Original article

# Bibliometric study on pedagogical practice in nurse training in the context of MERCOSUR*

Estudo bibliométrico sobre a prática pedagógica na formação do enfermeiro no contexto do MERCOSUL

Estudio bibliométrico sobre la práctica pedagógica em la formación de enfermeras em el contexto del MERCOSUR

Elaine Regina Corrêa de Souza[I] , Ilma Pastana Ferreira[I] , George Pinheiro Carvalho[I]

[I] Universidade do Estado do Pará. Belém, Pará, Brasil

## Abstract

**Objective:** to analyze scientific production on pedagogical practice in Nurse training in the context of MERCOSUR indexed in the Web of Science. **Method:** descriptive study, quantitative approach, with bibliometric analysis of indicators: number of publications per year, language, journals, most productive authors, co-authorship and keywords. Data collection took place on June 29, 2022, analysis using Microsoft Excel® Software. **Results:** 389 documents were identified, distributed among: 354 articles (91%), 19 review articles (4.9%) and 16 conferences (4.1%), published in 126 different journals, in the languages: English, Portuguese and Spanish, between the years 1958 to 2021. The journal with the largest number of publications was the Latin American Nursing Journal. The 10 most productive authors are from Brazil. In the analysis of terms, the words "Nursing", "Nursing Education" and "Education" stood out. **Conclusion:** significant Brazilian productivity and little production from other MERCOSUR countries indexed in the Web of Science.
**Descriptors:** Education; Universities; Mercosur; Bibliometrics; Nursing

## Resumo

**Objetivo:** analisar a produção científica sobre a prática pedagógica na formação do Enfermeiro no contexto do MERCOSUL indexada na *Web of Science*. **Método:** estudo descritivo, abordagem quantitativa, com análise bibliométrica dos indicadores: número de publicações por ano, idioma, periódicos, autores mais produtivos, coautoria e palavras-chave. A coleta de dados ocorreu em 29 de

junho de 2022, análise mediante o *Software Microsoft Excel®*. **Resultados:** foram identificados 389 documentos, distribuídos entre: 354 artigos (91%), 19 artigos de revisão (4,9%) e 16 conferências (4,1%), publicados em 126 periódicos diferentes, nos idiomas: inglês, português e espanhol, entre os anos de 1958 a 2021. O periódico com maior quantitativo de publicações foi a Revista Latino-Americana de Enfermagem. Os 10 autores mais produtivos são do Brasil. Na análise de termos, destacaram-se as palavras "Nursing", "Nursing Education" e "Education". **Conclusão:** expressiva produtividade brasileira e escassa produção dos demais países do MERCOSUL indexada na *Web of Science*.
**Descritores:** Educação; Universidades; Mercosul; Bibliometria; Enfermagem

## Resumen

**Objetivo:** analizar la producción científica sobre la práctica pedagógica en la formación de Enfermeros en el contexto del MERCOSUR indexada en la Web of Science. **Método:** estudio descriptivo, enfoque cuantitativo, con análisis bibliométrico de indicadores: número de publicaciones por año, idioma, periódicos, autores más productivos, coautorías y palabras clave. La recolección de datos se realizó el 29 de junio de 2022, análisis mediante el software Microsoft Excel®. **Resultados:** Se identificaron 389 documentos, distribuidos entre: 354 artículos (91%), 19 artículos de revisión (4,9%) y 16 conferencias (4,1%), publicados en 126 revistas diferentes, en los idiomas: inglés, portugués y español, entre los años 1958 al 2021. La revista con mayor número de publicaciones fue la Revista Latino-Americana de Enfermería. Los 10 autores más productivos son de Brasil. En el análisis de términos se destacaron las palabras "Enfermería", "Educación en Enfermería" y "Educación". **Conclusión:** significativa productividad brasileña y poca producción de otros países del MERCOSUR indexadas en la Web of Science.
**Descriptores:** Educación; Universidades; Mercosur; Bibliometría; Enfermería

## Introduction

Nowadays, with advances in science and technological innovations, there is a significant growth in studies that allow evaluating scientific production in different areas of knowledge, measuring aspects related to the productivity of researchers, journals, institutions and countries, being called bibliometric studies. [1]

Bibliometrics is characterized as a mathematical technique whose objective is to calculate the number of production, dissemination and use of recorded information of scientific knowledge through the identification of authors, impact of citations, sources of information and keywords. In short, it is a method that can analyze scientific production related to a research topic, quantifying communication processes in science.[2]

In this context, it is noteworthy that researchers are committed to publishing the

results of their studies, ensuring the essence of science through feedback from the socialization of scientific discoveries, which comes from social collaboration with the purpose of generating new knowledge and, consequently, the scientific community achieves greater accessibility to information through the increasing evolution of knowledge production by researchers.[3]

Through the contextualization of bibliometrics, it is essential to understand scientific development in the area of Nursing Education, with regard to pedagogical practice in Nurse training in the context of MERCOSUR. In this sense, it is important to understand that, in the educational process, pedagogical practices must be planned with the objective of promoting meaningful and comprehensive learning, which stimulates students' critical and reflective thinking and ensures decision-making in the training of the future Nurses, aiming to provide quality care.[4-5]

It is noteworthy that, since the emergence of the first nursing journals, a boost in the number of publications was identified, representing an important instrument for communicating scientific research and advancing and consolidating this area. In this sense, knowing the production of these researchers at the top of the production chain of science and technology in the area of nursing education allows us to gather indicators of growth and development, thus making it possible to evaluate the impact of these productions.[2]

From the perspective of the Southern Common Market (MERCOSUR) approach, we cite the treaty signed in 1991, constituted by the Southern Cone countries: Paraguay, Uruguay, Brazil, Argentina, Colombia, Ecuador and Peru. Furthermore, it is seen as a path for professional integration in these countries, which includes professionals who work in different areas of knowledge, including education and health.[6-7]

The study entitled "MERCOSUR education in the Nursing career"[6] sought to discuss the nurses' training movements in MERCOSUR, reflecting on whether the path of regional integration is related to the implementation of actions in the education and health sector. When analyzing the context involving the historical, social, political and economic aspects that influenced the practice and training of nursing professionals in MERCOSUR, challenges arise, which are linked to the gap in bibliographical references that analyze the specificities of nursing in such countries, as well as the unpreparedness of the university system to train

professionals capable of meeting the needs in each country and current legislation.

In relation to nursing education, it is noteworthy that the United Nations Educational, Scientific and Cultural Organization (UNESCO) establishes four pillars that must support Education in the 21st century: learning to know; learn to do; learn to live together; learn to be, and, it is worth remembering, these paths cannot be dissociated. Therefore, the learning process constitutes human conditions and the needs of living beings, whose basis is growth, evolution and constant learning.[8-9]

The present study is justified by the need to identify some characteristics of scientific production related to pedagogical practice in the training of Nurses through bibliometric indicators: scientific journals, most productive authors, co-authorship and keywords contained in the documents, with the purpose of presenting the basis of research in this field and corroborate with nursing science. In this way, Bibliometrics becomes a statistical tool for information and knowledge management, in information, communication and scientific and technological evaluation systems.

In view of the problem of scientific production on pedagogical practice in the training of nurses indexed in the Web of Science (WoS) database, the following guiding question was proposed: What are the characteristics of scientific production on pedagogical practice in the training of nurses in the context of MERCOSUR?

The general objective of the study was to analyze the scientific production on pedagogical practice in Nurse training in the context of MERCOSUR indexed in WoS, whose specific objectives were: a) to identify the core of journals most used on the subject in light of the Bradford Law; b) verify the existence of an Elite Group regarding scientific production on the topic in accordance with Lotka's Law; c) identify the relationship between the most researched topics based on Zipf's Law.

## Method

This is a bibliometric study, descriptive research, with a quantitative approach. Data collection took place on June 29, 2022, in the WoS database, through online institutional access on the Periodicals Portal of the Coordination for the Improvement of Higher Education Personnel (CAPES), signature of the Federal University of Pará (UFPA).

In these terms, the bibliometric study presents itself as a promising and effective methodology in investigating the behavior of scientific literature, based on classical laws, namely: Lotka's Laws (1926) / Price's Law (1963), Bradford's Law (1934) and Zipf's Law (1949). Lotka's Law refers to the evaluation of the distribution of researchers' productivity, reflecting results that highlight the importance of researchers in a given area of knowledge. Price's Law, called the Law of Elitism, is based on the square root of the total number of authors observed, evidenced by √k, in which **k** emerges as the total number of different authors, while the result of the square root corresponds to the so-called Elite Group, which is theoretically responsible for half of the production of all published documents. Bradford's Law, in turn, recognizes the relevance of information sources, based on the number of publications and, finally, Zipf's Law, which estimates the occurrence of keywords in texts. In this context, the use of this design facilitates the determination of the relationship between the research contribution and the variables related to the problem and the research environment.[10-11-12-13]

The Web of Science was chosen for this study because it is an international, multidisciplinary database, in addition to allowing the measurement and analysis of scientific production through its metadata. In this way, the evaluation of a certain area of knowledge makes it possible to value knowledge, when reliable and systematic methods are used to show society the development of the scientific field.[14]

The design of the research question and search strategy was based on the Population, Concept and Context (PCC) methodology, which incorporates the Target Audience (Nurses), the Concept of the central question (Pedagogical Practices in Nurse Training) and the Context of the research (MERCOSUR) in its preparation, being essential for identifying the descriptors, although these elements may be present implicitly.[15]

From this perspective, the search was carried out in WoS using descriptors authenticated on the Health Sciences Descriptors (DeCS) platform, with the help of the Boolean operators AND and OR. The search expression used was: *((Enfermeiro OR Enfermeira OR Nurses) AND ("Nursing Faculty Practice" OR "Faculty Nursing" OR "Nursing Education" OR "Teaching" OR "Higher Education" OR "Ensino Superior") AND (Mercosul OR pMercosur OR Brasil OR Brazil OR Argentina OR Paraguai OR Paraguay OR Uruguai OR Uruguay OR Equador OR Ecuador OR Chile OR Peru OR Colombia OR Bolivia OR Suriname OR*

*Guyana))*. The DeCS does not present an exact descriptor for the term "pedagogical practices", interconnecting it with the other terms chosen in the concept area of the central research question.

The search was carried out by the "Web of Science Main Collection", advanced search, using the field label "TS", which represents the search by topics (Titles, Abstracts and Keywords). Initially, the period that emerged in the WoS database covered the years from 1945 to 2021.

As a result, 409 documents were recovered. Then, the following refinement strategies were applied: 1) Time frame: 1958-2021; 2) Document typologies: Article, Proceedings Paper and Review, totaling 389 documents, distributed from 1958 (with the publication of the first article on the topic) to 2021, which is the object of study of this research. In the meantime, the 389 documents were exported in data tabulation format to Microsoft Excel®, which was the study's analysis point.

The data analysis stage was based on the following indicators: a) number of documents per year (articles, review articles and conferences); b) language; c) title of journals; d) more productive authors; e) co-authorship (partial indicator to measure science collaboration); f) keywords (most frequent topic in searches).

To characterize the journals most used by the scientific community, the Impact Factor (IF) was used, assessment year 2021. The IF is a scientific indicator created by Garfield and Sher in 1963[16] and provided annually by Journal Citation Reports (JCR), from Clarivate Analytics. To evaluate the most productive researchers, the h Index is collected (in WoS, on the same data collection date), an indicator created by Hirsch in 2005.[17] Microsoft Excel® Software was used to analyze the data. As this is a study carried out on databases, approval by the Research Ethics Committee was not required.

## Results

The scientific production on pedagogical practices in Nurse training indexed in WoS totaled 389 documents between the years 1958-2021, distributed as follows: 354 articles, 19 review articles and 16 conferences, as shown in Figure
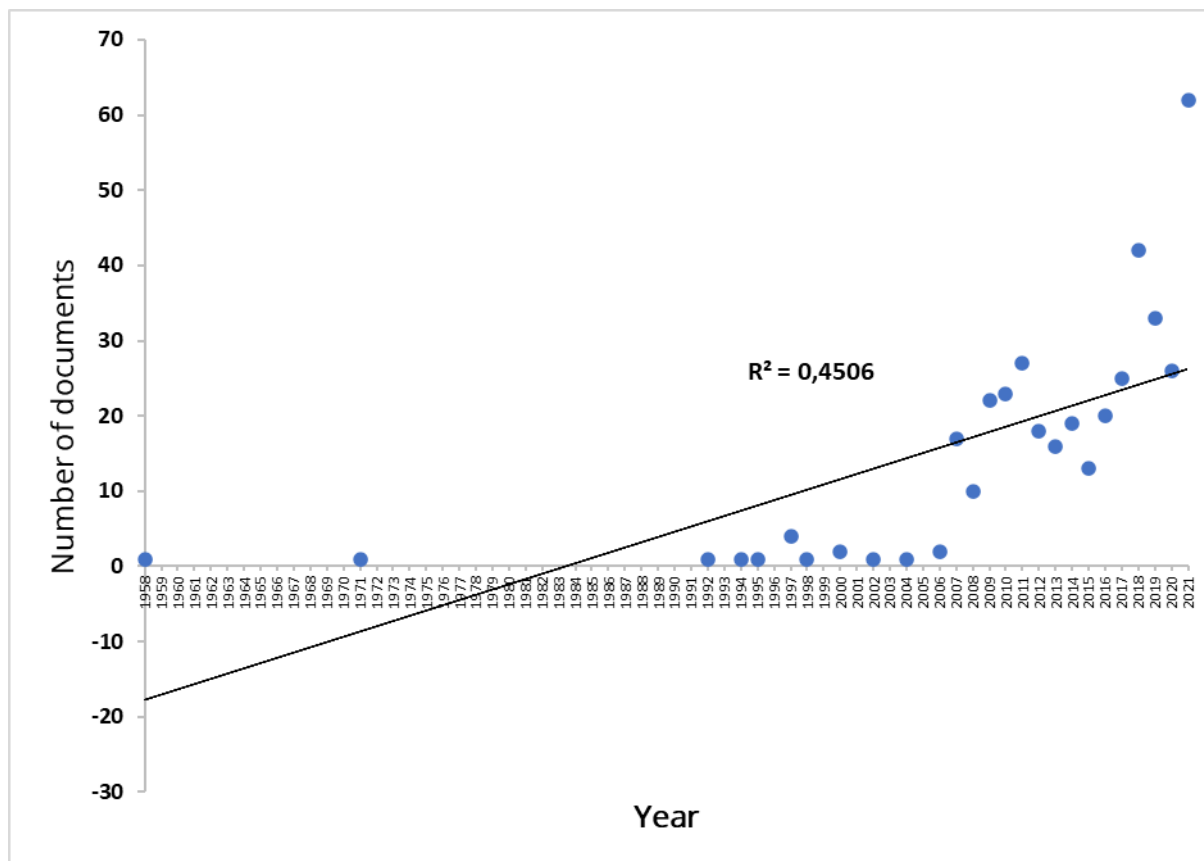
1.



**Figure 1 -** Distribution of scientific production on pedagogical practices in Nurse training indexed in the Web of Science (WoS), in the period 1958-2021.

From the application of the quality test, evidenced by linear regression, we have the R-Square with a value of 0.4506 or 45% of variance for the number of publications per year, with a distance between the points in relation to the adjusted line, in addition to the linear highlight for publications that occurred between 2007 and 2021, which are with points close to the regression line.

With regard to scientific production, it was observed that the initial milestone of scientific production on the subject occurred in 1958, which has a study. This publication is entitled "Nursing – Education in Brasil", written in English and published in the journal International Nursing Review, on January 1, 1958. On the other hand, there is great variability regarding the number of publications per year, with production gaps between the years 1958 and 1971, and the second gap extends from 1971 to 1992.

Even so, from 1997 onwards, the number of documents referring to pedagogical practice in Nurse training emerged significantly, with production in 1997, containing four documents representing 1%, followed by a peak in 2007 with 17 publications representing 4.3%. Furthermore, in the last 10 years, there were peaks in publications in 2011, with 27 documents, the percentage of which was 7%, in addition to 2018, which presented 42 documents (11% of total productions) and, finally, the peak of Publications took place in 2021, with 62 documents, representing 16% of the studies.

With regard to the analysis of data regarding the language of documents indexed in WoS, it was found that 289 documents were published in English, while 71 were published in Portuguese and 29 were reproduced in Spanish, representing a percentage of 74.3%, 18.3% and 7.4%, respectively.

Regarding the applicability of Bradford's Law, which discusses zoning into three plans with the objective of measuring the productivity of journals, 389 documents were analyzed according to the journals in which they were published, accounting for 126 different journals. In this sense, the zoning of journals was carried out based on the premise that each zone makes up 1/3 of publication sources and/or approximately 33.3%, with Table 1 showing that the core zones (or 1st Zone), The 2nd and 3rd have 3, 16 and 107 journals, respectively; however the core has a publication volume of 139 documents, while the 2nd has 128 productions and, finally, the 3rd incorporates 122 publications.

Table 1 - Applicability of Bradford's Law in relation to journals on pedagogical practice in Nurse training in MERCOSUR, indexed in the Web of Science (WoS), in the period 1958-2021.

| Zones | Journals | Documents | % |
|---|---|---|---|
| Core/1st Zone | 3 | 139 | 35.7 |
| 2nd Zone | 16 | 128 | 32.9 |
| 3rd Zone | 107 | 122 | 31.4 |
| Total | 126 | 389 | 100 |

In the analysis of the total of 126 journals, it is highlighted that those with the highest

publication rates on the topic of this study come from Brazil, especially the Latin American Nursing Journal, with 56 documents representing 14.4%; followed by the USP Nursing School Journal, which has 47 documents; and later the Brazilian Nursing Journal, with 36 documents, totaling 139 documents in the area of Nursing, which represents a total of 35.8%.

Along these lines, in order to prove that the journals belonging to the core are in fact the most published in the thematic field covered, the Bradford multiplier formula was applied, $k=(1.781\times Y_m)^{1/P}$, in which $Y_m$ corresponds to the maximum productivity; and P is the number of zones, having the following expression: $k=(1.781\times56)^{1/3}$ = 4.6.

In the dispersion of publications, it was evident that the greatest concentration of scientific production was arranged in eight journals, divided between three journals present in the core and five listed in the 2nd zone, as shown in Table 2. The journals are ordered in descending order by to the frequency of available documents and their respective percentage, with the addition of their Impact Factor for the scientific environment, measured in this study through the JCR available on Web of Science, assessment year 2021.

Table 2 - Distribution of most used journals on pedagogical practice in Nurse training in MERCOSUR, indexed in the Web of Science (WoS), in the period 1958-2021.

| Order | Periodic | Impact Factor (JCR, year 2021) | Frequency (number of documents) | % |
|---|---|---|---|---|
| 01 | Latin American Nursing Journal. | 1.725 | 56 | 14.4 |
| 02 | Journal of the USP School of Nursing | 1.123 | 47 | 12.1 |
| 03 | Brazilian Journal of Nursing - REBEn | N/I* | 36 | 9.3 |
| 04 | Paulista Nursing Act | 1.027 | 28 | 7.2 |
| 05 | Text & Context Nursing. | N/I | 27 | 6.9 |
| 06 | Nurse Education Today / 2011 | 3.906 | 15 | 3.9 |
| 07 | Culture of Care | N/I | 8 | 2.1 |
| 08 | Research Journal - Care Is Fundamental Online | N/I | 8 | 2.1 |
| | Total | | 225 | 58 |

*Not included.

Considering Lotka's Law, with authorship analysis carried out on the 389 documents, the number of 1,533 different authors was observed, making it clear that several documents were written by more than one author. It is noteworthy that there were 1,769 authorships

that represent the total participation of the authors in the preparation of the documents.

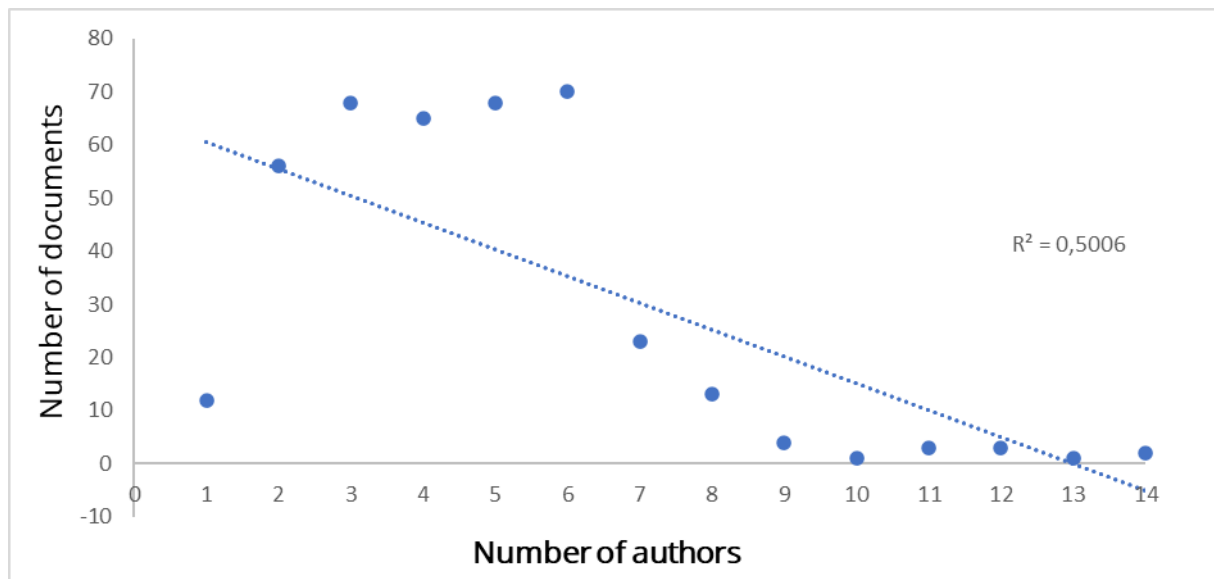Figure 2 illustrates the number of authorships per number of documents.



**Figure 2 -** Distribution of the number of authorships per document on pedagogical practice in Nurse training in MERCOSUR, indexed in the Web of Science (WoS), in the period 1958-2021 (n = 389).

When applying the linear regression test with the R-Square calculation, we have a value of 0.5006 or 50% variance for the number of authors per document. Regarding the number of documents in collaboration, collective work occurred in 84% of documents signed between two and six authors, with a predominance of cases with six authors per document, representing 18% of the total documents; followed by three and five authors, which equally represented 17.4%; with four authors 16.7%; and with two authors 14.4% of scientific production on the topic indexed in WoS.

It was also found that single-author scientific production represents 3.1% of the total documents. However, there was a smaller number of documents composed of nine to 14 authors, with a percentage of 1%, 0.2%, 0.8%, 0.8%, 0.2%, 0.5% respectively, which together they make up a total of 3.5% of the scientific production in the area, demonstrating that collaboration in large groups is not a characteristic feature of scientific production in the area of Nursing Education.

In this context, from the complete count, which involves the productivity of all authors

regardless of their participation status as main authors or collaborators, the number of 1,533 different authors was observed, who together produced 389 documents. Taking as a basis the measurement parameters, expressed by mean, variance, standard deviation and dispersion index, the total mean of authors was 1 document per author, with a variance of 0.4 documents, as well as the standard deviation of 0.6 documents and, finally, the dispersion index equal to 0.5 documents.

To measure the most productive authors, a connection was presented between Lotka's Law and Price's Law. In this study, there is a total of 1,533 authors, resulting in the square root of this value being approximately 39 authors, considered as the Elite Group regarding scientific production on pedagogical practice in Nurse training in Mercosur in light of Price's Law, being 2.5% of the total number of authors.

From this perspective, it was observed that the production of this Elite Group corresponded to 168 documents, representing approximately 43% of all documents produced, falling below the 50% postulated in Price's Law.

In Table 3, the 10 authors were listed, corresponding to 25% of the authors belonging to the Elite Group, who participated in the production of five or more documents each, reaching a productivity of 37% of the documents in the field under analysis, presenting the frequency of published documents, country, affiliation and h-Index.

Table 3 - Distribution of the most productive authors on pedagogical practice in Nurse training in MERCOSUR, indexed in the Web of Science (WoS), in the period 1958-2021.

| Order | Author | Frequency (number of documents) | Country | Affiliation | h-index WoS |
|---|---|---|---|---|---|
| 01 | Mendes, Isabel Amelia Costa | 9 | Brazil | University of São Paulo | 14 |
| 02 | Mazzo, Alessandra | 7 | Brazil | University of São Paulo | 11 |
| 03 | Fernandes, Josicelia Dumet | 7 | Brazil | State University of Southwest Bahia | 9 |
| 04 | Do Prado, Marta Lenise | 7 | Brazil | Federal University of Santa Catarina | 7 |
| 05 | Backes, Vania Marli Schubert | 7 | Brazil | Federal University of Santa Catarina | 5 |
| 06 | Lunardi, Valeria Lerch | 5 | Brazil | Federal University of Rio Grande do Sul | 14 |
| 07 | Erdmann, | 5 | Brazil | Federal University of | 12 |

|     |                            |   |          |                                    |   |
| --- | -------------------------- | - | -------- | ---------------------------------- | - |
|     | Alacoque Lorenzini         |   |          | Santa Catarina                     |   |
| 08  | Da Silveira, Rosemary Silva | 5 | Brazil   | Federal University of Rio Grande do Sul | 9 |
| 09  | De Godoy, Simone           | 5 | Brazil   | University of São Paulo             | 8 |
| 10  | Martins, Jose Carlos Amado | 5 | Portugal | Nursing School of Coimbra          | 6 |

The author Mendes, Isabel Amelia Costa portrayed predominance as the most productive author with the publication of nine documents, followed by the authors Mazza, Alessandra; do Prado, Marta Lenise; Fernandes, Josicelia Dumet and Backes, Vania Marli Schubert, with publication of seven documents each. The authors who emerged with the publication of five documents each were Lunardi, Valeria Lerch; Erdmann, Alacoque Lorenzini; da Silveira, Rosemary Silva; Simone de Godoy and Martins, José Carlos.

In the same sense, there was a predominance of authors Mendes, Isabel Amelia Costa and Lunardi, Valéria Lerch, who obtained an h Index of 14, representing the highest reference in this research, despite the differentiation of publications between these authors, as the first published nine documents and the second had five publications. It is also important to highlight the performance of author Erdmann, Alacoque Lorenzini, who obtained an h-Index of 12, followed by researcher Mazzo, Alessandra, with an h-Index of 11. Thus, the impact of researchers' scientific production on the WoS database is correlated with the use of citations obtained by published articles.

In this context, it was also observed that, among the countries, Brazil stood out with a significant participation in scientific production. The growth of Brazilian participation in global scientific production has evolved, as shown in the study "Another version of the facts and figures on the production of publications and the relative impact of citations from 107 countries 1978-1980". It is worth remembering that all this growth in Brazil has led Brazilian science to gain notoriety, with repercussions on a national and international level. In WoS, the criteria for indexing a journal are extremely rigorous, so the fact that a journal is indexed on this basis is enough to be considered of quality.[18-19]

From the zoning of the authors' keywords, based on the principles of Zipf's 1st Law (1949),13 the mathematical principle exposed in the study is considered, which refers to the

"comparison of Zipf's Law in textual content and oral speeches",[20] represented in the formula: √TP = PE √PE = SE, where "TP" refers to the total number of words; "PE", first sphere, called Trivial Zone; "SE", second sphere, called Intermediate Zone; further highlighting that the third sphere, Dispersion Zone, is not endorsed in the formula, as it is characterized by low frequency terms, which are diverse and seen as noise. According to the data presented on the Web of Science, a total of 1,164 words were recorded, which were submitted to the formula, resulting in "PE" = 34.10 and "SE" = 5.83, leaving 1,124.07 words that constitute the third sphere. In the present study, only the Trivial and Intermediate Zones were represented.

In accordance with the keyword analysis, it was found that there were approximately 5.83 keywords defined as relevant in the area studied. In view of this, the six most frequently occurring terms were listed within the 389 documents analyzed and, as a result, these are characterized as defining the central axis of the theme. These terms were aligned in decreasing order regarding the number of occurrences, being: Nursing (115 frequency of occurrences), Nursing Education (66), Education (64), Teaching (35), Education, Nursing (32) and Nursing Care (32).

## Discussion

There was a notable growth in scientific productions and publications in Nursing, which serves as an indication of the development of research focusing on pedagogical practices in Nurse training, with the inference that this increase was driven by the growing number of Graduate programs in Nursing in recent years.[21] In another way, it is also linked to the study on "Pedagogical training in nursing: reflection for practice",[22] which reflects on the increase in pedagogical practices in nursing to the detriment of the exercise of safe care, in addition to the qualification requirements of the current job market.

In this scenario, the results allow us to visualize the predominance of the English language (including over the Portuguese language) followed by Spanish in the publications analyzed. And considering that both languages are from Latin America and the Caribbean, it is possible to assume a certain internationalization of the area of nursing education. Another aspect to consider is that this area has a "universal language", which favors communication between researchers. Furthermore, the preponderance of the English language in Brazilian

articles can be explained by the growing number of journals indexed in the Web of Science, ensuring greater visibility for the area of Nursing education, with prospects that other researchers may be interested in the work of Brazilian authors.[23]

Furthermore, a study entitled "The role of the English language in academic-scientific publishing: theoretical reflections and the case of Brazilian online writing courses",[24] reflects on the use of the English language in the academic environment, denoting that English has a predominant language regarding the dissemination of scientific knowledge, mainly in biological and health sciences. Furthermore, there is also a preference for the English language for publishing research results in scientific communication, which proves the recognition of the language as a lingua franca of science.

Regarding the application of the Bradford Law, it was found that the main group of journals represents 35.7% of scientific productions, while in the other zones, the 2nd and 3rd zones represent 32.9% and 31.4% respectively. Furthermore, by applying the Bradford multiplier formula, it was proven that the core is made up of the most used journals in the thematic field. In this way, the sources of publications belonging to the central zone (core) are considered the most relevant in approaching the topic, in view of the concentration of scientific literature in such sources and, therefore, these sources make up the core of quality and relevance in dealing with the theme.[25]

In line with the perspective of qualifying and quantifying the importance of journals through the relationship between the number of citations and the amount of scientific production each journal has, IF arises. Each database presents its coverage in terms of the impact/visibility index of the journals, with the Web of Science, the Impact Factor, made available annually by the JCR, which consists of a systematic and direct tool for evaluating and comparing journals in the specialties in the fields of science, social sciences and technology.[26]

With regard to the calculation of the JCR, this occurs by adding the number of citations that the articles present in the journals receive during the two-year period divided by the number of publications published by the journal in the same time frame as the citations, resulting in the impact of journal in the year of evaluation.[26]

In this scenario, it was found that the journals that published the most on the subject belonging to the area of nursing education were: Latin American Nursing Journal, which

presented the highest percentage of publications (14.4%), with 56 documents, but with IF of 1,725. Furthermore, the results showed that the journals with the highest IF are not those that published the greatest number of documents, as evidenced in the journal Nurse Education Today, which despite having the highest IF of 3,906, published 15 documents with a percentage of 3.9% of total documents. Thus, this result highlighted the predominance and prominence of journals with the highest frequency of document publications, seeking to give greater scope to scientific dissemination.[21]

Regarding the applicability of Lotka's Law and Price's Law, it was noted that both the variance and the standard deviation are low in relation to the mean, indicating little dispersion in the pattern of the authors' productive behavior. This is confirmed by the distribution dispersion index, since this value does not denote dispersion around the mean, which means that the authors work collaboratively between pairs. In view of this, the result showed that the trend of co-authorship in this research was six authorships per document, so the general trend is towards an increasing collectivization of research, that is, the pedagogical practice in the training of nurses has been disseminated by several collaborative studies. From this perspective, the evolution of the mean number of authors per article and the proportionality of documents with more than one author constitutes a revealing indicator of the collectivization of research from the 20th century onwards.[27]

Regarding affiliation, it was found that the majority of institutional ties of the most productive authors occur in public institutions in Latin America, predominantly represented by Brazilian Universities. In view of this, it is noted that the majority of scientific production emerges from the university, as well as the fact that the authors are linked to Graduate courses, which provides greater proximity to research.[28]

Regarding the institution of the most productive authors, it was proven that the authors come from different institutions, but with a predominance of the Federal University of Santa Catarina and the University of São Paulo with an equal occurrence of three authors, followed by the Federal University of Rio Grande do Sul, with two authors. This result highlighted the axis of the South and Southeast regions of Brazil, which concentrate renowned Universities that support researchers, as their performance is relevant to the institutions. Thus, another fact that can be explained is the concentration of higher education

institutions with Graduate programs and researchers, in addition to the growing relationship of consolidation of research groups in Nursing, which enables greater interaction between researchers, which points to partnerships and scientific production carried out in an interinstitutional collaboration network.[21]

However, the only European affiliation is the Nursing School of Coimbra, located in Portugal. It is worth highlighting the lack of authors affiliated with institutions from other MERCOSUR countries when analyzing the most productive authors. Corroborating these data, the study "Higher nursing education in MERCOSUR: a bibliometric study" [28], with regard to the number of publications by country of origin, highlights, in its results, a certain emphasis on Brazil (84.72%), followed by Chile (5.98%) and Colombia (4.98%), further inferring that small numbers of publications (4.32%) were observed in the other Latin American countries.

From the zoning of keywords, based on the principles established by Zipf's Law, the terms most used in textual productions are discussed, presenting the distribution of terms in zones, characterized based on the frequency of occurrence of keywords. Thus, we have zone 1 Trivial, containing potentially innovative and interesting terms; in zone 2, the most relevant keywords for the thematic field are considered; and finally, zone 3 shows words that are characterized by emerging or sporadic concepts.[29]

The term analysis discusses the evidence from zone 2, which brings the most relevant terms to the topic studied. As a fundamental element, the word "Nursing" was found, which refers to the area of central element of the study, while the words "Nursing Education" (Educação em enfermagem), "Education, Nursing" (Educação, Enfermagem), "Teaching", "Education", "Nursing Care" emerge as characterizing terms that support the research context.[29]

The theme of pedagogical practices in nurses' training was linked to the terms shown previously. The conception of the terms demonstrates an intimate relationship with the theme, in addition to providing an overview of scientific production in that area, highlighting the need to promote studies that include the critical and reflective training of nurses, especially after the context of the Covid-19 pandemic.[30]

The limitations highlighted are configured by the use of metasearch engines to retrieve information and which gave rise to the algorithm string used by WoS. Furthermore,

the choice for a single indexing base, in itself, already constitutes a limitation of the study, which implied low evidence of scientific production from the other MERCOSUR member countries. The second limiting factor is the choice of metrics, because although there is no perfect metric, some can be chosen as they better explain the scientific production on a given topic or subject.

As contributions to nursing, it is necessary to increasingly encourage publications relating to pedagogical practices in nurses' training from the perspective of bibliometrics, as the results of this research reveal innovative possibilities and future investigations, aiming to expand understanding of the phenomenon of scientific communication in the light of Bibliometrics, which constitutes an essential evaluation process of scientific production, in the area of nursing education. Finally, it is hoped that the results from this research will arouse investigative interest in carrying out other studies to advance scientific research in order to intensify the visibility of Nursing on the international scene.

## Conclusion

This study made it possible to characterize the scientific production indexed in the Web of Science database on the topic involving pedagogical practice in nursing training in the context of MERCOSUR, through bibliometric analysis. From this perspective, it is a methodology that can be considered important for the area of nursing education as it reveals research patterns, such as identification of scientific production, most productive researchers, co-authorship network and most researched topics.

The research, in this context, enabled the identification of 389 documents distributed among 354 articles, 19 of which were reviews and 16 were conferences. In the time frame, the milestone of scientific production in 1958 was revealed, however the annual distribution of scientific production showed variability in relation to the number of documents published per year, emerging in proof of the literary scarcity of the topic. Otherwise, the predominance of the English language in publications was noted, with signs of possible internationalization of the theme.

With regard to the other indicators analyzed in this study, using Bradford's Law, it was possible to verify that the journal that published the most was the Latin American Nursing

Journal, with an impact factor of 1.725 by JCR in 2021.

Lotka's Law, in turn, ratified the principle that "few authors produce a lot, while many authors produce little". Mendes, Isabel Amelia Costa portrayed predominance as the most productive author and h Index of 14. It was observed that the production of this Elite Group corresponded to 168 documents, representing approximately 43% of all documents produced, still below the 50% postulated in the Law by Price.

Furthermore, it was found that the authors' institutional ties occur in public institutions in Latin America, predominantly represented by Brazilian Universities. It was also identified that there were no authors affiliated with institutions belonging to other MERCOSUR countries, with the exception of Brazil, when analyzing the most productive authors.

Along these lines, the applicability of Zipf's Law showed a direct relationship between the terms set out in zone 2 "Nursing", "Nursing Education", "Education", "Teaching", "Education, Nursing" and "Nursing Care" with the research object.

Finally, it is noted that this research made contributions to the thematic field of nursing education, as well as metric studies, by promoting the diagnosis of literary behavior in the WoS database through bibliometrics, with identification and analysis of metric indicators.

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## Authorship contributions

### 1 – Elaine Regina Corrêa de Souza

Corresponding Author
Nurse, PhD in Public Health - elainersouza@yahoo.com.br
Conception and/or development of the research and/or writing of the manuscript.

### 2 – Ilma Pastana Ferreira

Nurse, PhD in Nursing - ilma.pastana@uepa.br
Review and approval of the final version.

### 3 – George Pinheiro Carvalho

Nurse, Graduate - georgecarvalho99@gmail.com
Conception and/or development of the research and/or writing of the manuscript.

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