

Bibliometric study of the scientific production on music education in Spain (1978–2022)

Estudio bibliométrico de la producción científica de educación musical en España (1978-2022)

Gregorio VICENTE-NICOLÁS, PhD. Associate Professor. Universidad de Murcia (gvicente@um.es).

Judith SÁNCHEZ-MARROQUÍ, PhD. Early-Years Teacher. Escuela Infantil No. 1. Molina de Segura (jsm12@um.es).

Abstract:

This work aims to identify the principal journals with the most scientific production on music education by Spanish authors, to establish a ranking of the most cited articles and Spanish authors with the most scientific contributions, and to determine the most researched trends in music education over time in Spain. The sample comprises all articles by Spanish authors listed in the WoS and Scopus databases (peer-reviewed) from 1978 to 2022. The final sample comprises 1001 articles, 1372 authors, and 293 journals. The analysis of the information is based on productivity and dispersion indicators (Price's, Bradford's, and Lotka's bibliometric laws), impact indicators (JIF, H index) and collaboration, scientific mapping, and multivariate multiple correspondence factor analysis. The results show an annual rate of increase of music research by Spanish authors of 11.96%, with growth increasing from 2000 and becoming exponential since 2010. Asymmetrical productivity was found in journals and authors, with many articles being concentrated in a small group of journals and authors. It was also observed that the most relevant research trends in music education up to 2022 related to methodology, teacher training, technology, creativity, innovation, performance, emotions, music therapy, interculturality and inclusive education.

Keywords: music education, journals, bibliometric analysis, scientific maps, scientific production, literature review, music research.

Resumen:

Los objetivos de este trabajo han sido identificar las principales revistas con mayor producción científica de autoría española sobre educación musical, establecer un *ranking* de los artículos más citados y de los autores españoles con mayor número de contribuciones científicas, y determinar las tendencias más investigadas en educación musical a lo largo del tiempo en España. Para la configuración de la muestra, se seleccionaron todos los artículos de autoría española publicados en las bases de datos WoS y Scopus (revisados por pares) desde 1978 hasta 2022. La muestra final alcanzó los 1001 artículos, 1372 autores y 293 revistas. El análisis de la información se ha fundamentado en indicadores de productividad y de dispersión (leyes bibliométricas de Price, de Bradford y de Lotka), indicadores de impacto (JIF, índice H) y de colaboración, mapeo científico y técnica multivariante del análisis factorial de correspondencias múltiples. Los resultados revelan una tasa de crecimiento anual de la investigación musical realizada por autores españoles del 11.96%, con un mayor crecimiento a partir de 2000, que se convierte en exponencial desde 2010. Se constató una productividad asimétrica tanto en las revistas como en la autoría, de forma que gran parte de los artículos se concentraban en un grupo reducido de revistas y autores. Asimismo, se observó que las tendencias investigadas más relevantes en educación musical hasta 2022 estaban relacionadas con metodología, formación del profesorado, tecnología, creatividad, innovación, *performance*, emociones, musicoterapia, interculturalidad y educación inclusiva.

Palabras clave: educación musical, revistas, análisis bibliométrico, mapas científicos, producción científica, revisión bibliográfica, investigación musical.

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1. Introduction

Scientific production in music education has increased considerably over recent years and, as a consequence, so has the existence of journals specialising in music (Anglada-Tort & Sanfilippo, 2019; Calderón & Gustems, 2018; Marín-Suelves et al., 2022; Morales et al., 2017). Notable among the most recent Spanish production relating to music education is research into musical methodologies (García-Gil & Cremades-Andreu, 2019; Rodríguez-Quiles, 2023); curriculum, analysis of didactic materials and resources (Aróstegui, 2016; Chao-Fernández et al., 2020; Cores & Rodríguez, 2023); digital competence (Colás-Bravo & Hernández-Portero, 2023; Serrano, 2017); teacher training (Bautista et al., 2019; Cuervo et al., 2023); comparative education (Lorenzo et al., 2023; Mateu-Luján, 2020); cultural aspects and students' musical preferences (Cuadrado-García et al., 2023; Marín-Liébana & Botella-Nicolás, 2020); emotional education (Bonastre Vallés & Nuevo Benítez, 2020; Montiel-Guirado & Clares-Clares, 2023), and the influence of music on social and psychological development (Cabedo-Mas et al., 2023; Lorenzo, 2020), among others.

Given this increase in music research, bibliometrics make it possible to decipher and represent the accumulated knowledge, making sense of a large volume of data. Donthu et al. (2021) note that the aim of bibliometric analysis is to apply quantitative methods to data about scientific production, enabling the bibliometric and intellectual structure of a field to be identified and studied through analysis of the social and structural relations between the different components of the research (authors, countries, institutions, topics, journals, etc.). Owing to the large number of scientific documents, specific techniques are required to analyse scientific production and its impact or analyse collaborative or thematic networks (Vélez-Estévez et al., 2023). In this sense, it is necessary to recall that the principal bibliometric techniques are citation, co-citation, co-authorship, and co-words (Zupic & Čater, 2015).

Bibliometric analysis can be applied to a wide variety of academic fields (Ellegaard & Wallin, 2015). However, bibliometric methods are not used as frequently in education as in other fields; only 1.34%, compared to 27.23% in information and library sciences or 21.86% in computer science, as

found in the recent study by Verma et al. (2023). This work also identifies the most productive countries in bibliometric research, with the leading positions being held by China, the USA, and Spain, followed by Brazil, the UK, Germany, and Canada.

In bibliometric studies, we can differentiate between studies that analyse the performance of articles and journals to discover emerging trends and patterns of collaboration and other studies that focus on a specific area of the existing bibliography with the aim of exploring its intellectual structure (Donthu et al., 2021). There are studies of both types in music education. Notable works from the first group of bibliometric research include Hancock and Price (2020), who analysed the production of the *Journal of Research in Music Education* (JRME); Anglada-Tort and Sanfilippo (2019), who reviewed the publications *Psychology of Music*, *Music Perception*, and *Musicae Scientiae*; and Rohwer (2018), who studied the content of the *International Journal of Community Music*.

The other group of studies includes authors who research specific topics, such as Özenç-Ira and Gültekin (2022), who performed a bibliometric study of musical creativity. They note its growth over the last two decades, especially in the USA and the UK (which are the countries with the highest output in studies on this topic relating to psychology, cognitive science, and neuroscience), and in Spain (one of the countries with most research on musical creativity in educational and curricular aspects). Li et al. (2021) carried out a bibliometric analysis of 1004 publications on music therapy recorded in WoS, identifying a notable increase from the year 2000. Levine et al. (2023) analyse music research in the field of medicine over fifty years and note a proliferation of research relating to neuroscience, alternative therapies, and music therapy. We can also mention some current reviews of literature on music, such as the one by He et al. (2023) on musical creativity in children or the one by Blackwell et al. (2023) on feedback in music education.

In the case of Spain, there are various studies comprising bibliometric analyses of music education, albeit to a lesser extent than in other countries such as the USA or China. Among them, we should note the work by Morales et al. (2017), who, in their bibliometric analysis of Spanish articles

listed in WoS from 2000 to 2015, find an increase in journals specialising in music education and a dispersion of related journals, while, at the same time, noting the limited impact of music publications compared with other areas. We should also note the study by Calderón and Gustem (2018), whose analysis of the scientific production of 447 articles published in journals indexed in Journal Citation Reports (JCR) from 2006 to 2017 reflects an increase in this production over the years. However, they also note the limited repercussion that research in music education has compared with other areas, as it receives very few citations.

We also found bibliometric studies or systematic reviews on more specific topics. Marín-Suelves et al. (2022) perform a bibliometric analysis in WoS and Scopus on technology in music education and confirm the increase in publications over the last five years, with the USA and Spain standing out as the most productive countries. Vargas-Serrano et al. (2023) analyse the situation of music in primary and secondary schools and conservatories after the pandemic, noting collaboration through online platforms and students' musical creativity. Olvera-Fernández et al. (2023) offer a review of innovative methodologies in music education. Monreal-Guerrero and Herrero (2023) analyse research centred on YouTube as a tool for learning music. And Fernández-Barros et al. (2023) review studies on the benefits of peer tutoring in musical contexts.

Having reviewed the literature relating to the object of study, this work aims to provide an overview of research in music education over time, based on the principal bibliometric laws proposed by Ardanuy (2012), namely: Price's law, which analyses the increase in scientific production in a specific field of research; Bradford's law, which studies the asymmetric distribution of journals by their publications in a discipline; and Lotka's law, which describes the unequal productivity of authors in a given area. The main aims of this work, taking into account the aforementioned laws and bibliometric techniques, are to identify the principal journals with the most scientific production by Spanish authors on music education, to establish a ranking of the most cited articles and Spanish authors with the most scientific contributions, and to determine the most researched trends in music education over time in Spain.

2. Method

2.1. Methodological design

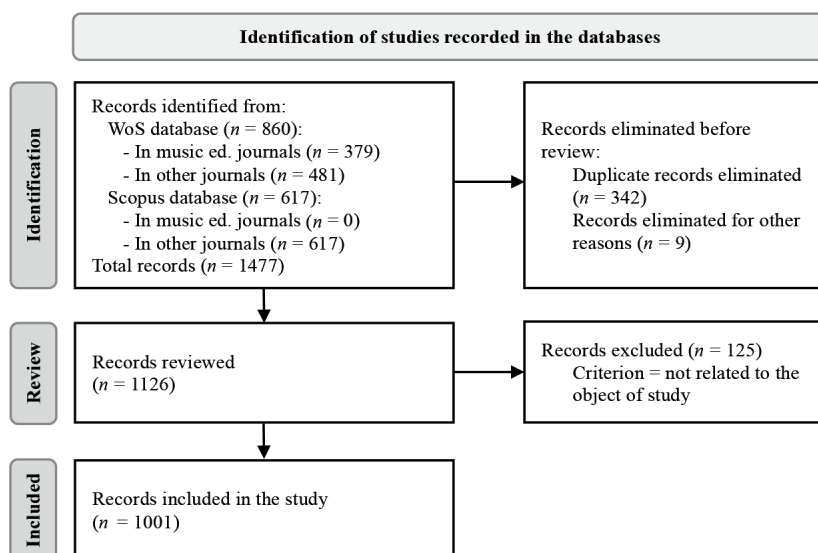
The bibliometric method was used to provide a quantitative analysis of the publications written (Ellegaard & Wallin, 2015). We started by selecting data. Although the number of databases has increased in recent years (Vélez-Estévez, 2023), we restricted this study to WoS and Scopus, given the broad cover they provide and the quality of the citations of the articles (Martín-Martín et al., 2018). The information was then analysed using bibliometric indicators. The production was presented by means of science maps with the objective of creating a representation of an area by dividing documents, authorship, journals or words into different groups (Zupic & Čater, 2015).

2.2. Data collection

The search for information was divided into two phases. The first included all peer-reviewed articles by Spanish authors published in music education journals indexed in WoS and Scopus. To do so, we selected journal articles only as document type; Spain as the country; and from the earliest record to 2022 for the publication date. We also identified articles by Spanish authors relating to music education published in any other journal by carrying out an advanced search in the two databases. For this search, we limited the title and keywords using the following terms: music and education, sound and education, music and school, teaching and music, teachers and music, learning and music, and music and children. The results we obtained comprised 860 articles in WoS and 617 in Scopus. We should note that, in the case of Scopus, we excluded any journals already included in WoS.

In the second phase, we exported the data from WoS and Scopus in BibTex format and combined them into a single file using the Rstudio program. Duplicate articles ($n = 247$) were automatically eliminated. Nonetheless, we also performed a manual review, eliminating other duplicate articles not identified by the software ($n = 95$) and others that did not fulfil the established criterion of being published before 2023 ($n = 9$). Afterwards, we reviewed the titles and abstracts of the articles with the aim of excluding any that were not directly related to music education ($n = 125$). The final sample comprised 1001 articles by Spanish authors. Figure 1 shows the general process for collecting information from the articles recorded in the databases.

FIGURE 1. Process of identification, review, and inclusion of records from WoS and Scopus.



Source: adapted from the diagram by Page et al. (2021).

2.3. Data analysis

The data analysis was based on the bibliometric laws proposed by Ardanuy (2012), which make it possible to establish general explanations and seek statistically regular behaviours over time in scientific production and information. This work studies the following ones:

- The law of exponential increase (Price's law). Price established that scientific production grew very rapidly and doubled every ten or fifteen years.
- The law of dispersion of scientific bibliography (Bradford's law). This law states that most of the bibliography on a topic will be concentrated in a very small group of journals. If the journals are put in decreasing order of productivity, they can be split into three groups, with a third of the articles in each. The first group, the *Bradford core*, comprises very few journals; the second, quite a few journals; and the third, the bulk of journals (ratio 1: n : n^2).
- Law of productivity of authors (Lotka's law). Lotka found a quantitative relationship between authorship and the number of articles published. This law states that the productivity of authors shows an uneven distribution, and so there is a small group of highly productive researchers and a large number of authors with low productivity.

In addition to the indicators of productivity and dispersion mentioned above, we calculated other bibliometric indicators, such as impact indicators (JIF, H index) and collaboration indicators. Equally, with regards to citations, we considered whether they are global citations or local citations, in other words, whether they come from the whole body of articles that are found in the databases consulted or, on the contrary, from the articles that comprise the sample of this study.

In addition, during the analysis process, we used science mapping. This is a bibliometric method that makes it possible to create a visual representation of the structure of an area of research and uses analysis techniques such as citation, co-citation, co-authorship, and co-words, among others (Zupic & Čater, 2015). The structures represented in this work relate to the journals (map of co-citations), authorship (map of collaboration with authors), and keywords (thematic map). The latest was prepared using the multivariate technique of multiple correspondence analysis (MCA) in order to represent a conceptual structure of the field and a grouping of documents that express shared concepts. In this case, the results are interpreted based on the relative positions of the points and their distribution across the dimensions; the more similar the words are, the closer they are on the map (Cuccurullo et al., 2016). Table 1 displays the variables analysed and the type of analysis performed with each of them.

TABLE 1. Structure of the data analysis.

Units of analysis	Type of analysis	Bibliometric techniques or indicators
Articles ($n = 1001$)	Growth since 1978	Price's law
	Mean articles cited per year	Citations
	Ranking of the 10 most-cited articles	Global citations and local citations
Journals ($n = 293$)	Ranking of the 10 journals with the most articles	Productivity
	Distribution of the production of the journals	Bradford's law
	Ranking of the journals with the greatest impact	H-index and JIF
	Science map of journals cited at least 30 times by authors	Co-citations
Authors ($n = 1372$)	Authors with most articles	Productivity
	Distribution of the production of the authors	Lotka's Law
	Ranking of the universities	Productivity
	Map of collaboration by authors	Co-authors
Keywords: ($n = 2589$)	Ranking of the most frequent words	Frequency
	Trends researched	Frequency
	Thematic map of keywords	Multiple correspondences

To analyse the data, we used the RStudio, Bibliometrix (Aria & Cuccurullo, 2017), and VOSviewer programs (Van Eck & Waltman, 2017). In addition, we utilised the SPSS program for inferential analysis (correlation, regression analysis, and ANOVA) establishing $\alpha = .05$ as the critical value in the interpretation of the results.

3. Results

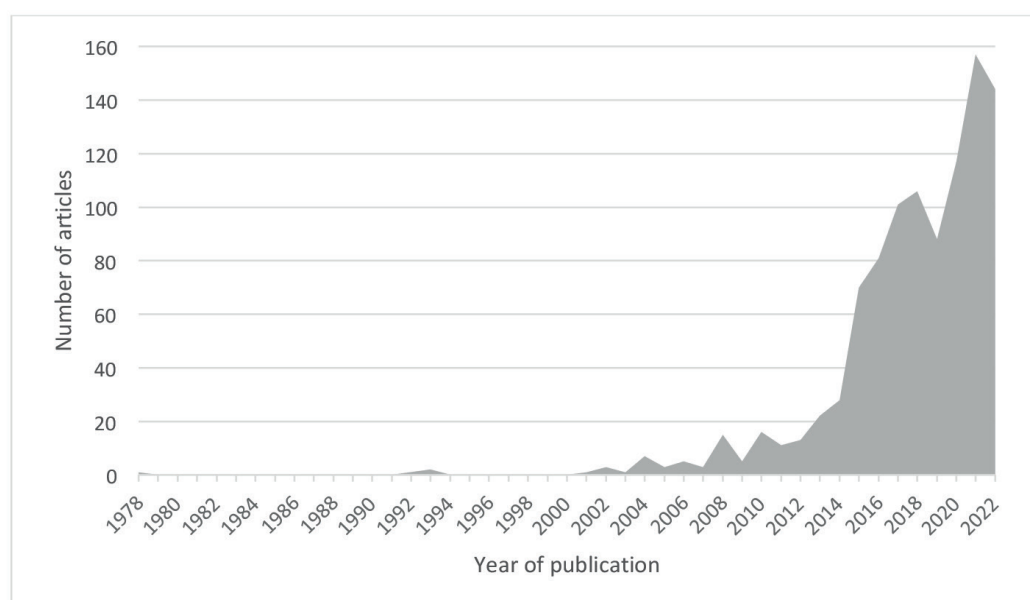
3.1. Articles and journals

The first article recorded in the databases was from 1978, although it was not until 2000 that scientific pro-

duction started to increase, with 2021 being the year with the most articles published ($n = 157$) (Figure 2). The mean articles per year was 22.24, with a variability of 42.54 (SD) and an annual growth rate of 11.96%. There is a significant relationship between the number of articles and the year of publication according to the correlation, $r_s = .890, p < .001$; the simple linear regression analysis with the coefficient of determination $R^2 = .524$; and ANOVA, $F(1, 43) = 47.255, p < .001$.

The extraordinary increase in this production over the last decade should be noted, as the figures for the

FIGURE 2. Annual academic production.



correlation are higher from 2010, $r_s = .962$, $p < .001$. Besides, the regression analysis confirmed Price's exponential increase, with a goodness of fit of 87%, $R^2 = .878$, and with a significant relationship according to ANOVA, $F(1, 11) = 79.467$, $p < .001$.

The articles from the sample have a mean of four citations ($M = 4.005$) and a variability of nine citations ($SD = 9.047$), although the number of citations of the articles has varied over time. Articles from

1993, 2008, and 2013 had the most citations, while ones from later years had lower mean citations, with this figure decreasing as they became more recent (Figure 3).

The articles that recorded the most global citations in WoS and Scopus from any field exceeded 100 and corresponded with the field of psychology more than education. Table 2 presents the ranking of the articles with the most global citations.

FIGURE 3. Mean citations received per article.

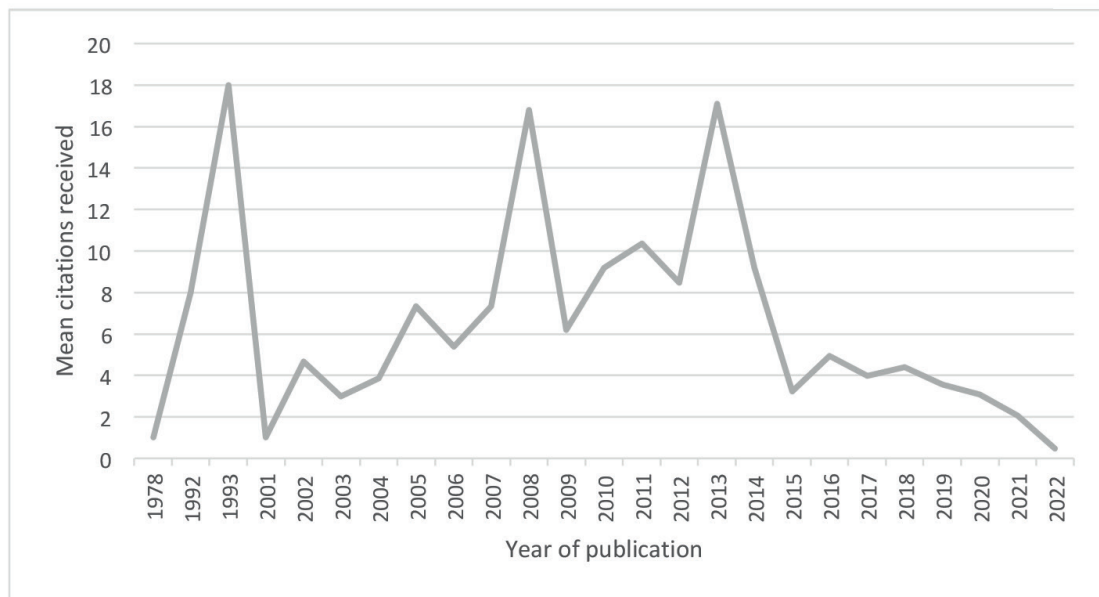


TABLE 2. Ranking of music articles with the most global citations.

	Título del artículo	Autoría	Año	Revista	Citaciones
1.	Individual differences in music reward experiences	Mas-Herrero et al.	2013	<i>Music Perception</i>	151
2.	Effects of music learning and piano practice on cognitive function, mood and quality of life in older adults	Seinfeld et al.	2013	<i>Frontiers in Psychology</i>	122
3.	Structural neuroplasticity in expert pianists depends on the age of musical training onset	Vaquero et al.	2016	<i>Neuroimage</i>	82
4.	Modulation of functional connectivity in auditory-motor networks in musicians compared with nonmusicians	Palomar-García et al.	2017	<i>Cerebral Cortex</i>	61
5.	Effects of phonological and musical training on the reading readiness of native- and foreign-Spanish-speaking children	Herrera et al.	2011	<i>Psychology of Music</i>	46
6.	Developing music teacher identities: An international multi-site study	Ballantyne et al.	2012	<i>Inter. Journal of Music Education</i>	44
7.	Self-determination theory applied to flow in conservatoire music practice: The roles of perceived autonomy and competence, and autonomous and controlled motivation	Valenzuela et al.	2018	<i>Psychology of Music</i>	44

8.	Synaesthesia: The existing state of affairs	Hochel & Milán	2008	<i>Cognitive Neuropsychology</i>	43
9.	Musical practice as an enhancer of cognitive function in healthy aging - A systematic review and meta-analysis	Román-Caballero et al.	2018	<i>Plos One</i>	43
10.	Exploring the global decline of music education	Aróstegui	2016	<i>Arts Education Policy Review</i>	41

However, articles in the field of music education received only fourteen citations from within the sample of this study (local citations), although, in this

case, the distribution of works linked to the context of psychology and that of education was more balanced (Table 3).

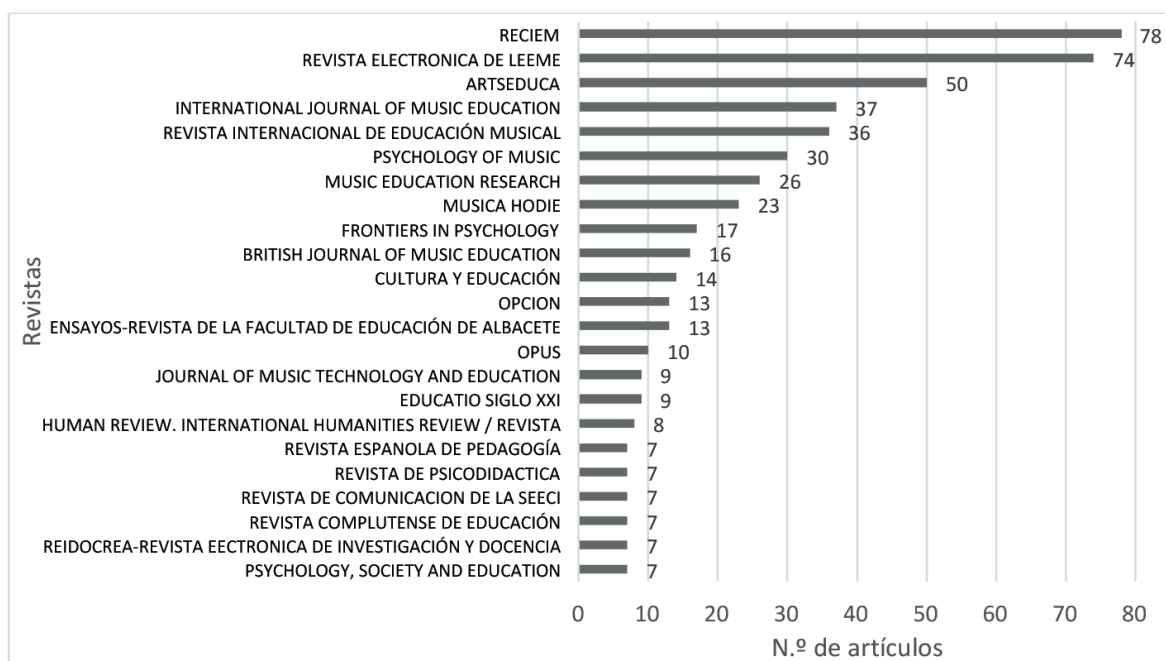
TABLE 3. Articles with most local citations.

	Article title	Authorship	Year	Journal	Citations
1.	Music performance teachers' conceptions about learning and instruction: A descriptive study of Spanish piano teachers	Bautista et al.	2010	<i>Psychology of Music</i>	14
2.	Metas y estrategias para una práctica constructiva en la enseñanza instrumental [Targets and strategies for a constructive practice in teaching musical instruments]	Torrado & Pozo	2008	<i>Cultura y Educación</i>	10
3.	The influence of music learning cultures on the construction of teaching-learning conceptions	Casas-Mas et al.	2014	<i>British Journal of Music Education</i>	10
4.	The older, the wiser? Profiles of string instrument teachers with different experience according to their conceptions of teaching, learning, and evaluation	López-Íñiguez et al.	2014	<i>Psychology of Music</i>	10
5.	Using the musical score to perform: A study with Spanish flute students	Marín et al.	2012	<i>British Journal of Music Education</i>	7
6.	Music teachers professional competences: From a theoretical framework to a concrete proposal	Carrillo	2015	<i>Revista Internacional de Educación Musical</i>	7
7.	Piano students' conceptions of musical scores as external representations: A cross-sectional study	Bautista et al.	2009	<i>Journal of Research in Music Education</i>	6
8.	Musical tastes of secondary school students with different cultural backgrounds: A study in the Spanish north African city of Melilla	Cremades-Andreu et al.	2010	<i>Musicae Scientiae</i>	6
9.	Formal music education not only enhances musical skills, but also conceptions of teaching and learning: A study with woodwind students	Marín	2013	<i>European Journal of Psychology of Education</i>	6
10.	La educación musical en la formación básica en España. El problema de la dispersión curricular [Music education in basic education in Spain: The problem of curricular dispersion]	Belletich et al.	2016	<i>Perspectiva Educacional</i>	6

The 1001 articles in the study sample were published in a total of 293 journals. Figure 4 shows the ranking of the journals with the most articles

on music education by Spanish authors. It should be noted that four of the top five journals were Spanish.

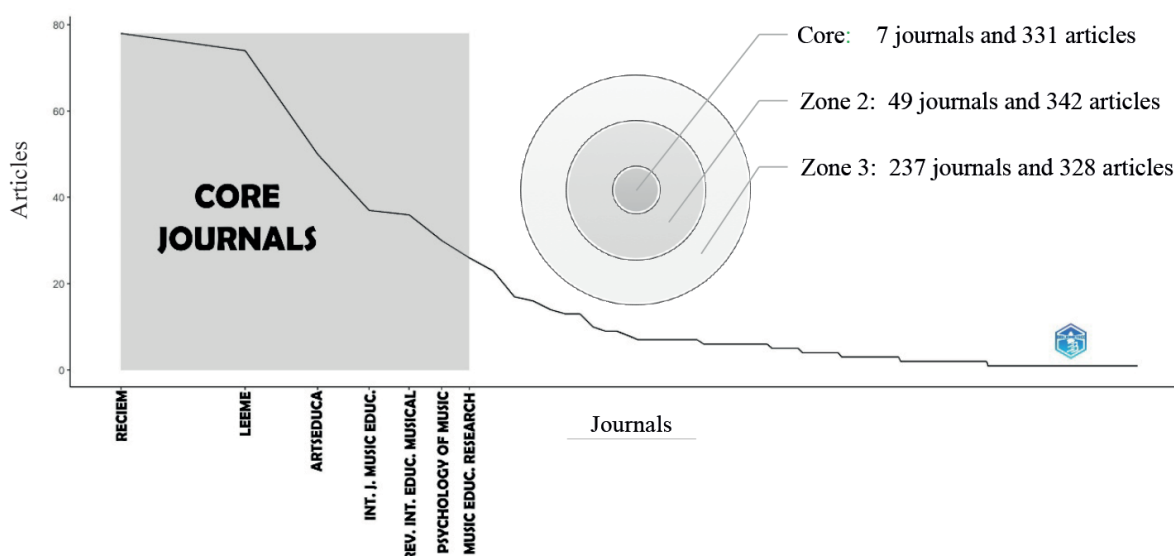
FIGURE 4. Ranking of journals with the most articles.



As for the distribution of articles in the different academic journals according to Bradford's law, we have established three zones (core, zone 2, and zone 3). These had approximately the same number of articles, but the principal core of articles published by Spanish authors comprised seven journals (Figure 5). This law is confirmed by the strong negative

correlation between the two variables, $r_s = -.939$, $p < .001$; the coefficient of determination of the regression analysis, $R^2 = .881$; and the significant results of the ANOVA, $F(1, 291) = 2164.645$, $p < .001$. That is to say, 88% of the variance in the publication of articles of the journals is explained by their position in the ranking.

FIGURE 5. Core journals: Bradford's law.



As shown in Table 4, of the 293 journals in the sample, the ones that have the most impact within the analysed location of Spain differ considerably from those that contain more articles by Spanish authors shown above in Figure 4. This difference is principally because of the number of citations the

published articles receive, which determines the H index of the journal. Therefore, when a journal has published fewer articles, but these articles have been widely cited by Spanish authors, they can have a higher H index than other journals with more publications but fewer citations.

TABLE 4. Journals with the greatest local impact factor.

	Journal	H-index	JIF	Articles	Cita- tions	Year of 1 st article*	Index (WoS)
1.	<i>Psychology of Music</i>	10	1.7	30	312	2010	SSCI
2.	<i>International Journal of Music Education</i>	9	1.8	37	262	2003	SSCI
3.	<i>Music Education Research</i>	8	2.3	26	169	2008	SSCI
4.	<i>Cultura y Educación</i>	7	0.7	14	136	2008	SSCI
5.	<i>Frontiers in Psychology</i>	7	3.8	17	221	2013	SSCI
6.	<i>Revista Electrónica Complutense de Investi- gación en Educación Musical-RECIEM</i>	7	1.0	78	224	2004	ESCI
7.	<i>British Journal of Music Education</i>	6	2.0	16	113	2011	SSCI
8.	<i>Music Perception</i>	5	2.3	5	211	2006	SSCI
9.	<i>Revista Complutense de Educación</i>	5	1.6	7	36	2010	ESCI
10.	<i>Revista de Psicodidáctica</i>	5	3.6	7	50	2007	SSCI

*Year of the first article published by Spanish authors.

There were 19880 references in the articles in the sample. The journals cited most often in these referen-
ces were *Psychology of Music*, *Thesis*, *Music Education
Research*, *Journal of Research in Music Education*,
British Journal of Music Education, and *International
Journal of Music Education*, all of which had more than

three hundred citations (Table 5). Taking into account
those journals cited thirty times or more ($n = 72$), two
large related groups were established, one comprising
music education journals and journals from the field of
education and another comprising journals connected
to the field of psychology (Figure 6).

TABLE 5. Most-cited journals from the sample as a whole.

	Journal	Citations (<i>F</i>)	Strength of relationship*
1.	<i>Psychology of Music</i>	559	10586
2.	<i>Thesis</i>	368	3553
3.	<i>Music Education Research</i>	321	5280
4.	<i>Journal of Research in Music Education</i>	320	6057
5.	<i>British Journal of Music Education</i>	308	5172
6.	<i>International Journal of Music Education</i>	259	4164
7.	<i>Frontiers in Psychology</i>	182	4541
8.	<i>Eufonía</i>	178	1691
9.	<i>Music Perception</i>	159	2959
10.	<i>Revista Electrónica LEEME</i>	117	1279

*This value indicates the total number of times that the journal has been cited along with other journals.

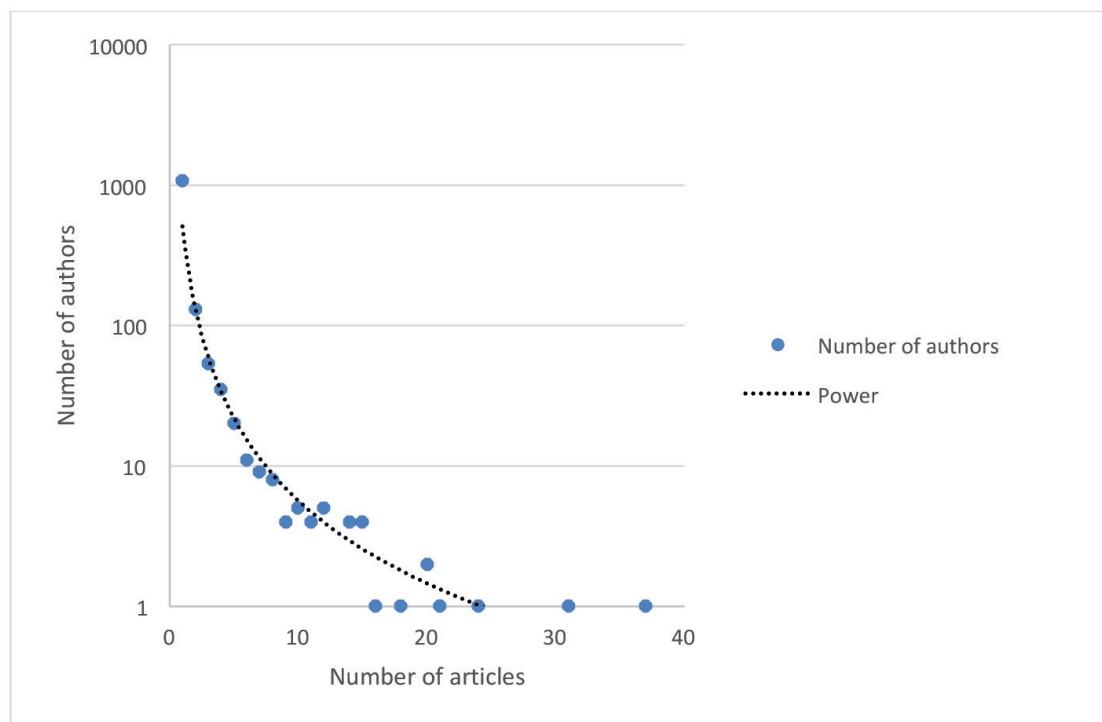


articles; 10.2%, three to nine, and only 30 authors (2.18%) published ten or more. These authors are listed in Figure 7.

Authors	No. of articles
BOTELLA-NICOLÁS A	37
GUSTEMS-CARNICER J	31
CABEDO-MAS A	24
BERNABÉ-VILLODRE M	21
CALDERÓN-GARRIDO D	20
LORENZO-QUILES O	20
TEJADA GIMÉNEZ J	18
MARÍN-LIÉBANA P	16
CASANOVA-LÓPEZ O	15
CREMADES-ANDREU R	15
GARCÍA-GIL D	15
VICENTE-NICOLÁS G	15
ARRIAGA-SANZ C	14
BLASCO-MAGRANER J	14
POZO J	14
ZARZA-ALZUGARAY F	14
BAUTISTA A	12
BERRÓN RUIZ E	12
MURILLO-RIBES A	12
OREJUDO HERNÁNDEZ S	12
RIAÑO-GALÁN M	12
ÁNGEL-ALVARADO R	11
GÉRTRUDIX-BARRIO F	11
RAMÍREZ R	11
ARÓSTEGUI J	10
BERBEL-GÓMEZ N	10
CASAS-MAS A	10
CHAO-FERNÁNDEZ R	10
DÍAZ-GÓMEZ M	10
MONREAL-GUERRERO I	10

of authors published more articles, reflecting the uneven distribution of scientific production described in Lotka's law with a fit of 94%, $R^2 = .947$, and a significant relationship between these variables according to the ANOVA, $F(1, 19) = 342.657, p < .001$.

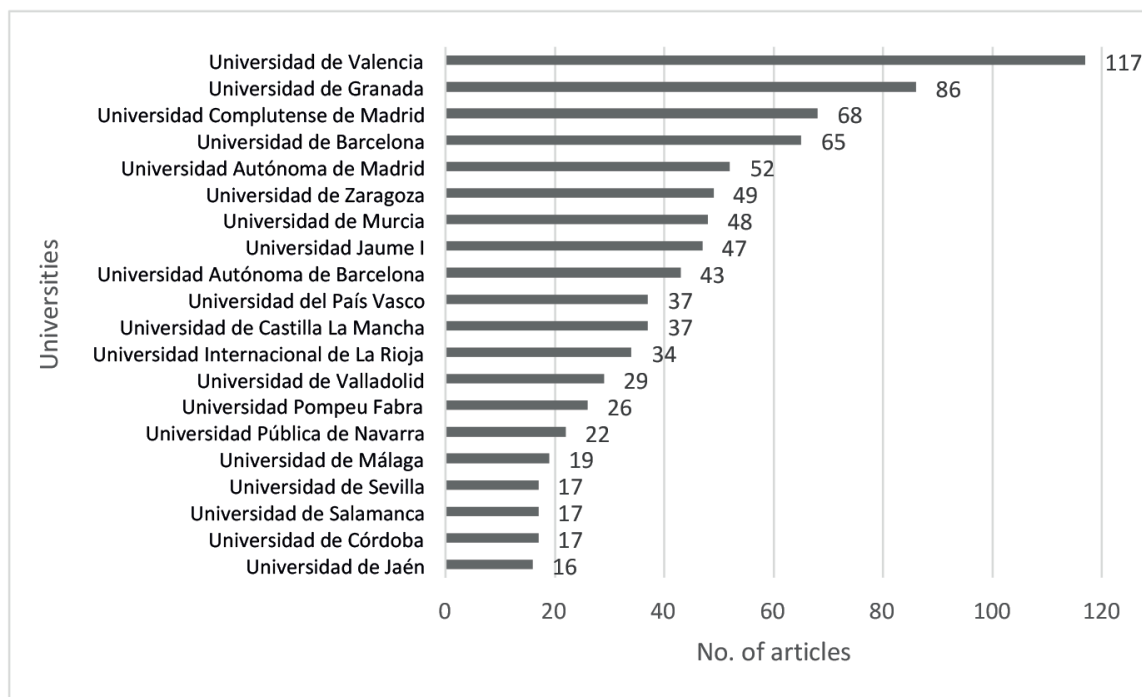
FIGURE 8. Productivity of authors: Lotka's law.



The universities of Valencia and Granada, the Universidad Complutense de Madrid, the Universitat de Barcelona, and the Universidad Autónoma de Ma-

drid stood out as the Spanish universities with the most scientific production in music education, with more than fifty articles published each (Figure 9).

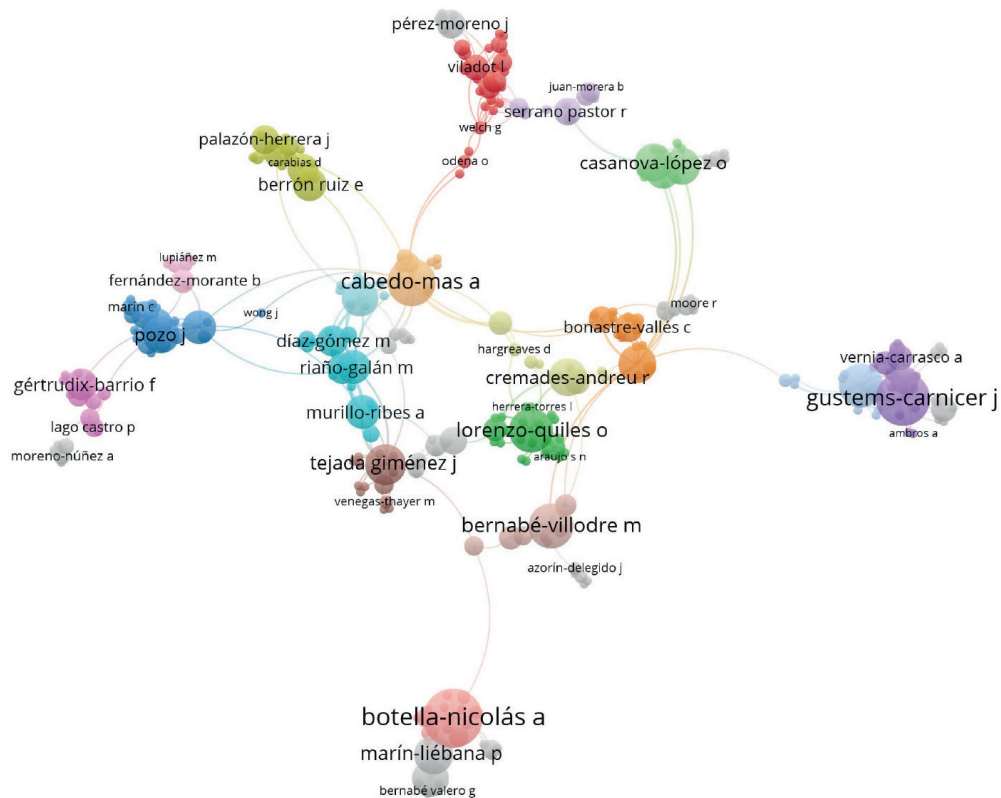
FIGURE 9. Ranking of universities.



With regards to collaboration in scientific production in Spain, 25.37% of articles had a single author while the others had two or more authors, with a mean of 2.41 co-authors per article. Figure 10 shows twenty-nine collaborative groups in the area of study (there

are other groups of authors who publish jointly but do not appear in this network because they are not related with the principal collaborative groups). These groups comprise 313 authors, that is to say, 22.81% of the total authors are involved in the most collaborations.

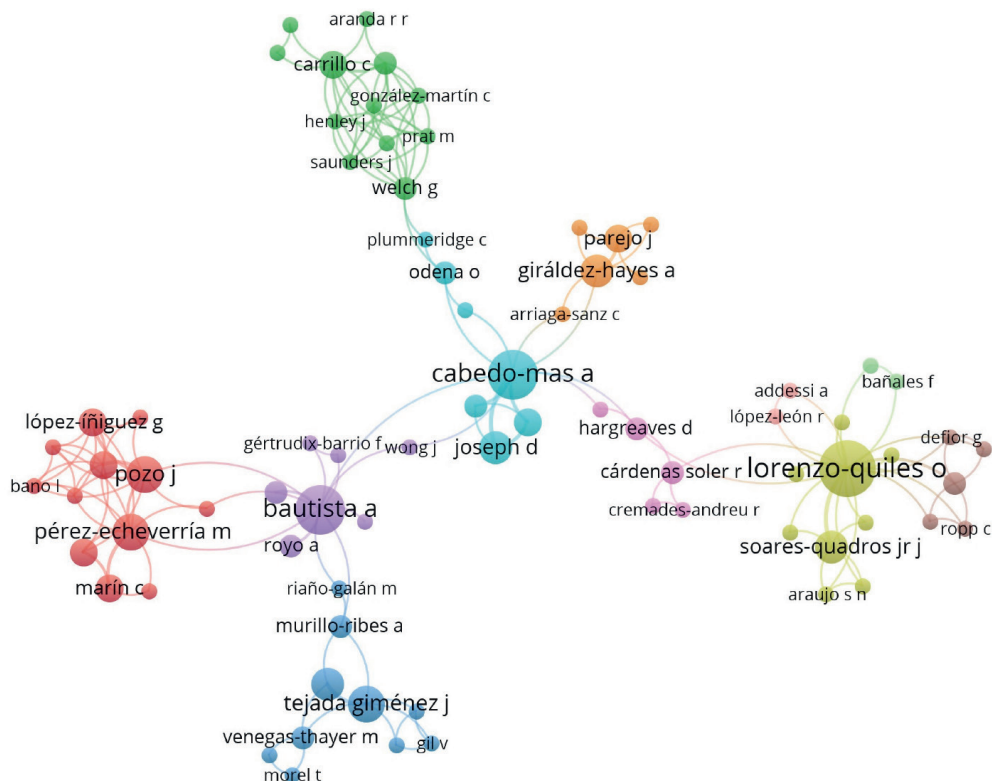
FIGURE 10. Network of collaboration of the study authors.



Collaboration by Spanish authors with foreign authors was found in 10.89% of works, among which we note twenty-two collaborations with the United Kingdom (2.2%), eleven with the USA (1.1%), nine co-authorships with Brazil and another nine with Australia, eight collaborations with Chile, and six each with Canada,

China, and Germany. Figure 10 shows collaborations with other countries. These collaborations result in eleven groups comprising seventy-seven authors from different countries, which means that 5.6% of the total number of authors do more publications with foreign authors (Figure 11).

FIGURE 11. Network of collaboration of Spanish authors with foreign authors.



3.3. Keywords and topics

A total of 2589 keywords were included in the 1001 articles, the most frequent ones being *teaching*

methods, *teacher training*, *technology*, and *primary education*, all of them with values greater than 75 (Table 6).

TABLE 6. Keywords cited most in the sample as a whole.

Keywords	F	Keywords	F
1. Teaching methods	105	11. Early-childhood education	40
2. Teacher training	88	12. Innovation	40
3. Technology	86	13. Emotions	30
4. Primary education	76	14. Intercultural education	30
5. Higher education	56	15. Music therapy	28
6. Creativity	54	16. Motivation	26
7. Conservatories	53	17. Instrumental learning	24
8. Curriculum	44	18. Inclusive education	22
9. Secondary education	43	19. Interdisciplinarity	20
10. Performance	40	20. Gender	20

Regarding the evolution of keywords over the last decade, we found that the most current ones were *textbooks*, *e-learning*, and *Covid-19*. The ones that have

persisted the most over the last ten years are *conservatory*, *intercultural education*, *rhythm*, and *informal education* (Figure 12).

FIGURE 12. Most frequent keywords over the years.

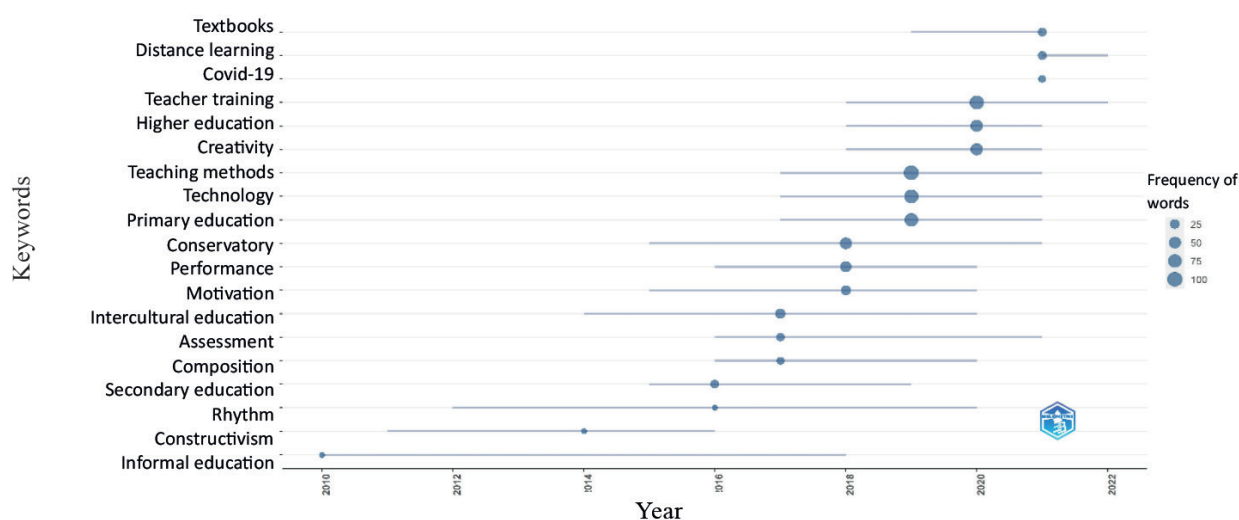
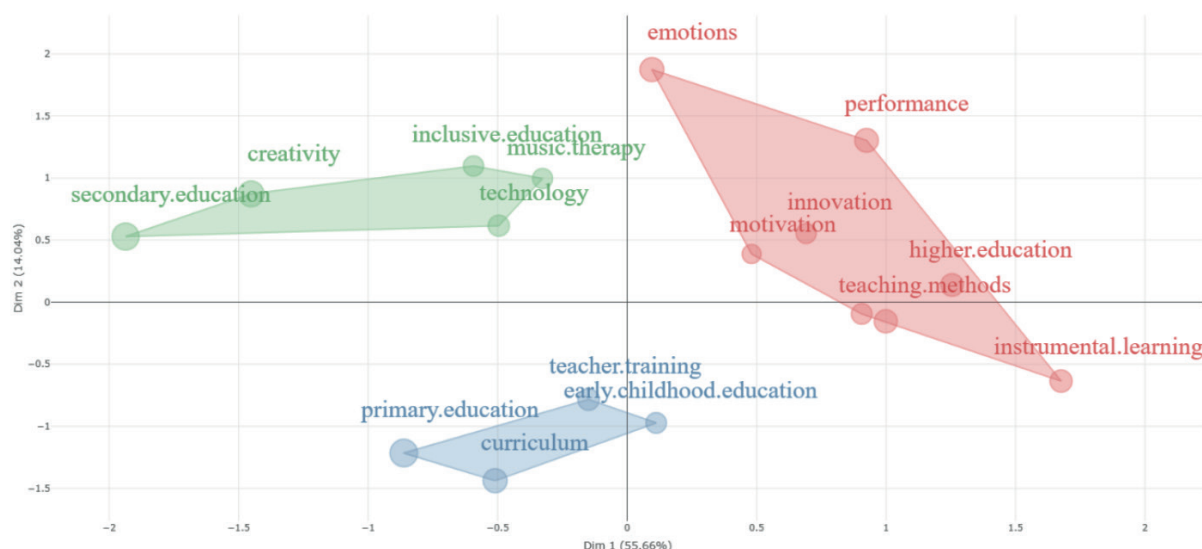


Figure 13 is a thematic map derived from the factor analysis of multiple correspondences that shows three large areas of research. Although any topic can be researched at any educational stage, an association of general topics with particular stages was observed. Accordingly, the first group (red) encompasses research in higher education and conservatories, related principally with methodology,

performance, instrumental learning, and emotions. The second group (blue) shows that articles on early-childhood education and primary education more frequently research aspects relating to the curriculum and teacher training. Finally, the third group (green) includes studies on secondary education, associated with topics of creativity and technology, among others.

FIGURE 13. Thematic map of the articles' keywords.



Considering that MCA aims to explain the greatest possible inertia in the different axes, the previous map can be said to be capable of identifying the most significant relations between variables, given that the two dimensions explain almost 70% of the total inertia (55.66% the first and 14.04% the second); in other words, a large proportion of the articles that share similar topics are represented and associated.

4. Discussion and conclusions

The results of this study confirm that scientific production in music education has grown in recent years, as previous studies observed (Anglada-Tort & Sanfilippo, 2019; Calderón & Gustems, 2018; Marín-Suelves et al., 2022; Morales et al., 2017; Özenç-Ira & Gültekin, 2022). In Spain, music research grew very quickly from 2000, and this growth became exponential from 2010, fulfilling Price's law on increase.

As for citations of music education articles, we can conclude that the mean number of citations ($M = 4$) is similar to the figure of 3.91 citations in earlier studies (Calderón & Gustems, 2018) and slightly higher than the mean of 2.96 observed by Morales et al. (2017). This increase should be regarded as something positive, although it is still far from the mean of the articles that are more related with musical psychology or music therapy, which is around seventeen citations (Anglada-Tort & Sanfilippo, 2019; Li et al., 2021). Indeed, the articles cited most internationally correspond more with the field of psychology

than education and exceed one hundred citations. In contrast, our analysis of local citations reveals that the most-cited articles in Spanish musical research exclusively belong to the field of education, with the particular feature that they have received a considerably smaller number of citations, just fourteen. The greater dissemination or impact, in terms of citations, of articles that belong to or relate to the field of psychology raises the question of whether music education researchers should prioritise these topics when choosing their topics if they want to achieve a high impact in their publications. Accordingly, an article on the musical preferences of students would logically have fewer potential journals interested in it than if its topic matter covered, for example, musical preferences and emotions, or musical preferences and disruptive behaviour in adolescents. The importance and validity of the interdisciplinarity of knowledge are not questioned, but, to some extent, are researchers in music education not sometimes obliged to divert those strictly musical-educational lines to be able to publish more or in *more prestigious* journals? This idea has already been addressed by Mantie (2022), whose approaches point in the same direction as this study and who argues that "If you want a high score, you must publish in the right journals (which tend to be *medical* rather than *social* in orientation)" (p. 25). The results of this research do not answer this question, but considering it in future studies would be of interest.

Regarding the productivity of journals, other studies (Calderón & Gustems, 2018) have identified an unequal distribution, in line with Bradford's law. In

other words, the articles published are concentrated in a very small group of journals. In Spain, seven journals make up this core, although they do not all have the same impact. In contrast with other areas where the journals with the highest impact publish the most articles (Silva-Díaz et al., 2022), in this study, only half of the journals with the largest output are the ones with the greatest impact in Spanish music research: *Psychology of Music*, *International Journal of Music Education*, *Music Education Research*, and *Revista Electrónica Complutense de Investigación en Educación Musical-RECIEM*.

As with the journals, the productivity of authors has an asymmetric distribution, with a small number publishing most on music education, as established by Lotka's law and confirmed by different studies on aspects of music (Marín-Suelves et al., 2022; Özenç-Ira & Gültekin, 2022). In the case of collaboration between authors, the mean number of co-authors is 2.41. This is very close to the figure of 2.61 established in earlier Spanish works (Morales et al., 2017), although it is somewhat lower than the mean number of co-authors of articles on musical psychology, which is 4.4 (Anglada-Tort & Sanfilippo, 2019). Three quarters of the articles involve collaboration between Spanish authors, and only one in ten, with foreign authors as well. The United Kingdom, the United States, Brazil, and Australia, which are the most productive countries in bibliometrics and the ones that carry out the most collaborations, are most notable (Verma et al., 2023).

The most important trends in research in music education up to 2022 in Spain relate to methodology, teacher training, technology, creativity, innovation, performance, emotions, music therapy, interculturality, and inclusive education, among others. A variety of authors have identified Spain as one of the most productive countries in some of these topics; for example, in music education and technology (Marín-Suelves et al., 2022) or in musical creativity (Özenç-Ira & Gültekin, 2022). Other trends such as music therapy, emotions, and teacher training or performance were also identified in earlier works (Anglada-Tort & Sanfilippo, 2019) and are still the subject of research in Spain at present.

On the other hand, it can be said that the musical research by the Spanish authors is directed at all educational stages, being more frequent in primary education and higher education, and less frequent in

secondary education and early-childhood education. Similarly, although the articles in this work cover a wide variety of topics in each educational level, we have identified some general lines that are investigated in each level.

The main limitation of this study is that the sample consisted of scientific production from two databases; therefore, Spanish research on music education that is not recorded in them was not included in the analysis. Furthermore, we should note that the information that the databases collect is not always complete or accurate, a limitation that we have reduced as much as possible through exhaustive revision and manual correction of the data. In addition to these, there are other limitations typical of bibliometric analyses. For example, as more recent articles have had less time to be cited, this measure is biased towards older publications (Zupic & Čater, 2015). Also, there are limitations deriving from the quantitative method, given that, while the present work studies the general structure of scientific production of music education through a descriptive analysis and analyses of correlation and regression, it does not analyse in depth each of the units of analysis studied (articles, authors, journals, and keywords). Finally, as possible lines of future research, it would be of interest to assess the study variables with other quality indexes, expand the sample with other databases, and complement the information with scientific production in books, contributions to music education conferences held in Spain or contributions by Spanish authors at conferences held in other countries.

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Authors' biographies

Gregorio Vicente-Nicolás. He has the qualifications of diploma in General Basic Education, conservatory teacher (percussion specialism), licentiate degree in Musicology, and doctorate in Pedagogy (European mention) from the Universidad de Murcia. He is currently associate professor in the Area of Didactics of Musical Expression at the Universidad de Murcia and teaches on undergraduate and postgraduate programmes in the Faculty of Education. His research interests centre on two interrelated lines: (1) music and movement and (2) music education. Both lines include various articles, book chapters, innovation and research projects, and supervising doctoral theses, as well as conference papers, and lectures at different universities in Spain and in countries such as Japan, Finland, and India.



<https://orcid.org/0000-0001-6882-6157>

Judith Sánchez-Marroquí. Early-childhood education teacher, licentiate degree in Educational Psychology (end of degree prize), professional degree in Music (guitar speciality), and doctorate from the Universidad de Murcia. Her main research interests are music in early-childhood education and music and didactic resources. She currently works at a public early-childhood education centre, where she is also a music teacher. She has published works

in journals specialising in music education such as *Music Education Research* and the *British Journal of Music Education*.



<https://orcid.org/0000-0002-9524-8986>