

Strengthening eye-hand coordination in infants aged 3 to 5 years: A Bibliometric Analysis in Scopus Using PRISMA

Nayeli Adriana Peñafiel González ^{a, 1,} , Pamela Lissbeth Rivera González ^{a, 2,} ,

José Marcelo Urgilés Becerra ^{a, 3,} 

^a Universidad Nacional de Educación, Ecuador

¹ napenafiel@unae.edu.ec; ² plrivera@unae.edu.ec; ³ jmurgiles3@unae.edu.ec

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ABSTRACT

Eye-hand coordination is an essential skill in early childhood that enables holistic development and contributes to the strengthening of motor skills during learning from the earliest years of life. Consequently, the aim of this study was to conduct a bibliometric study to produce a systematic review of eye-hand coordination in children aged 3 to 5 years through educational activities and strategies in a school setting. The study was conducted using a quantitative, descriptive, analytical and non-experimental approach. Data collection was carried out through a bibliometric analysis of peer-reviewed academic publications in the Scopus Elsevier database, applying the PRISMA methodology and the search formula TITLE-ABS-KEY (hand-eye AND coordination AND education). The results were organised and tabulated using descriptive statistics, according to parameters such as country of origin, year of publication, document type and subject area. The results were organised and tabulated using descriptive statistics, according to parameters such as country of origin, year of publication, document type and subject area. The findings show a gradual increase in scientific publications between 2021 and June 2026, with a notable rise in 2025. Research output is concentrated mainly in the United States and China, whilst Ecuador's contribution is limited. The articles focus on medicine and the social sciences, demonstrating that the topic is addressed from various disciplinary perspectives. It is concluded that eye-hand coordination is a growing field and that Latin America needs to strengthen its scientific contribution in order to design fundamental educational strategies and thereby support educational policies in early childhood.

Keywords: bibliometric analysis; early childhood; hand-eye coordination; initial education; PRISMA; Scopus; systematic review.



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Corresponding Author:

Nayeli Adriana Peñafiel González, Universidad Nacional de Educación

napenafiel@unae.edu.ec

INTRODUCTION

During childhood development, hand-eye coordination is regarded as an essential skill, as it contributes to the child's holistic development in areas such as visual perception and hand movements. This skill enables learning to take place through activities such as precision tasks or the manipulation of objects, guided movements, and coordination in shape-sorting activities,

amongst others. It also helps to develop essential skills in early childhood education and promotes active student participation in early childhood [1].

Various international studies, through their analyses, conclude and affirm that adequate development of this complex cognitive coordination skill will influence a child's academic performance, as it is a capacity that involves a certain level of complexity, encompassing processes such as writing, drawing or carrying out detailed tasks that require a precise level of accuracy [2]. However, when this skill is not developed adequately, it can lead to suboptimal results in task execution, which in turn affects the child's performance in an educational context

Furthermore, encouraging play and physical activity from an early age not only improves visual-motor coordination, but also gives children greater independence, dexterity and confidence. By engaging in these activities, these experiences encourage pupils to participate more actively, helping them to integrate better into the classroom, which in turn facilitates constructive and participatory learning [3].

Conversely, unlike in countries such as Peru and Colombia from an international perspective, in Latin America the lack of local studies on eye-hand coordination limits access to up-to-date data; consequently, this restricts pedagogical innovation. This information gap is not merely an academic problem, as in practice it prevents teachers from applying methods based on real evidence. It is therefore essential to encourage new lines of research that strengthen early years education and thus optimise children's learning in our schools [4].

However, there is little research carried out in Latin American countries that highlights obstacles to the development of eye-hand coordination. A significant proportion of these obstacles are linked to the limited use of appropriate activities in educational settings. Consequently, difficulties and limitations are encountered in the progression towards effective development in young children [5].

Similarly, the lack of teacher training in educational settings is considered a limiting factor, as is the scarcity of necessary resources. This significantly reduces the implementation of effective methods that strengthen eye-hand coordination, thereby hindering an understanding of the fundamental educational needs of early childhood [6]. In the Ecuadorian context, research findings on eye-hand coordination are limited. This limits our understanding of the issue and the design of appropriate educational approaches that can develop skills in young children; in other words, the scarcity of research findings hinders a strategic design process aimed at enhancing and improving learning [7].

In specific contexts, such as the province of Cañar, the findings regarding eye-hand coordination in early childhood are not particularly favourable. These findings are reflected in difficulties with skills such as drawing lines, using a pincer grip and manipulating objects, amongst other aspects. When young children are unable to perform coordination tasks, this hinders the development of the basic skills necessary for comprehensive and effective development [8].

In this regard, several young children have difficulties with tasks such as holding a pencil, cutting out shapes or tracing lines in the classroom. These activities require coordination and proper motor control; therefore, any shortcomings in these areas have a negative impact on their learning. Furthermore, this limits their active participation in schoolwork and the development of age-appropriate skills [9].

This problem is exacerbated by the lack of appropriate methods and the scarcity of teaching resources in educational establishments. This limits opportunities for experimentation and hinders the gradual development of these essential skills. Ultimately, this lack of teaching strategies not only impedes learning but also widens equity gaps, preventing educational institutions from fulfilling their role as drivers of holistic development [10].

If this situation persists, children will eventually experience learning difficulties. These restrictions may affect their ability to carry out activities such as writing and other basic tasks. They also have an impact on motivation, participation and performance within the school. Furthermore, as children feel frustrated at being unable to meet the requirements, their self-esteem may be undermined, leading to a loss of interest in the school environment [11]

Finally, the lack of local scientific studies hinders the implementation of evidence-based educational methodologies. Without a solid research foundation, it is inevitable that solutions tailored to the context will be proposed, which not only slows down progress towards better educational quality but also leaves children's needs unmet [12]. In line with the above, the following research question is posed:

What is the bibliometric framework for conducting a systematic review of eye-hand coordination in children aged 3 to 5 years through educational activities and strategies in a school setting?

Overall objective

To conduct a bibliometric study to produce a systematic review of eye-hand coordination in children aged 3 to 5 years through educational activities and strategies in a school setting.

METHODS

Research approach

This study was conducted using a quantitative approach, as this enabled the collection, distribution and analysis of statistical data relating to scientific output on eye-hand coordination in an educational context. This approach made it possible to examine various bibliometric indicators, such as authors' publication frequency, keywords, years of publication, predominant themes and links to scientific studies indexed in the Scopus database. Furthermore, it contributed to an objective and systematic analysis of the data, enabling the identification of patterns and trends within the subject area under study.

The quantitative approach emphasises the application of procedures that analyse data using statistical techniques and systematic methods, thereby achieving measurable, objective and reliable results in the research process [13]. In projects focusing on eye-hand coordination, specifically on motor skills in educational contexts, it was found that a variety of authors employed qualitative methodologies to evaluate the results obtained and to establish the links between the different study variables [14].

The implementation of this approach was relevant and appropriate, as this bibliometric analysis involved collecting data and quantifying scientific information from indexed articles. This made it easier to identify research trends, levels of academic output and the main elements of the literature relating to eye-hand coordination in early childhood education.

Type of research

The study was conducted using a descriptive, analytical and non-experimental design, drawing on basic statistics. Its descriptive nature enabled the identification and detailed analysis of the scientific literature on hand-eye coordination in the context of early years education, including variables such as authors, years of publication, countries of origin, subject areas and keywords. Similarly, the research adopted an analytical approach, as this allowed for the examination and interpretation of the relationships between the various bibliometric data collected, identifying trends, patterns and behaviours within the different scientific publications that had been gathered and previously analysed. Furthermore, the research was non-experimental in nature, as it relied solely on previously published and indexed studies from the

Scopus database; there were no direct interventions on the subjects of study nor any manipulation of variables.

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In turn, the study employed basic statistical methods to organise, classify and systematise the data collected during the bibliometric analysis, facilitating the presentation of the findings in terms of percentages and frequencies, and the systematisation of the scientific information obtained. This also enabled a clearer and more objective interpretation of the results found [15].

Source of information

The study utilised primary and secondary data sources. The primary sources consisted of scientific articles retrieved directly from the Scopus database, which provided original information relating to eye-hand coordination and its connection to education. These sources enabled access to up-to-date records that had been validated through academic indexing processes.

Furthermore, secondary sources comprised documents, theoretical background material and reviews. These elements made it possible to refine the analysis of the bibliometric findings and situate the subject of study within its corresponding conceptual framework. The collection and selection of research studies were carried out using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) method, which enabled a structured process to be followed for the records through the identification, search, screening, eligibility assessment and selection of scientific documents.

In the study of motor skills, coordination and educational development, the use of rigorous methods for data collection and selection enables a vast amount of information to be transformed into a coherent and structured framework of knowledge. This systematic approach is essential for enhancing the reliability and planning of the scientific records analysed [16].

Furthermore, the research involves a bibliometric review based on the analysis and collection of scientific publications recorded in the Scopus database. A structured search strategy was implemented in Scopus, based on Boolean operators and defined parameters. The formula used was: TITLE-ABS-KEY (hand-eye AND coordination AND education). Scientific articles addressing eye-hand coordination and its link to the educational context were therefore selected, taking into account the titles, abstracts and keywords of each publication. This process ensured a thorough and accurate review of the available literature, minimising the risk of excluding theoretical and empirical contributions relevant to the study [17].

Techniques and tools

The methodological approach was based on documentary and bibliometric analysis, appropriate tools and a detailed examination of the scientific output indexed in Scopus. This methodology led to a review of relevant bibliometric indicators: publication volume, publication frequency, authorship, disciplines involved, keywords and current lines of research.

Thus, the documentary audit served as a fundamental pillar of the bibliometric research, enabling the systematic organisation of the data for subsequent discussion. This type of processing and quantitative assessment of scientific output has been recognised by previous studies in the field of motor skills and educational processes as a robust means of substantiating their evidence [18].

To collect the information, a data extraction and cataloguing form was used, specifically designed to summarise the corpus of selected texts [19]. This tool streamlined the indexing of key indicators such as authorship, year of publication, country of origin, indexed journal, keywords, methodological approach, core theme and relevant conclusions of each document analysed. In addition, digital resources for data processing and analysis were incorporated, which improved the conversion of bibliometric data into statistical representations and enabled the analytical interpretation of the empirical findings collected.

Analytical techniques

The data collected were analysed using quantitative descriptive techniques, which enabled the information from the various articles selected on the Scopus platform to be organised. This analytical process allowed the information to be systematised, making it possible to identify aspects such as the authors of the texts, keywords, countries of origin, publication frequencies and lines of research relating to eye-hand coordination in early childhood education.

Similarly, the analysis made it possible to identify existing patterns and trends in scientific output relating to the research topic, thereby providing a deeper and more objective understanding of the information gathered through bibliometric analysis and the PRISMA method. This analytical procedure enabled the identification of trends and research needs within the specific scientific field [20].

RESULTS AND DISCUSSION

Results

The following section presents the findings obtained through the bibliometric analysis carried out in the Elsevier Scopus database, focusing on the variable of eye-hand coordination over the period from 2021 to June 2026. This descriptive study identified the chronological progression of publications, the countries with the highest academic output, the relevant document types and the main fields of knowledge involved in the development of this line of research.

With regard to the output of scientific research by country relating to eye-hand coordination, the results show that the United States led the way with approximately 18 published papers, establishing itself as one of the countries making the greatest contribution in the area analysed. Meanwhile, China produced around 16 published papers, maintaining a significant contribution to international research.

At an intermediate level, the results show that Germany and Turkey each contributed around 9 papers. Further behind, France and Indonesia recorded around 7 publications, followed by India with around 6 papers, whilst Italy, Japan and the Netherlands similarly recorded a total of 5 papers.

Conversely, Ecuador was the country with the lowest level of scientific output, recording just one paper. This distribution shows that scientific output is largely concentrated in countries with a more established scientific and technological base, with Latin American countries making a smaller contribution.

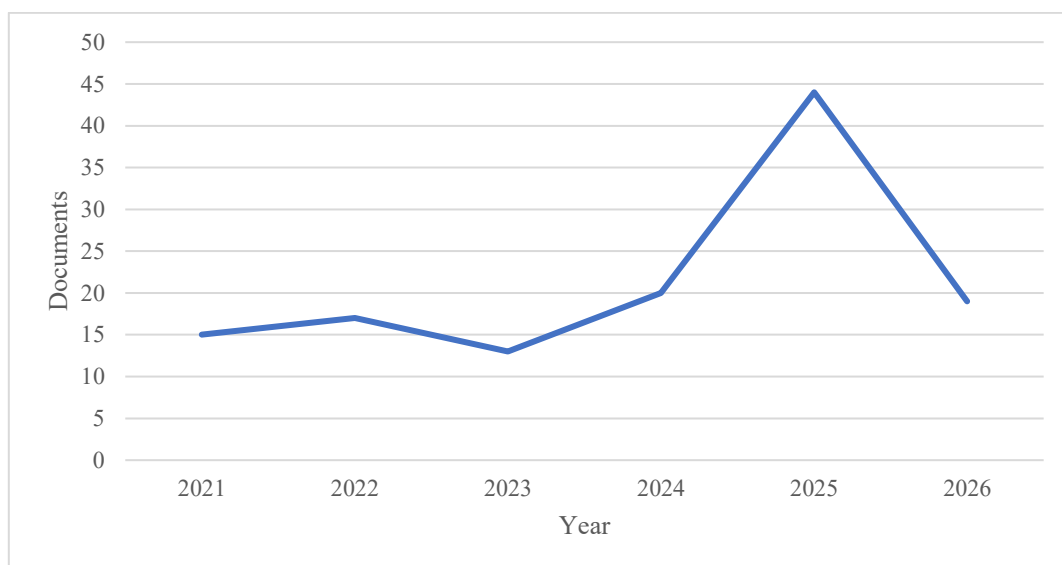


Figure 1. Documents by year retrieved from the Elsevier Scopus database from 2021 to June 2026.

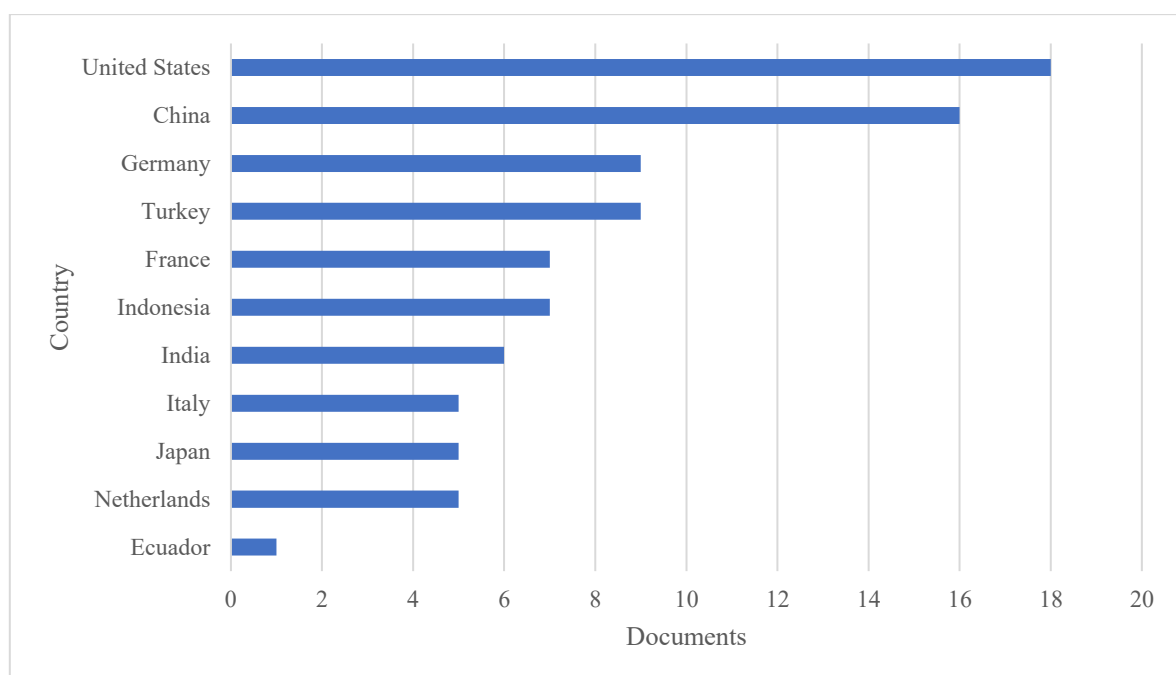


Figure 2. Documents published in the Elsevier Scopus database by country from 2022 to June 2026

The findings revealed that the highest number of publications was recorded in 2025, with around 44 documents, establishing this period as the one with the highest volume of indexed publications on hand-eye coordination. This positive trend marked a notable development compared with previous cycles.

Between 2021 and 2024, there was a moderate increase in the volume of publications, with growth ranging from approximately 15 papers in 2021 to 20 publications in 2024. However, 2023 saw a slight decline, with around 13 scientific papers published.

For the 2026 cycle, and taking into account only the information indexed up to June, around 19 scientific papers were recorded, a figure that already approached the total output for

2024. Overall, the bibliometric indicators showed an upward trend in scientific output on eye-hand coordination within the Scopus database throughout the period analysed, marking a definitive methodological strengthening since 2024.

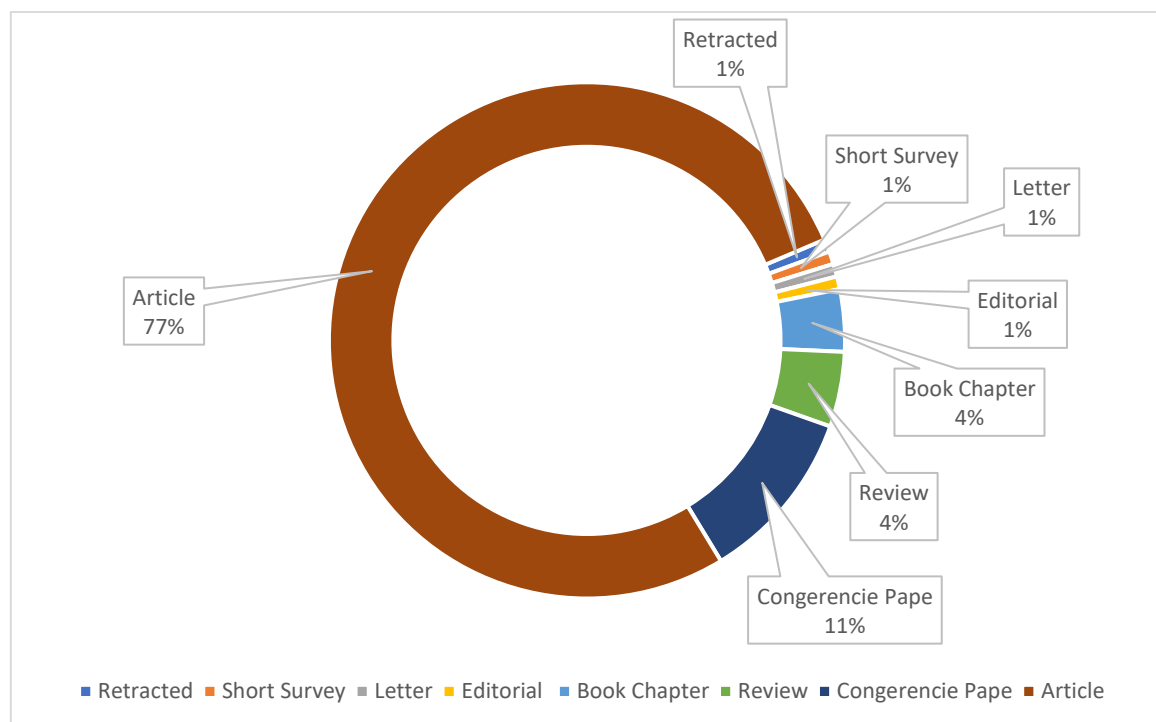


Figure 3. Types of documents on eye-hand coordination published in the Elsevier Scopus database from 2021 to June 2026.

An analysis of the types of documents revealed a clear predominance of scientific articles, which account for 77 per cent of total output. Consequently, this result showed that the main channel for disseminating knowledge relating to eye-hand coordination is the publication of articles in specialist scientific journals. In addition, conference papers and proceedings were found to account for 11% of the publications, indicating significant participation in academic forums for the dissemination of findings and the presentation of preliminary research results. Book chapters and literature reviews each account for just 4 per cent, whilst editorials, short surveys, letters and retracted papers barely reach 1 per cent. In summary, the bulk of output is concentrated mainly on original research published in indexed journals, leaving other formats with a minimal share.

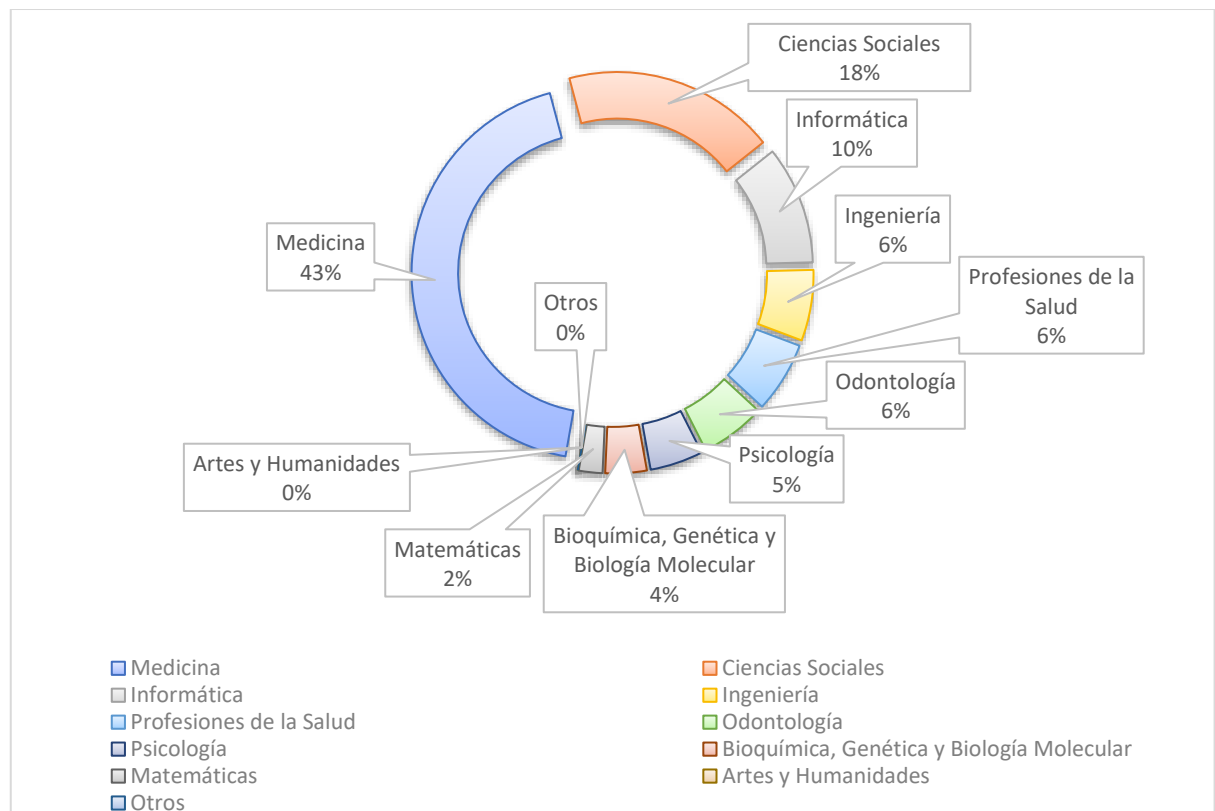


Figure 4. Subject areas and scope of studies published in the Elsevier Scopus database from 2021 to June 2026

Analysis of the distribution by subject area revealed that medicine was the field with the highest volume of scientific output on eye-hand coordination, accounting for 43 per cent of the results analysed. This finding suggests that research on this topic has been conducted primarily from clinical, rehabilitation and diagnostic perspectives.

Secondly, the social sciences accounted for 18 per cent of the publications, reflecting an interest in studying eye-hand coordination in fields related to education, behaviour and human development. Furthermore, computer science accounted for 10 per cent of the papers analysed, standing out for its contributions relating to the development of technologies, measurement systems and tools applied to this field.

Similarly, the fields of Engineering, Health Professions and Dentistry each accounted for 6 per cent. Psychology contributed 5 per cent of scientific output, whilst Biochemistry, Genetics and Molecular Biology accounted for 4 per cent. Finally, Mathematics accounted for 2 per cent of the research included in the analysis.

Discussion

The findings revealed a growing trend in scientific output on eye-hand coordination between 2021 and 2026, with a peak in publications recorded in 2025. This trend reflected a growing academic interest in the analysis of fine motor skills and their relationship to child development. Furthermore, the identified increase demonstrated a greater focus on developing strategies aimed at strengthening holistic development from the earliest stages of life [21].

The chronological study, carried out by time period, showed that the number of research studies increased significantly during 2024. These results indicated that eye-hand coordination

continues to hold an important position as a key topic within the field of education. Similarly, this growth could be linked to the need for early-life interventions and the recognition of these as an essential element for effective subsequent learning [22].

Although there was a slight decline in scientific output during 2023, the overall analysis of the period under review showed a positive trend. This finding suggests that research into motor skills in early childhood remains relevant within the scientific community. Consequently, the observed decline could be interpreted as a temporary fluctuation inherent to the pace of research rather than a loss of academic interest [23].

When examining scientific output by country, the United States stood out, accounting for a predominant proportion of publications recorded during the period analysed. This finding highlighted that factors such as research funding, technological advancement and institutional capacity have a direct impact on the production of scientific knowledge. Furthermore, this leadership can be linked to the continuity of lines of research focused on child development and motor skills in early childhood [24].

The country with the second-highest scientific output during the period analysed is China. This led to the identification of consistent involvement in studies relating to visomotor skills and children's performance. Furthermore, a positive impact was observed from current scientific policies and the priority given to the inclusion of teaching tools and educational models in the development of new research [3].

On the other hand, Ecuador's scientific productivity was found to be lower than that of the group of countries analysed. This finding highlights the limited number of studies on eye-hand coordination in Latin America. For this reason, a need was identified to consolidate regional research programmes and promote scientific evidence tailored to the local educational context [5], [25].

The marked asymmetry in scientific output on this subject led to the observation that knowledge tends to be concentrated in contexts with greater academic progress. This trend demonstrates that factors such as economic capital, technological infrastructure and international co-authorship networks continue to influence the potential for scientific publications at a regional level. Consequently, the importance of consolidating mechanisms for synergy between territories was acknowledged [26].

With regard to the analysis of the documents, it was found that 77 per cent of the total indexed output consists of scientific articles. This finding suggests that scientific journals remain the predominant medium for knowledge transfer and the main mechanism for verification through peer review. Furthermore, this predominance highlighted a gradual strengthening of the research topics covered [27].

Furthermore, conference papers and proceedings rank second amongst the scientific output examined. This trend highlights the importance of these forums for the dissemination of preliminary findings, the discussion of methodological proposals and the development of future lines of research. Similarly, such events foster synergy among researchers and contribute to the scientific advancement of the discipline [28].

On the other hand, literature reviews and book chapters account for a smaller proportion of original articles. These findings lead us to conclude that research into eye-hand coordination continues to focus primarily on applied research and experimental data. Therefore, generating knowledge through direct research is a top priority [29].

By subject area, the largest proportion of published works focuses on medicine. This finding helps to explain why most of the existing knowledge still relates to visomotor coordination in clinical, diagnostic and therapeutic contexts. Furthermore, this trend reflects the understanding of visomotor skills in children's development and general health [30], [31].

Second place in the thematic distribution was taken by the social sciences. These results allow us to observe a growing interest in understanding the role of educational and psychomotor experiences in improving hand-eye coordination. Similarly, the importance of including these skills in teaching processes aimed at children's learning has been emphasised [32].

Computer science also makes a significant contribution to the range of research analysed. These findings demonstrate the gradual introduction of technological tools to improve the assessment of and intervention in children's visomotor development. Consequently, a trend towards interdisciplinary approaches that integrate education and technology has been identified [33].

Finally, the involvement of experts from fields such as psychology, engineering and public health has enabled us to recognise the interdisciplinary nature of eye-hand coordination. The combination of bibliometric results, scientific evidence and research interpretation has identified this topic as an emerging field of research. Consequently, there is a clear need to increase scientific output in Latin America and to conduct context-specific research for primary education [34].

CONCLUSION

This scientific bibliometric analysis enabled a systematic review of scientific studies focusing on eye-hand coordination in children aged 3 to 5 within an educational setting. The results showed a sustained increase in the number of published research papers between 2021 and June 2026, with the highest volume recorded in 2025. These findings highlight a growing scientific interest in this area and emphasise that the coordination between visual perception and motor activity remains a relevant topic with a significant impact on early years education.

The scientific bibliometric analysis enabled a systematic review of research studies focusing on eye-hand coordination in children aged 3 to 5 within an educational setting. The results showed a sustained increase in the number of research papers published between 2021 and June 2026, with the highest volume recorded in 2025. These results highlight an ever-increasing level of scientific interest and emphasise that the coordination between visual perception and motor activity remains a relevant topic with a significant impact on early years education.

Furthermore, the data obtained revealed that the countries with the highest number of academic publications are the United States and China, in contrast to Ecuador and other Latin American countries, where scientific output is limited. Furthermore, it was found that scientific articles are the main channel for disseminating knowledge, and that the fields of Medicine and Social Sciences account for the highest number of studies. This reflects the multidisciplinary nature of the subject and the lack of support for studies that integrate the educational sphere more rigorously.

In summary, bibliometric analyses revealed trends and gaps in research on eye-hand coordination in early childhood. This highlights the need to promote studies in Latin America, particularly in Ecuador, to generate scientific evidence that can guide the design of educational

strategies tailored to the needs of children aged 3 to 5. This will help to strengthen teaching practices and promote the holistic development of children.

CONFLICT OF INTEREST

The conflict-of-interest statement must clearly disclose any financial, personal, or professional relationships that could influence, or appear to influence, the research, analysis, or conclusions presented in the article. If no conflicts of interest exist, the authors must explicitly state: "The authors declare no conflict of interest." This section ensures transparency and helps maintain the integrity of the research.

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AUTHORS

Nayeli Adriana Peñafiel González is affiliated with Universidad Nacional de Educación, Ecuador. Her academic work includes research on early childhood development, infant motor skills, and evidence-based educational studies. In this bibliometric analysis, she contributes to examining research trends related to strengthening eye-hand coordination in infants aged three to five years using Scopus data and the PRISMA framework. She can be contacted at napenafiel@unae.edu.ec for academic correspondence, research discussion, and collaboration.

Pamela Lissbeth Rivera González is affiliated with Universidad Nacional de Educación, Ecuador. Her academic interests include early childhood education, infant development, motor coordination, and bibliometric research. In this study, she contributes to analyzing scientific literature on strengthening eye-hand coordination in infants aged three to five years through Scopus and the PRISMA framework. She can be contacted at plrivera@unae.edu.ec for academic correspondence, scholarly discussion, research networking, and potential collaboration in education and child development.

José Marcelo Urgilés Becerra is affiliated with Universidad Nacional de Educación, Ecuador. His academic work relates to early childhood education, infant development, motor coordination, and research synthesis. In this bibliometric study, he contributes to examining publication trends and research evidence concerning eye-hand coordination in infants aged three to five years using Scopus and PRISMA. He can be contacted at jmurgiles3@unae.edu.ec for academic correspondence, research discussion, and future scholarly collaboration activities.