Mapping the scientific footprint: a bibliometric study of self-regulated learning in music education using network analysis

Andini Isti Syafitri [a,1,*], Sisca Rahmadonna [a,2], Pujiriyanto [a,3]

[a] Education Technology Department, Faculty of Education and Psychology, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia
[1] andiniisti.2023@student.uny.ac.id*; [2] rahmadonna@uny.ac.id; [3] Pujiriyanto@uny.ac.id
* corresponding author

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ABSTRACT

This study aims to analyze bibliometric trends and thematic relationships in studies on self-regulated learning and self-directed learning in music. Data collected from Scopus include 145 documents published between 2002 and 2024 and analyzed using Biblioshiny and VosViewer tools with the PRISMA approach. The results reveal six main thematic clusters that show a variety of research focuses. The first cluster highlights students' experiences and ease of use of learning technologies. The second cluster focuses on motivation, self-directed learning, and the integration of technologies such as artificial intelligence. The third cluster reviews the role of social robots in supporting self-directed learning. The fourth cluster discusses music teaching and education systems. The fifth cluster connects medical and psychological research with educational contexts, while the sixth cluster, the largest cluster, highlights humans as the main subject, focusing on music, psychology, and learning. This study contributes to understanding global trends, collaboration patterns, and main themes in the literature, as well as opening up opportunities for the development of self-directed learning strategies in music education.

1. Introduction

Self-regulated learning and self-directed learning have become important topics in education, especially in the context of music learning [1]–[5]. Both concepts emphasize the role of students in regulating and managing their learning process, which is very relevant in the digital era and technology-based learning. However, although the importance of self-regulated and self-directed learning has been recognized, the literature relating to music tends to be scattered and unsystematic [6], [7]. This makes it difficult for researchers and practitioners to understand trends, collaboration patterns, and key contributions in this field. Furthermore, most of the research on this topic is conducted separately without holistically mapping the relationships between studies. The lack of bibliometric network analysis results in a lack of insight into how ideas on this topic have developed over time, who the main actors in scientific collaboration are, and the main themes that are the focus. This gap is an obstacle to building a more comprehensive knowledge base. Several previous studies have discussed self-regulated learning in music education, focusing on how students manage their time, motivation, and learning strategies [8], [9]. For example, research conducted by Utermohl [10] described the self-regulated learning model as a theoretical framework for understanding how students can improve their self-regulated learning abilities in online lessons by encouraging students' motivation, self-efficacy, and self-regulation strategies to improve their practice and performance. In the context of music, Regier [11] examined the relationship between students' learning strategies and success rates in music training.

On the other hand, research on self-directed learning has also made significant contributions, especially in non-formal music learning. Explored the concept of self-directed learning and how it applies to students learning music without formal supervision [12]. This study emphasized the importance of intrinsic motivation and independence in music learning. Although these studies have made significant contributions, most previous studies are isolated and focus on a specific context or subject [13]–[15]. Few have attempted to integrate self-regulated and self-directed learning concepts into a comprehensive research framework, especially about music learning. In addition, the approaches used are mostly descriptive without considering the network relationships between studies. In addition, most previous studies only focus on local contexts or small samples, so they pay little attention to the dynamics of global collaboration. The lack of bibliometric studies makes it difficult to understand this topic's main actors, citation patterns, and international research trends. Among the existing studies, [16] work is considered superior because it successfully combines self-directed learning strategies with formal and informal music learning contexts. This study provides a framework that can be used to evaluate the effectiveness of learning strategies at various levels of musical skill [17]. However, this study has not combined collaboration analysis and bibliometric network dynamics to broadly support their findings. This study contributes by providing a comprehensive bibliometric analysis using Scopus data to understand trends, collaborations, and key themes in research on self-regulated learning and self-directed learning in the context of music. Through an approach based on PRISMA, Biblioshiny, and VosViewer, this study not only maps collaboration patterns between researchers but also identifies key themes of global concern. Thus, this study is expected to be a primary reference for academics and practitioners interested in developing self-regulated learning in music.

2. Method

2.1. Data

The bibliometric data covering 2002 to 2024 recorded 145 documents from 83 sources, with an annual growth rate of 15.76%. The average age of the documents is 5.52 years, with an average citation per document reaching 10.74. In terms of keywords, there are 282 "Keywords Plus" and 435 keywords provided by the authors. A total of 267 authors are involved in this document, of which 41 are single-document authors, resulting in 46 documents with one author. The average author collaboration per document is 2.29, and 13.79% of documents result from international collaboration. Based on document type, there are 99 articles, four books, 15 book chapters, 11 conference papers, six conference reviews, seven reviews, two notes, and one editorial.

2.2. Analysis

The data processing process begins with a search in Scopus using the following query ("self-regulated learning" or "self-directed learning" and music). This query is designed to identify documents relevant to “self-regulated learning” or “self-directed learning” related to music. After running this query, the feature is activated to ensure automatic updates if new relevant documents are published. From the results of this search, 145 documents were identified for further analysis. To process the data using Biblioshiny [18] and VosViewer [19], the steps follow the document filtering flow based on the PRISMA [20]. After identifying the documents, the bibliometric data is downloaded from Scopus in CSV or BibTeX format. This data is then imported into the Biblioshiny web application via RStudio for the initial analysis process. In Biblioshiny, data is filtered to ensure compliance with research criteria, such as keyword relevance, document source, or publication year. Next, in the Screening stage, all identified documents (n = 145) are checked to ensure completeness of metadata and compliance with the topic being analyzed. Based on the screening results, no documents are excluded (n = 0), so all documents are continued for further analysis. In Biblioshiny, publication trends, keyword distribution, and document interrelationships are analyzed. The screening results also group documents by type, such as journal articles, book chapters, or conference papers. The next stage is the document eligibility assessment, where data is analyzed using a bibliometric approach. With Biblioshiny, network analysis such as co-citation, co-authorship, and keyword analysis are performed to identify collaboration patterns between authors, relationships between documents, and key research themes. This data is then exported into a compatible format for further processing using VosViewer. The data is imported into VosViewer to build more complex network visualizations in the final stage. Analysis such as co-authorship is used to map collaborations between

authors and countries, while co-citation analysis reveals referential relationships between documents. In addition, VosViewer visualizes a keyword network map that helps identify key themes and research trends in the dataset. With the systematic PRISMA method, the entire analysis process is carried out transparently, from document searches in Scopus to data processing. The results of this analysis are presented in the form of publication growth graphs, international collaboration maps, and research theme networks, providing in-depth insights into research trends and patterns generated from the bibliometric data. Data collection flowchart using the PRISMA approach for the Scopus database can be seen in Fig.1.

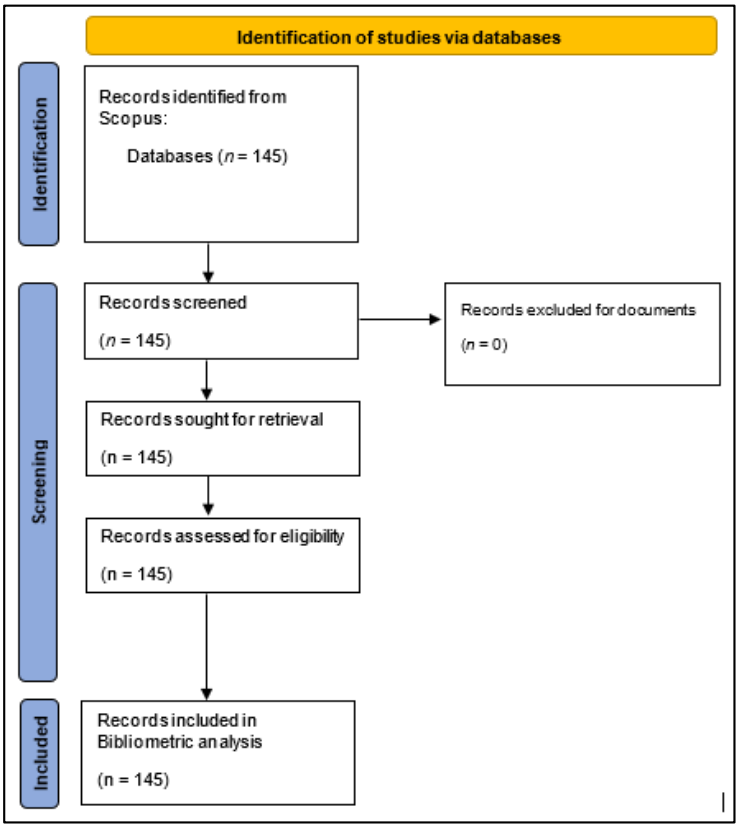

Fig. 1. Data collection flowchart using the PRISMA approach for the Scopus database

3. Results and Discussion

3.1. Self Regulated learning and music Most relevant sources

Fig. 2 shows that the main sources of articles on self-regulated learning and self-directed learning in music come from various leading international journals, and Fig. 3 shows the production for each top source over time. International Journal of Music Education dominates with a contribution of 13 articles. This shows that this journal is the main platform for research related to music education that focuses on self-directed learning. This significant contribution shows how this topic is a major concern in the global music education discourse. In second place, Frontiers In Psychology contributed 12 articles, reflecting the close relationship between the topic of self-directed learning and psychological aspects. This journal offers an interdisciplinary perspective, connecting music with the field of psychology to understand student behavior in the process of self-directed learning. Psychology Of Music, which produced nine articles, strengthens the relevance of the relationship between music and psychology, especially in the context of learning strategies used by students.

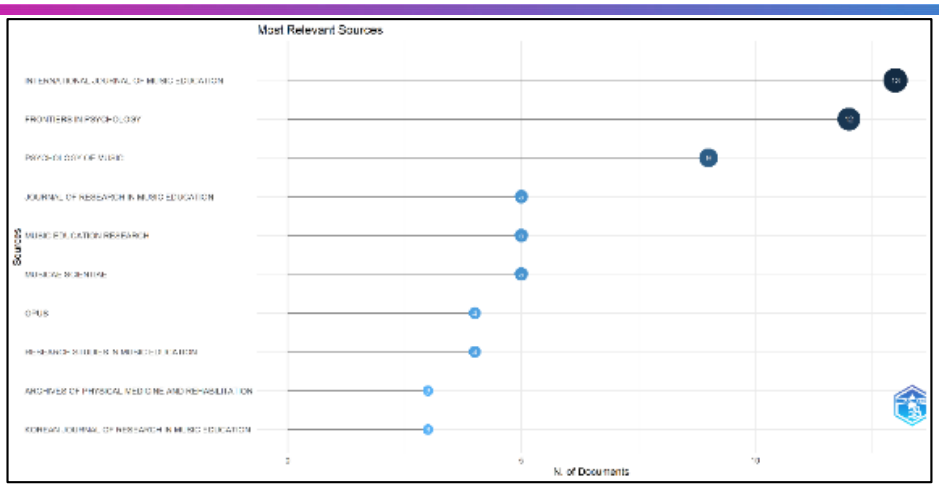

Fig. 2. Self-regulated learning and music edu are the most relevant sources.

Other journals, such as the Journal of Research In Music Education, Music Education Research, and Musicae Scientiae, each contributed five articles. These journals focus on music education-based research, providing in-depth insights into students' learning processes in both formal and informal contexts. Opus and Research Studies In Music Education, which contributed four articles each, were also important in this discourse, although with a more specific focus on music education studies. In addition, there were contributions from more diverse journals, such as Archives of Physical Medicine And Rehabilitation, with three articles showing how physical rehabilitation relates to music learning. Korean Journal of Research In Music Education also contributed three articles, reflecting the interest in this topic in the East Asian regional context, particularly in Korea. Overall, the distribution of these articles reflects a broad spectrum of research interests, ranging from education to psychology and health, all of which are relevant to understanding the dynamics of self-regulated learning in music.

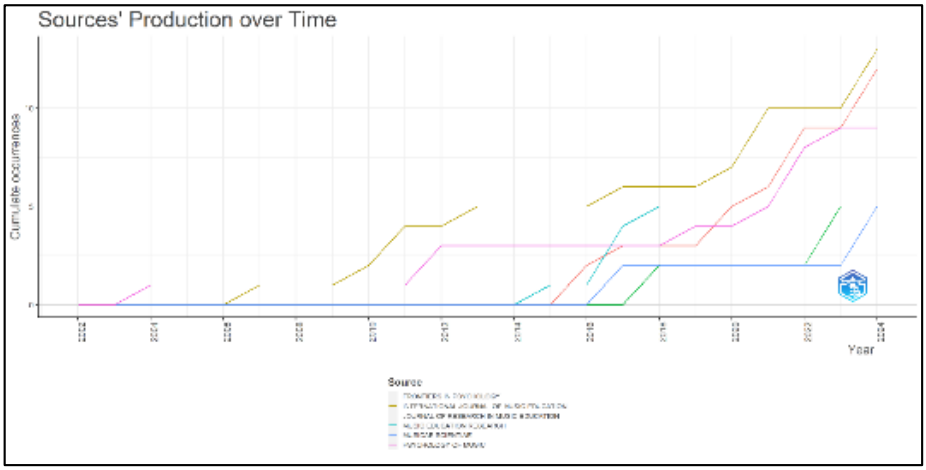

Fig. 3. Source production over time

3.2. Most Relevant Authors' Affiliation

Fig. 4 shows that Monash University came in at the top with 11 contributions. The university consistently demonstrates excellence in interdisciplinary research linking music, self-directed learning, and education. This significant number of contributions reflects Monash University's active role in advancing research in music education. Eindhoven University of Technology followed with nine articles. Although the university is known for its engineering and technology, its contributions to music research demonstrate an innovative approach to integrating technology with self-directed learning in a music context. Royal College Of Music contributed seven articles, confirming its role as a leading music institution actively involved in music education research. In addition, the Rehabilitation Institute of Chicago and the University of Medicine And Dentistry of New Jersey contributed 6 and 5 articles, respectively, demonstrating how self-directed learning in music is also applied in rehabilitation and medical fields.

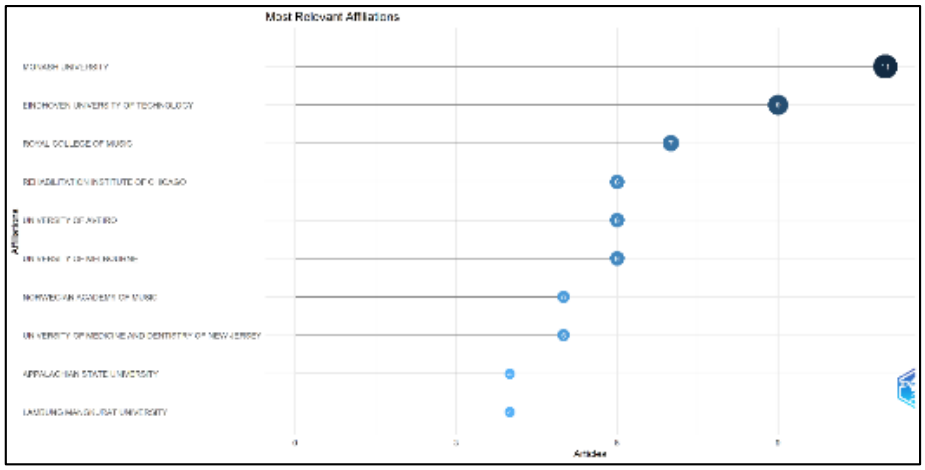

Fig. 4. Most relevant authors' Affiliations

Other institutions, such as the University of Aveiro in Portugal and the University Of Melbourne in Australia, each contributed six articles, reflecting the geographical diversity of the research. With five articles, the Norwegian Academy of Music demonstrates the Northern European focus on music education and self-directed learning. From an Asian perspective, Lambung Mangkurat University in Indonesia contributed four articles. This demonstrates the active participation of regional institutions in the global discourse on self-directed learning in music, enriching the international literature with local perspectives. This distribution reflects the diversity of institutions from different countries that contribute to research on self-regulated and self-directed learning in music. Institutions focused on music education, technology, and health play a key role in developing knowledge in this area, while the participation of institutions from different regions provides a global dimension to the research literature.

3.3. Most Frequent World

The data on the most frequently occurring keywords in this study show a clear focus on music as the primary context (Fig. 5). The word "music" appears 12 times, confirming that the topic of this study is rooted in music education and how self-directed learning is applied in this field. This aligns with the study's purpose to explore the dynamics of self-regulated learning and self-directed learning in a context that is highly culturally and practically relevant. In addition, the words "human" and "humans," which collectively appear 18 times, indicate that the main subject of this study is humans, both in psychological and social contexts. This focus shows attention to how individuals interact with music and the process of self-directed learning. It is important to understand the dynamics of learning in music, which involves cognitive, emotional, and social aspects.

Fig. 5. Most frequent document

In terms of the main concept of learning, "self-directed learning" appears 11 times, confirming its relevance as a central concept in this study. On the other hand, "self-regulated learning," although only appearing 5 times, remains an important part of the research framework, especially when discussing learning strategies involving students' internal control over their learning process. These two terms reflect different but complementary approaches to self-directed learning in music. The

methodological and media aspects of learning are also represented by the words "teaching" and "e-learning," appearing 7 and 6 times, respectively. "Teaching" highlights the importance of teaching as a context or supporting element in self-directed learning, while "e-learning" shows the role of technology in supporting self-directed music learning, especially in the era of digitalization of education. Demographic factors are also of interest, with the words "female" and "male" appearing 5 times each. This suggests an attempt to understand how gender factors may influence self-directed learning in music. This research may consider gender dynamics in motivation, learning strategies, or learning outcomes. Finally, the word "motivation" appears 5 times, emphasizing the importance of motivation in supporting the self-directed learning process. Motivation is often considered a key element that drives individuals to take control of their learning, both in formal and informal contexts. Overall, this keyword frequency analysis provides rich insights into the focus of the research and the main themes of concern in this literature.

3.4. Co-Occurrence Network

Fig. 6 presented groups of the various nodes into several clusters, each of which reflects thematic relationships or common focuses in the research. Cluster 1 contains nodes such as students and ease-of-use; this cluster appears to focus on student experience and ease of use of technology or methods in the learning process. This shows attention to how students interact with learning tools or strategies, especially in relation to convenience and accessibility. Nodes in Cluster 2, such as self-directed learning, e-learning, motivation, education, learning motivation, and artificial intelligence, reflect the themes of self-directed learning and educational technology. This cluster also highlights aspects of motivation and learning effectiveness, including how technologies such as artificial intelligence (AI) and the fuzzy Delphi method are used to support learning. Cluster 3 contains self-regulated learning, social robots, and learning experiences, which focus on self-regulated learning and the role of technologies such as social robots in creating learning experiences. This indicates a focus on technological innovations in supporting self-regulated learning. Nodes in Cluster 4, such as teaching, learning systems, and music education, indicate a focus on teaching systems, music education, and strategies used to enhance learning in formal educational contexts. Cluster 5 contains such reviews on occupational diseases and psychodynamics, and this cluster appears to focus more on medical or psychological research that may have relevance to education or learning but within a health or psychodynamic context.

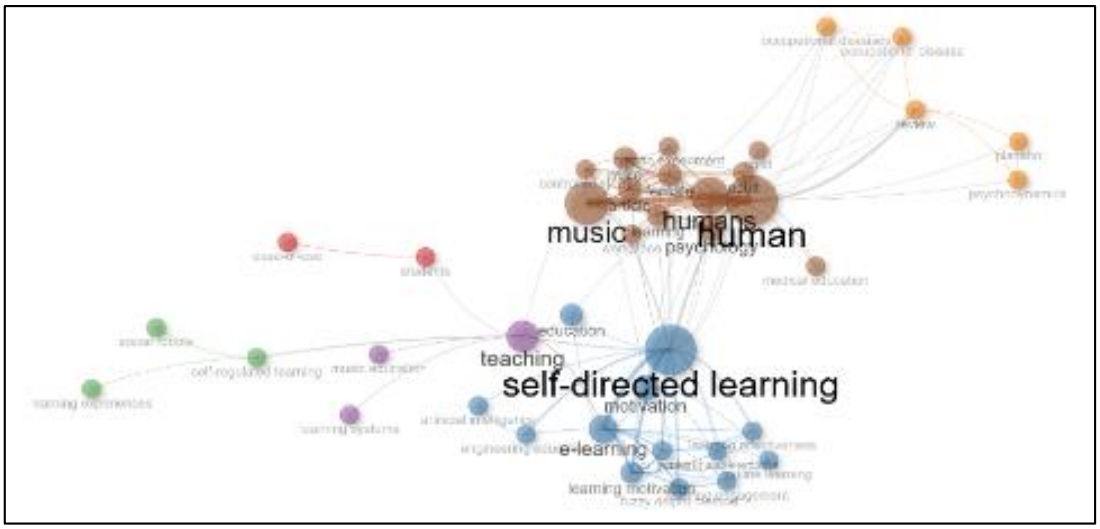

Fig. 6. Co-occurrence network

Cluster 6 is the largest cluster that includes music, humans, learning, psychology, and controlled study nodes. The focus is on humans as research subjects, including aspects of music, psychology, learning, and controlled studies in various contexts, such as music education and human experiments. The clustering shows the broad range of themes in the research, including self-regulated learning, the role of technology, music education, and medical and psychological relevance. The data provide insight into how the various aspects of the research are interrelated, from pedagogical perspectives to technological and social interventions. Each cluster highlights a particular dimension of the relevant literature, enhancing understanding of the complexity of this research field.

4. Conclusion

The results of the bibliometric analysis show that research on self-regulated learning and self-directed learning in music has a broad thematic scope organized into six main clusters. The first and second clusters emphasize the importance of student experience, motivation, and the role of technology in learning, including the use of artificial intelligence. The third cluster emphasizes technological innovations, such as social robots, that help create learning experiences that support self-directed learning. The fourth cluster focuses on teaching systems and strategies in music education, providing insights into the context of formal education. The fifth cluster reflects the relationship between medical and psychological research and the learning process. The sixth cluster, the largest, expands the understanding of humans as the main subject, covering music, psychology, and human experiments. This study provides a comprehensive overview of global collaboration and research patterns on this topic. With an interdisciplinary approach that combines technology, pedagogy, and psychosocial approaches, the results of this study are expected to be the main reference for the development of innovative self-directed learning in music education.

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