.

Moreover, other equally relevant research topics in this field include inclusive education and the perspectives of both teachers and students. These articles emphasise the need to develop more equitable pedagogical practices that are adapted to the needs of all students, which implies a significant shift in teacher training and educational policies in the primary education stage [26,27].

6. Conclusions

It should be recalled that the general objective of this study is to present an overview of the scientific production on teaching methodologies in the period 2000–2023 through the scientific papers indexed in the Scopus and Web of Science databases.

The data obtained allow us to conclude that the growth of scientific production on teaching methodologies between 2000 and 2023 is continuous, with two clear periods: a first decade characterised by the publication of a single paper, and a second period with exponential growth.

It should also be noted that almost a third of the papers are concentrated in nine journals, which represent 28.14% of the total sample. In this context, we underline that the most common form of scientific production is co-authorship, with a high rate of transience, reflected in the considerable number of authors who have made a single contribution.

By identifying the relationship between the category analysed—teaching methodologies—and others present in the papers analysed, it has been possible to extract some existing connections between various topics, revealing significant patterns that shed light on the predominant trends and approaches. In this sense, we can affirm the close link between the topic of teaching methodologies; we can affirm its close link with other areas of education, such as initial teacher training, attention to diversity, and the use of active methodologies for an effective teaching-learning process in any of the subjects that make up the curriculum of this educational stage.

This preliminary study underscores the need to continue researching teaching methodologies in primary education and the training of future teachers in this educational stage. There is evidence of limited international visibility for this research, which is primarily conducted by university institutions rather than by the schools themselves. Furthermore, there is a wide conceptual dispersion surrounding this topic, which can hinder a clear and coherent understanding of the most effective pedagogical practices.

These findings, along with the improvement proposals derived from them, may be relevant for decision-making in scientific and educational management. By promoting a more integrated and collaborative approach, we can contribute to greater transparency and a significant advancement of scientific knowledge, benefiting both the academic community and society at large. Thus, it is imperative for researchers, educators, and educational policymakers to work together to strengthen this field of study and maximize its impact on teacher training and the quality of primary education. **Author contributions:** Conceptualization, MV and FJHV; methodology, MV; software, FJHV; validation, FJHV and MV; formal analysis, MV; investigation, FJHV; resources, FJHV; data curation, FJHV; writing—original draft preparation, MV and FJHV; writing—review and editing, MV; visualization, MV; supervision, MV. All authors have read and agreed to the published version of the manuscript.

Conflict of interest: The authors declare no conflict of interest.

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