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Original Article

Improvement of physical education of students at the university: bibliometric analysis of the literature

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Received: 14 January 2025; **Revised:** 26 March 2025; **Accepted:** 28 March 2025

ABSTRACT

The study aims to conduct a bibliometric analysis of the literature on enhancing physical education for students in higher education. Metadata were extracted from 5,349 scientific articles indexed in the Web of Science database for the period 1975-2025. The study employs bibliometric procedures to describe and visually represent the existing literature of this field over the past 50 years. Results indicate that research in this area: (a) demonstrates sustained growth in recent decades, particularly since 2008; (b) is published across a broad spectrum of journals in the categories of "Education and Educational Research," "Sport Sciences," and "Hospitality, Leisure, Sport and Tourism"; (c) is conducted by scholars from various geographical regions, with the USA, England, and Australia being the leading participating countries; (d) relies on a fragmented research community consisting of several academic groups with minimal interaction amongst them; (e) is interdisciplinary in nature and results from the convergence of research conducted in pedagogy, psychology, physiology, and sports medicine; (f) over the past 50 years has focused on seven research themes: pedagogical approaches and curriculum development in physical education; teacher training and professional development of specialists; motivation and psychological factors in student engagement; inclusive and equitable physical education practices; health assessment and sports applications; and sociocultural dimensions, including gender aspects and embodiment. The results of the bibliometric analysis will contribute to the further development and reconceptualisation of the research subject, opening prospects for identifying new directions and methodological approaches in studying the pedagogical conditions for enhancing students' physical education.

Keywords: Physical education of students, Physical culture in university, Physical culture in higher education, Pedagogical conditions of physical education, Physical education

Introduction

Improving physical education for higher education students represents one of the most pressing issues in modern pedagogical science. Research conducted by Graham (1995), Silverman (1999), Rikard (2006), and Qi (2012) demonstrates the growing recognition of this challenge within the academic community. In conditions of increasing technology use and informatisation of society, studies by Fountaine (2011) and Griban (2020) reveal a critical decline in the level of physical activity among young people, which negatively affects the general health status of students and the quality of their professional training. Statistical data compiled by Maher (2013) show a steady increase in the number of students with various health deviations, chronic diseases, and low levels of physical fitness. Longitudinal research conducted by Twenge (2018), Nagata (2020), and Wong (2021) indicates that more than 60% of modern students have health problems, a significant portion of which are acquired directly

Access this article online	
Website: www.japer.in	**E-ISSN:** 2249-3379

How to cite this article: Maratuly TN, Aychurok K, Nurlan B, Darkhan M, Meirkhanovna BA. Improvement of physical education of students at the university: bibliometric analysis of the literature. J Adv Pharm Educ Res. 2025;15(2):138-50. https://doi.org/10.51847/rx9LeEPsDv

during the period of university study, highlighting insufficient effectiveness of the existing physical education system [1-11].

The transformation of value orientations among modern youth exacerbates this problem and requires finding new motivational mechanisms to attract students to physical education activities. Traditional methods of physical education often do not take into account the interests and preferences of modern students, reducing their effectiveness and requiring the development of innovative approaches. Research by Jastrow (2022) emphasises the need for approaches based on personalisation and individualisation of the educational process [12, 13].

The digitalisation of education and implementation of distance learning formats present additional challenges for the physical education system in universities, as documented by Barkley (2021). Studies conducted by Nishiyama (2021) reveal how the COVID-19 pandemic has exacerbated the problem of organising physical education in conditions of limited opportunities for traditional forms of in-person work. Educational institutions are forced to seek new methods and technologies for physical education adapted to modern realities, requiring serious scientific substantiation and experimental verification, according to findings by Lesser (2020) [14-18].

Simultaneously, the modern labor market places increased demands on the physical condition of university graduates. Professional activities in most fields require specialists to have high work capacity, stress resistance, concentration, and other qualities, the formation of which is directly related to physical development, necessitating the integration of physical education into the general system of professional training for students, taking into account the specifics of future professional activities [19-23].

Processes of education, globalisation, and integration of Kazakhstan universities into the global educational space open opportunities for addressing these issues through studying and implementing the best global practices in improving physical education for students. International experience demonstrates a variety of approaches to organising physical education, allowing local universities to adapt the most effective methodologies, taking into account national specifics and regional characteristics. Research by Dyson (2014) and Edginton (2016) highlights successful international models, while reports from the World Health Organization (2019) and studies by Xu (2021) provide comprehensive frameworks for adapting these approaches to local contexts [24-29].

Under these conditions, bibliometric analysis of literature on improving physical education of university students becomes especially important, as it will reveal the structure and dynamics of scientific research in this field, identify the most cited works, influential authors, and leading scientific journals, creating a foundation for systematizing existing knowledge and determining key trends in the development of the science of physical education for students.

The results of bibliometric analysis will serve as a theoretical and methodological basis for understanding the current state and prospects for research development in the field of improving physical education for students, allowing identification of the most promising directions of scientific inquiry and determination of educational policy priorities in the sphere of physical education in higher educational institutions.

Research Question: "What are the growth trajectory, productivity indicators, social, intellectual, and conceptual structures of research literature on improving physical education for students in higher educational institutions?"

Structure of the research question according to PICOS

P (Population): scientific publications on improving physical education for students, indexed in international scientometric databases

I (Instrument): bibliometric analysis

C (Comparison): dynamics of publications by year, distribution by countries/organizations, comparison of thematic clusters, analysis of collaborations, and more

O (Outcomes): visualization of the trajectory of scientific productivity growth

S (Setting): global scientific discourse on the research subject, time range of publications - 1975-2025.

Thus, the purpose of this research is to map the literature on improving physical education for students in higher education using metadata extracted from scientific articles indexed in the Web of Science database for the period 1975-2025. The study employs bibliometric procedures to describe and visually represent the available literature in terms of growth trajectory, productivity, and social, intellectual, and conceptual structures of the field over the past 50 years.

Justification of search terms

In the context of bibliometric analysis of literature on improving physical education for students, the use of a specific set of search terms is justified to provide a comprehensive and representative reflection of the research topic. The choice of search terms "physical education of students" OR "physical culture in university" OR "physical culture in higher education" OR "pedagogical conditions of physical education" OR "physical education" is determined by the following methodological imperatives.

The term "physical education of students" represents the main conceptual construct, directly reflecting the focus of research on physical education of student youth. This term is well-established in international scientific literature, ensuring identification of works specifically targeted at the student audience.

The inclusion of terms "physical culture in university" and "physical culture in higher education" expanded the search field by including research operating with the concept of "physical culture" in the context of higher education, which is especially characteristic of the domestic scientific tradition and several European approaches.

The term "pedagogical conditions of physical education" is aimed at identifying research focusing on pedagogical aspects of organizing physical education, which directly correlates with the

targeted direction of bibliometric analysis, facilitating identification of works studying didactic, methodological, and organizational conditions for the effectiveness of physical education.

The inclusion of the generalized term "physical education" provided comprehensive coverage of scientific discourse in the field of physical education, containing relevant information about pedagogical conditions for improving the physical education of students, even if direct mention of higher education is absent in the keywords or titles of publications.

The application of the logical operator "OR" between these terms is methodologically justified by the task of maximizing the information field of analysis and ensuring completeness of the sample of scientific publications, conforming to the principles of bibliometric literature review and allowing minimization of the risk of missing relevant research due to terminological differences.

Conceptual differentiation between two main research constructs: "physical education of students" and "improvement of physical education of students"

In scientific-pedagogical discourse, the concepts of "physical education of students" and "improvement of physical education of students" represent interrelated but not identical categories, determining different aspects of pedagogical reality. This distinction has been explored in detail by Green (2008), who provides a foundational framework for understanding these concepts [30-32].

The concept of "physical education of students" has a substantial character and reflects the institutional, content, and procedural aspects of educational activities aimed at forming physical culture of the personality of higher educational institution students, integrating a set of educational practices, methodological approaches, organisational forms, and pedagogical interactions that ensure the development of physical qualities, motor skills, health-preserving competencies, and value orientations of students in the field of physical culture. This comprehensive definition is supported by recent research conducted by Sysoev (2024) [33, 34].

In the ontological sense, "physical education of students" is characterised by the presence of established educational traditions, a regulatory framework, software, personnel, and material-technical resources. This concept reflects the static state of the system, fixing the current state of affairs in a specific temporal and spatial continuum, as demonstrated in studies by Ma (2018) [35-37].

In contrast, the concept of "improvement of physical education of students" has a dynamic, procedural character and represents transformational processes aimed at qualitative change of the existing physical education system. This concept emphasizes the innovative component of pedagogical activity, oriented toward overcoming contradictions between traditional approaches to physical education and modern requirements for specialist training [38, 39].

"Improvement of physical education of students" implies purposeful activity to modernize the content, forms, methods, and means of physical education based on modern scientific achievements and advanced pedagogical experience, including the development and implementation of innovative pedagogical technologies, creation of new educational programs, enhancement of teachers' professional competence, optimization of material-technical base, and information support of the educational process [40, 41].

The epistemological difference between these concepts lies in the fact that "physical education of students" is an object of scientific knowledge, whereas "improvement of physical education of students" acts as a research paradigm, defining the vector of scientific inquiry and determining the choice of methodological approaches to studying this phenomenon [42, 43].

In the axiological aspect, the difference between the analyzed concepts is manifested in that "physical education of students" reflects the existing system of values and priorities in the field of physical culture, while "improvement of physical education of students" implicitly contains a critical assessment of the existing state of affairs and orientation toward achieving an ideal image of the future [44, 45].

Thus, the concepts of "physical education of students" and "improvement of physical education of students" are in dialectical interrelationship, reflecting different aspects and levels of understanding the problems of physical education in the higher education system. The first concept characterizes the actual existence of educational practice, the second – the process of its qualitative transformation in accordance with modern requirements and prospective directions of higher education development.

Materials and Methods

In this research, a bibliometric approach was used to map the literature over the past 50 years using metadata extracted from Web of Science (WoS): Social Sciences Citation Index (SSCI) on improving the physical education of students in higher education. The choice of WoS as the data source for this study is justified by its broad coverage, long history, data accuracy, and reliability of classification, making it an optimal tool for conducting a comprehensive bibliometric analysis of the research subject. The methodological approach used in this study is presented in **Figure 1** and is discussed in more detail in the following paragraphs.

For the bibliometric analysis, specialized software VOSviewer (version 1.6.18) was used, developed by the research team of the Centre for Science and Technology Studies at Leiden University. This methodological choice was justified by several significant functional advantages of this tool: superior algorithmic capabilities in generating and visualizing multi-level bibliometric networks; implementation of advanced clustering methods for scientific publications; high accuracy in mapping the intellectual

structure of the research subject area; multidimensional analysis of diverse bibliometric indicators (citation indices, co-citation, bibliographic coupling); intuitive user interface while maintaining capabilities for deep parametric analysis; optimal integration with leading bibliographic databases and scientometric information sources.

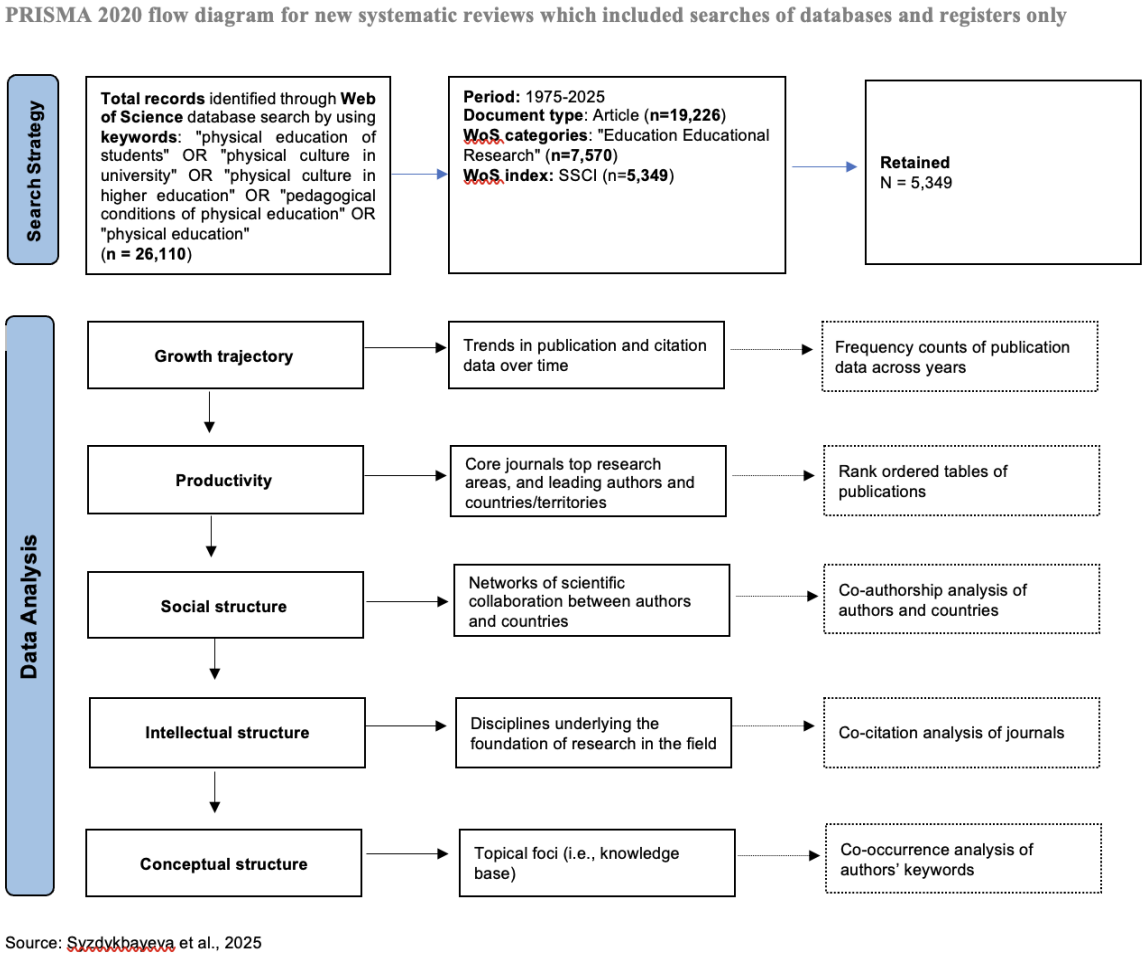

Figure 1. Methodological framework

Search strategy

The implementation of a comprehensive search strategy commenced on January 13, 2025, to establish a representative corpus of documents pertinent to the research inquiry. The identification of relevant scholarly publications proceeded through multiple sequential phases, initiating with the delineation of key terminological parameters and culminating in the application of specified filtration criteria.

The preliminary phase encompassed the formulation of a search query incorporating the following terminological constructs: "physical education of students" OR "physical culture in university" OR "physical culture in higher education" OR "pedagogical conditions of physical education" OR "physical education", with Boolean operators employed to optimize retrieval efficacy. The chronological parameters were established from 1975 to 2025, without linguistic constraints. This initial inquiry yielded a corpus of (n = 26,110) publications.

Subsequent refinement through the application of document type criteria - specifically limiting to "article" classification and thereby excluding reviews, monographs, book chapters, and conference proceedings - resulted in a refined corpus of n=19,226 publications. Further selectivity was achieved through the application of the Web of Science category "Education Educational Research", which circumscribed the corpus to n = 7,570 publications. The final refinement criterion, limiting to the Social Sciences Citation Index (SSCI), established the definitive dataset for bibliometric analysis, comprising n=5,349 publications.

Results and Discussion

Growth trajectory: evolution of publications and citations in the field

Bibliometric analysis of WoS demonstrates a significant evolution of research in the field of improving the physical education of students in higher education during the period 1975-2025 **(Figure 2)**. In 1975, 4 articles with minimal citation (1 citation) were indexed in the WoS database, indicating the initial stage of formation of this research direction. The period of the 1980s is characterized by a slight increase in publication activity, reaching 9 articles with a citation index of 2 by 1988, indicating a

relatively low degree of scientific interest in this topic. A significant quantitative and qualitative shift is observed in the early 1990s: in 1992, 43 publications with a total citation of 33 were recorded, reflecting the increasing actualization of issues of physical education of students in science. A substantial increase in publication activity and citation occurred in 2008 (132 articles with 1139 citations), reaching maximum values in 2019.

This dynamic is due to a complex of interrelated factors. First, there is a stable correlation between an increase in global concern about the physical health problems of young people and the intensification of scientific research in the field of physical education. Second, the significant internationalization of higher education and the deepening of intercultural communication in academic circles contributed to the spread of scientific discourse on this issue. Third, the rapid development of information and communication technologies and the digitalization of the scientific and educational space significantly increased the accessibility of scientific publications, which naturally affected citation indicators. Institutional and methodological transformations of higher education played a special role in intensifying publication activity after 2008, in particular, the implementation of the competence approach, which actualized the importance of physical development in the context of the formation of professional competencies. The peak indicators of 2019 correlate with the expansion of interdisciplinary research integrating achievements in pedagogy, psychology, physiology, and sports medicine.

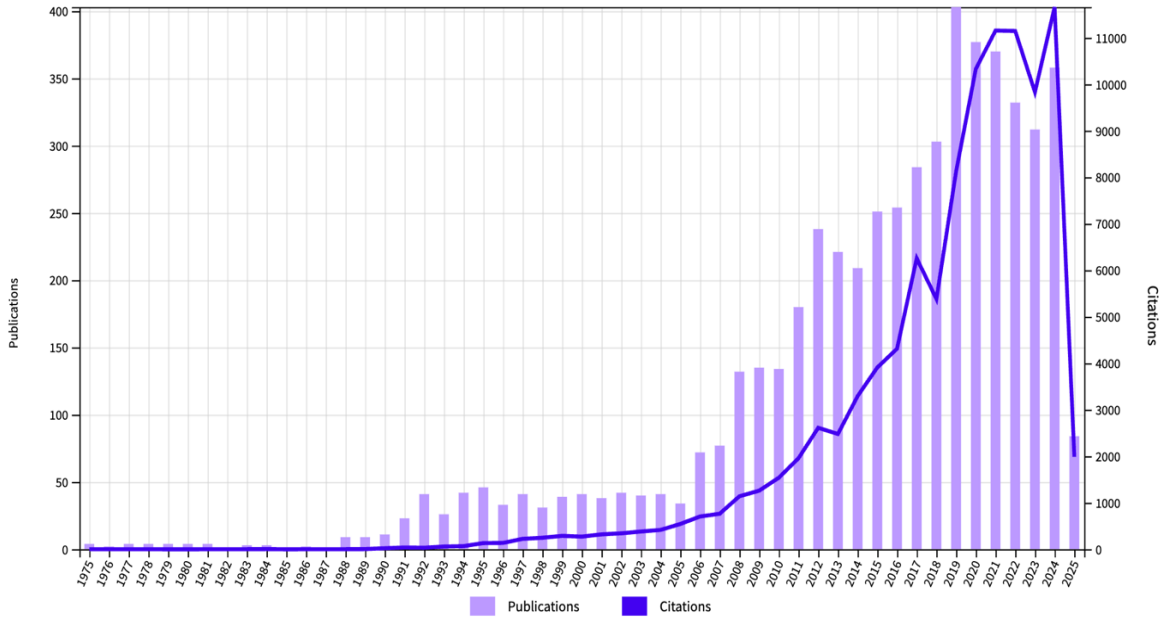

Figure 2. Publications and citations

The sample under review, N=5,349 scientific works, has 103,380 citations in the international scientific community. The average number of citations per publication is 19.33, and the H-index has reached 112, indicating high quality and demand for the conducted research. The total number of citing articles is 40,686, the number of citations without self-citations is 73,577, and citing articles without self-citations is 36,394. The high proportion of citations without self-citations (71.2% of the total) indicates significant recognition of these studies in the international scientific community and their considerable contribution to the development of theory and methodology of physical education in higher education.

The study "Physical education and sport in schools: A review of benefits and outcomes" collected the largest number of citations - 541; however, within the framework of our research, the following publications were of particular interest **(Table 1)** [46-51].

Table 1. Publications with high WoS citation levels

Article title	Publication data	Citation count	Core concept
Physical education and sport in schools: A review of benefits and outcomes	Bailey, R., 2006, Journal of school health, 76(8), 397-401	541 citations	This paper explores the scientific evidence on the contributions and benefits of physical education and sport (PES) in schools. Research evidence is presented in terms of children's development in physical, lifestyle, affective, social, and cognitive domains. The review suggests PES has the potential to make significant contributions to each domain, developing fundamental movement skills and physical competences, social skills, self-esteem, and, in certain circumstances, academic development.

Physical education and physical activity: results from the School Health Policies and Programs Study 2006	Lee, S. M., Burgeson, C. R., Fulton, J. E., & Spain, C. G., 2007, Journal of school health, 77(8), 435-463	331 citations	This study describes the characteristics of school physical education and physical activity policies and programs in the United States at the state, district, school, and classroom levels. Most states and districts had policies for teaching physical education, but few schools provided daily physical education. Many allowed exemptions from participation. Most schools provided some opportunities for physical activity outside PE. The study concludes that a comprehensive approach at all levels is necessary to enhance physical education.
Educational value and model-based practice in physical education	Kirk, D., 2013, Educational Philosophy and Theory, 45(9), 973-986	272 citations	This article advocates for a model-based approach to overcome the limitations of traditional physical education. It argues that physical educators have sought to achieve diverse and competing educational benefits that are rarely achieved. Model-based practice offers a solution by limiting learning outcomes, subject matter, and teaching strategies appropriate to each pedagogical model. Two examples support the case: Sport Education (informed by ethics) and Physical Literacy (based on existentialist philosophy). The author concludes that this approach with a reconstructed notion of educational value may offer a well-grounded future for physical education.
We hate gym: Student alienation from physical education	Carlson, T. B., 1995, Journal of teaching in Physical Education, 14(4)	216 citations	This article examines students who dislike gym class. While approximately 80% of students enjoy physical education, a substantial minority dislike these classes. The reasons vary, but one common aspect among students who disliked the subject was the feeling that they were not in control.
Physical education makes you fit and healthy. ' Physical education's contribution to young people's physical activity levels	Fairclough, S., & Stratton, G., 2005, Health education research, 20(1), 14-23	182 citations	This study assessed physical activity levels during high school physical education lessons in relation to recommended health-related goals. Students engaged in moderate-to-vigorous physical activity (MVPA) for 34.3% of lesson time. Boys participated in more MVPA than girls, and high-ability students were more active than average and low-ability students. Team games provided the most MVPA. The research suggests PE could contribute more significantly to regular physical activity if lessons are planned with MVPA goals in mind.

Initial data from the WoS database is presented in **Table 2**. **Table 2** presents only the three leading positions for each analysis criterion to focus attention on the most significant and representative indicators.

Table 2. Data from the WoS database

Criteria	Data	Records	% of 5,349
Leading researchers	Richards, Kevin	73	1.365%
	Macphail, Ann	70	1.309%
	Hastie, Peter A.	66	1.234%
Category	Education educational research	5,349	100.000%
	Sport sciences	2,208	41.279%
	Hospitality, leisure sport tourism	776	14.507%
Web of Science Index	Social Sciences Citation Index (SSCI)	5,349	100.000%
	Science Citation Index Expanded (SCI-EXPANDED)	2,204	41.204%
	Conference proceedings citation index – social science & humanities (CPCI-SSH)	60	1.122%
Affiliations	University System of Ohio	237	4.431%
	University of Limerick	191	3.571%
	Ohio State University	159	2.973%
Languages	English	5,112	95.568%
	Portuguese	463	8.656%
	Spanish	150	2.804%
Countries/Regions	Usa	1,793	33.520%
	England	620	11.591%
	Australia	602	11.254%
Document type	Article	5,349	100.000%
	Early access	333	6.225%
	Proceeding paper	60	1.122%

The leading researchers in the studied field are Richards Kevin (73 publications, 1.365%), Macphail Ann (70 publications, 1.309%), and Hastie Peter A. (66 publications, 1.234%). The dominant thematic areas are Education Educational Research (5,349 publications) and Sport Sciences (2,208 publications, 41.279%), which are reflected in the Social Sciences Citation Index (SSCI) with 5,349 records and Science Citation Index Expanded (SCI-EXPANDED) with 2,204 records. Among

academic institutions, the leading positions are occupied by the University System of Ohio (237 publications, 4.431%), the University of Limerick (191 publications, 3.571%), and Ohio State University (159 publications, 2.973%), demonstrating a significant concentration of research potential in these regions. Publication activity is predominantly presented in English (5,112 publications, 95.568%), with notable contributions in Portuguese (463 publications, 8.656%) and Spanish (150 publications, 2.804%). Geographically, research is concentrated in the USA (1,793 publications, 33.520%), England (620 publications, 11.591%), and Australia (602 publications, 11.254%). By document type, scientific articles predominate in 100% of all publications (5,349), as we set the "Articles" filter, while early publications of results (Early access) with 333 documents (6.225%) and conference proceedings (Proceeding paper) with 60 publications (1.122%) also hold leading positions in the database.

Productivity trajectory: leading author, countries/territories, and collaboration

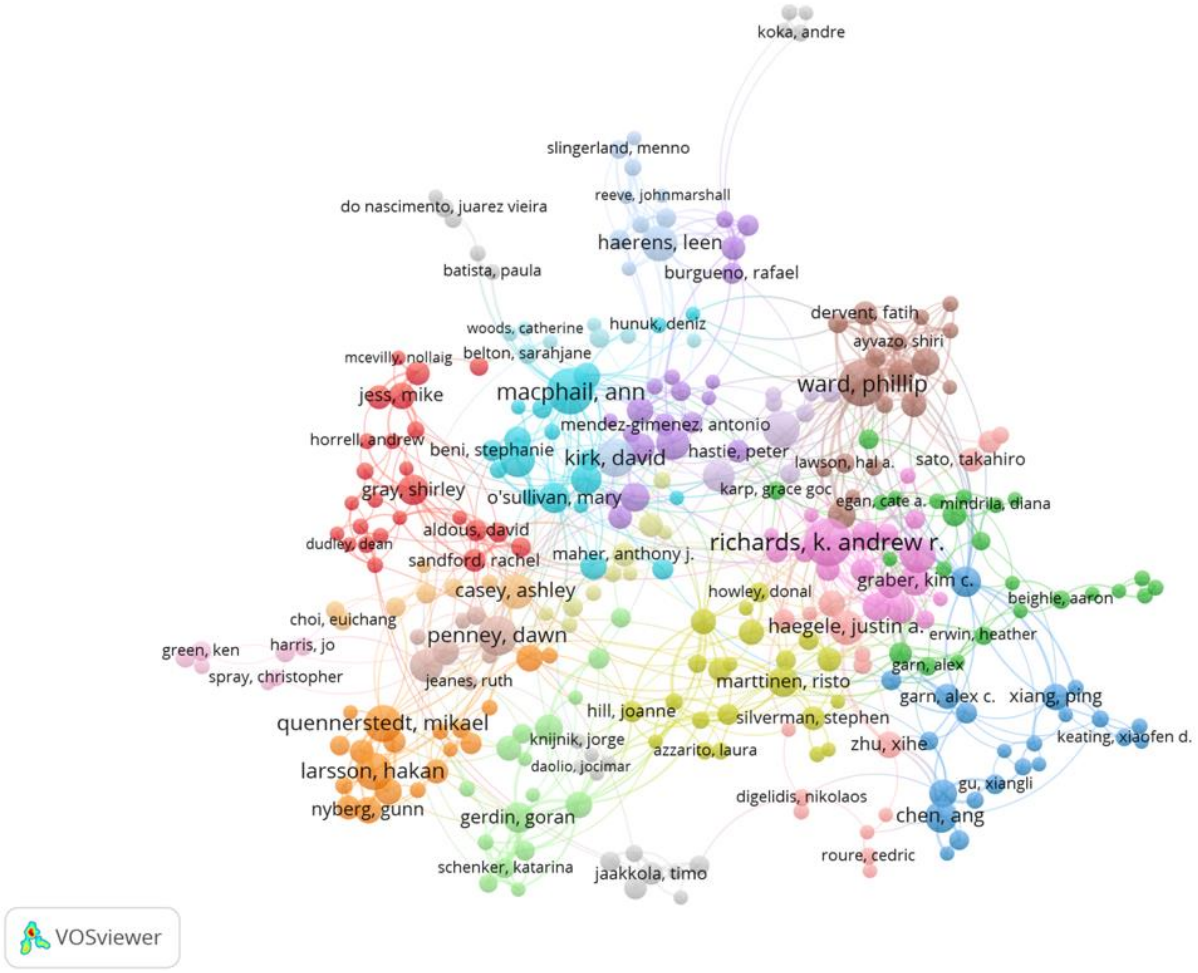

Figure 3. Leading Authors (n=302)

The bibliometric analysis covers a sample of 302 authors distributed across 22 clusters **(Figure 3)**. The most significant are the seven leading clusters, clearly visualized in the presented network structure. The purple cluster includes researchers such as Haerens Leen, Burgueno Rafael, Mendez-Gimenez Antonio, and O'Sullivan Mary. This group focuses on developing and analyzing pedagogical approaches in physical education, paying special attention to methodological aspects of teaching and their impact on students' educational outcomes. Closely interacting with this direction, the red cluster, represented by the works of Jess Mike, Horrell Andrew, Gray Shirley, and McEvilly Nollaig, focuses on developing and implementing curricula adapted to modern requirements of higher education in the field of physical culture.

Continuing the development of methodological aspects, the blue-turquoise cluster, led by Macphail Ann, Kirk David, and Beni Stephanie, develops student-centered teaching methods, emphasizing personalization of the educational process and active student involvement. This direction finds conceptual development in the research of the yellow-light green cluster with key researchers Silverman Stephen, Martinen Risto, and Hill Joanne, who concentrate on issues of assessment and increasing student motivation in the context of physical education, developing innovative methods of control and stimulation of educational activities.

Philosophical understanding of physical education is presented in the works of the orange cluster, represented by research from Quennerstedt Mikael, Larsson Hakan, and Nyberg Gunn,

studying the concepts of bodily learning and movement education, integrating philosophical aspects of corporeality into pedagogical practice. Practical application of concepts is reflected in the research of the dark blue cluster with scientists such as Xiang Ping, Chen Ang, Garn Alex, and Garn Alex C., developing motivation and engagement strategies aimed at increasing the effectiveness of the educational process and forming sustainable interest in physical activity. The circle of leading research directions is completed by the brown cluster, uniting the works of Ward Phillip, Hastie Peter, and Derveni Fatihi, focused on instructional teaching models and increasing the effectiveness of pedagogical impact. The central figures of the entire research network are Richards K., Andrew R., Macphail Ann, Ward Phillip, Kirk David, and Haerens Leen, indicating their significant contribution to forming the conceptual apparatus of this scientific field and the high citation of their works.

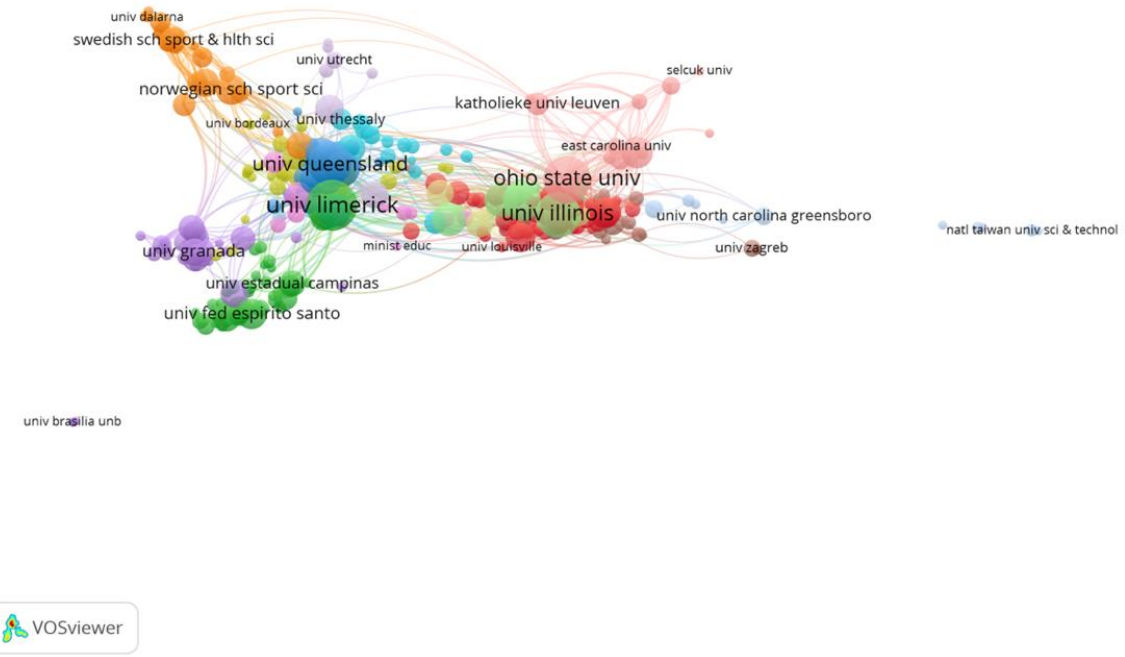

Figure 4. Collaboration of universities (n=322)

Bibliometric analysis demonstrates an extensive academic network consisting of 322 universities distributed across 15 research clusters **(Figure 4)**. The red cluster unites major educational institutions such as Ohio State University, Catholic University of Leuven, Selcuk University, and East Carolina University, specializing in research in the field of physical education in the context of large-scale state educational systems, developing comprehensive approaches to forming students' physical culture. In close relationship with them is the green cluster, represented by the University of Illinois, Federal University of Espirito Santo, State University of Campinas, and the Ministry of Education of Brazil, focusing on South American approaches to building physical education curriculum, integrating national educational traditions with modern pedagogical concepts. The light blue cluster is formed by the University of Queensland, the University of Thessaly, and the University of Limerick, which develop international perspectives on physical education pedagogy, promoting global exchange of educational practices and innovative methodologies. The orange cluster includes Dalarna University, Swedish School of Sport and Health Sciences, and Norwegian School of Sport Sciences, representing Scandinavian approaches to sports science and health-preserving education, characterized by the integration of scientific research with practice-oriented training. The purple cluster consists of the University of Granada, Utrecht University, and the University of Bordeaux, developing European approaches to physical education, combining traditional academic values with innovative pedagogical technologies. The central institutions in this research network are the University of Limerick, Ohio State University, the University of Illinois, and the University of Queensland, indicating their significant influence on shaping the global scientific discourse in the field of improving the physical education of students in higher educational institutions.

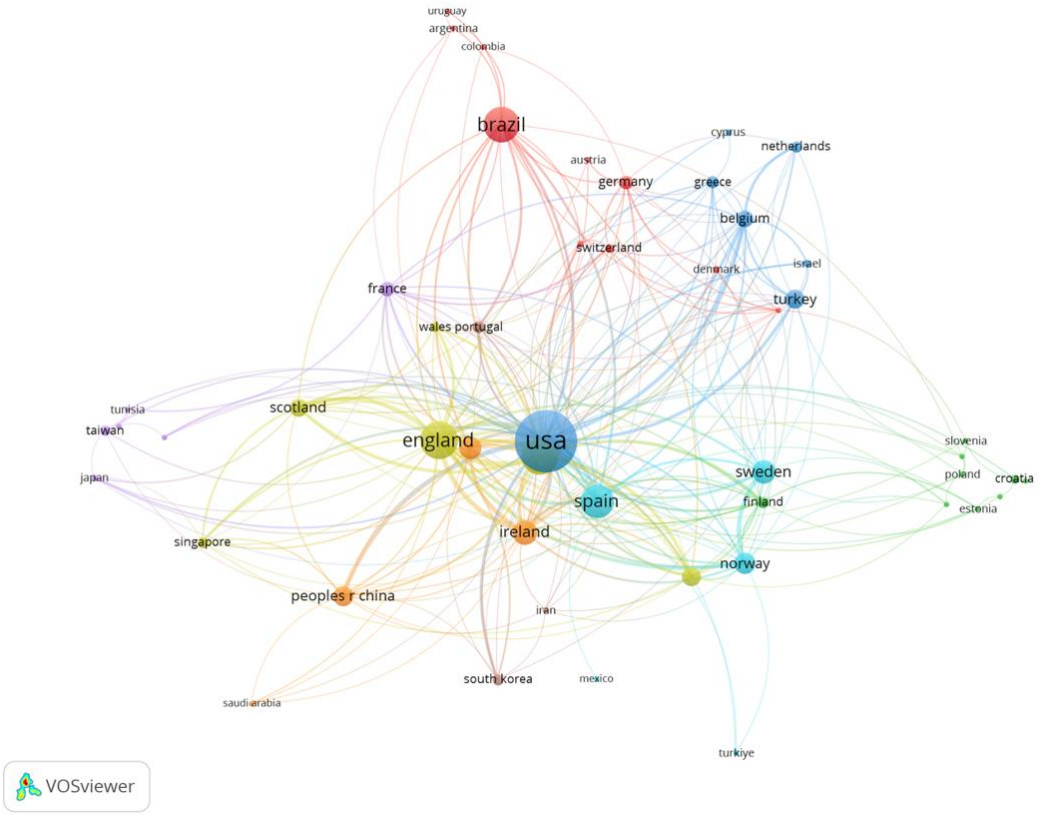

Figure 5. Networks of scientific collaboration between countries

Bibliometric analysis covers an extensive geography of scientific research, including 50 countries distributed across 8 clusters **(Figure 5)**. The presented data allowed for evaluating not only the structure of international scientific communications but also quantitative indicators of the research activity of leading countries. The central position in this network is occupied by the blue-turquoise cluster, represented by the USA (1244 documents, 28744 citations, total link strength 365). The USA acts as a global center for research in the field of physical education, demonstrating the most intensive connections with virtually all countries represented in the network structure. The light blue cluster includes Spain (366 documents, 5045 citations, link strength 135), Turkey, Belgium (88 documents, 2438 citations, link strength 90), Netherlands, Greece, Denmark, and Israel, characterized by strong research connections with the USA and forming a significant European-Mediterranean scientific alliance specializing in innovative methods of physical education. The green-yellow cluster consists of England (461 documents, 14375 citations, link strength 324), Scotland (101 documents, 1967 citations, link strength 103), Ireland (190 documents, 3954 citations, link strength 171), Wales, and Portugal. This group of countries demonstrates intensive scientific communications with both the USA and other European research centers, developing Anglo-Saxon traditions in the field of physical education and sports pedagogy. The red cluster is represented by Latin American countries, where Brazil (419 documents, 1569 citations, link strength 94) occupies a central place, acting as a link between Latin American researchers and scientific communities in the USA and Europe, reflecting the growing importance of the South American school of physical education.

The green cluster unites Scandinavian and Eastern European countries: Sweden (178 documents, 3807 citations, link strength 96), Norway (145 documents, 2137 citations, link strength 112), Finland, Estonia, Poland, Slovenia, and Croatia, developing predominantly regional cooperation, demonstrating moderate connections with other European scientific centers. The purple cluster represents a geographically diverse group including France, Tunisia, Taiwan, Japan, and Singapore, reflecting the international nature of research and the formation of transcultural approaches to physical education. The orange cluster includes China (132 documents, 1066 citations, link strength 73), Saudi Arabia, South Korea, and Iran. These countries are characterized by less intensity of international scientific connections, maintaining communications predominantly with the USA and leading European research centers. Australia (443 documents, 10728 citations, link strength 292), Canada (167 documents, 3020 citations, link strength 115), and New Zealand (122 documents, 3059 citations, link strength 91) also play a significant role in the research network, emphasizing the importance of the English-speaking scientific community in the development of physical education research.

The intellectual structure of the map demonstrates the distribution of publication activity among 987 scientific journals, grouped into 8 main clusters. The blue cluster is represented by such leading publications as "Journal of Teaching in Physical Education" (8276 documents, 260829 citations), "Quest" (3906 documents, 116875 citations), "Journal of Teaching in Physical Education" and "American Educational Research Journal", which specialize in researching methodological aspects of physical education teaching, developing innovative pedagogical

technologies, and evaluating their effectiveness in the educational process. The red cluster is concentrated around the journal "Sport Education and Society" (6821 documents, 201521 citations) and includes such publications as "Journal of Curriculum Studies", "Physical Education Curriculum", "Sport Sociology", and "Routledge International Handbook". The thematic focus of this cluster is related to sociological aspects of physical education and curriculum development, reflecting researchers' interest in social determinants of physical activity and educational policies in this field. The green cluster unites publications specializing in psychological aspects of physical education and sport: "Journal of Physical Education and Recreation" (1292 documents, 45646 citations), "Psychology of Sport and Exercise" (832 documents, 34728 citations), "Journal of Sport and Exercise Psychology" (988 documents, 40582 citations), and "Journal of Educational Psychology" (1400 documents, 54853 citations). These publications focus on psychological mechanisms of motivation, engagement, and self-regulation in the context of physical education. The yellow cluster is represented by journals with a medical and healthcare orientation: "Medicine & Science in Sports & Exercise" (865 documents, 29090 citations), "Pediatric Exercise Science," "British Journal of Sports Medicine," and "Lancet," emphasizing physiological and medical aspects of physical activity, the interrelation between physical education and public health. The light blue/turquoise cluster includes journals "Adapted Physical Activity Quarterly", "Disability and Rehabilitation", and "Health Education", focusing on adaptive physical education and inclusive approaches in education, reflecting growing interest in providing equal educational opportunities for students with special needs. The purple cluster unites Latin American publications: "Movimento-Porto Alegre", "Movimento", "Thesis", and "Revista Brasileira de Ciências", specializing in research in the field of physical education in the context of Brazilian and Latin American educational systems, demonstrating the formation of regional research traditions.

Among the top 5 journals by number of citations, leading positions are occupied by publications of different thematic orientations: "Journal of Teaching in Physical Education" (260829 citations), "Sport Education and Society" (201521 citations), "Physical Education and Sport Pedagogy" (3889 documents, 131725 citations), "Research Quarterly for Exercise and Sport" (3588 documents, 124403 citations), and "Quest" (116875 citations). Analysis of the journal network also shows the presence of specialized publications with a high level of citation in specific areas: "European Physical Education Review" (979 documents, 33162 citations), "Physical Education - US" (649 documents, 23615 citations), "Journal of School Health" (761 documents, 21446 citations), and "Journal of Sports Science" (548 documents, 21392 citations), emphasizing the diversification of research directions in the field of physical education.

The analysis of coincidence of authors' keywords (n=978) allowed for identifying the main research directions using key concepts across 7 main thematic clusters. The central red-orange cluster is formed around fundamental concepts "physical education" (1392 occurrences, link strength 2893), "physical activity" (217 occurrences, link strength 547), "motivation" (108 occurrences, link strength 252), "adolescents" (25 occurrences, link strength 60), and "secondary school" (23 occurrences, link strength 49), concentrating on key concepts of physical education with emphasis on motivational aspects in the context of secondary education, forming a methodological foundation for research in higher education. The green cluster includes terms "teacher education" (123 occurrences, link strength 284), "professional development" (90 occurrences, link strength 193), "pedagogical content knowledge" (17 occurrences, link strength 35), and "content knowledge" (16 occurrences, link strength 28), focusing on teacher training and professional development of specialists in the field of physical education, emphasizing the importance of quality preparation of pedagogical personnel for effective implementation of educational programs. The light blue cluster unites concepts "pedagogy" (146 occurrences, link strength 373), "curriculum" (153 occurrences, link strength 405), "teaching" (110 occurrences, link strength 264), "learning" (75 occurrences, link strength 200), and "assessment" (77 occurrences, link strength 192). The thematic focus of this cluster is related to pedagogical approaches and the design of physical education curricula, indicating the significance of didactic aspects in the studied field. The yellow cluster concentrates on concepts of inclusivity and equality in physical education, including terms "inclusion" (73 occurrences, link strength 203), "equity", "social justice" (44 occurrences, link strength 123), "diversity" (10 occurrences, link strength 28), and "ability" (24 occurrences, link strength 61), reflecting modern tendencies toward democratization of education and ensuring equal opportunities for all students.

The purple cluster unites sociocultural aspects and critical perspectives in physical education through concepts such as "gender" (118 occurrences, link strength 313), "embodiment" (29 occurrences, link strength 86), "power" (15 occurrences, link strength 39), "sexuality" (9 occurrences, link strength 26), and "bodies" (6 occurrences, link strength 14). Research within this cluster analyzes the influence of social and cultural factors on physical education practices, emphasizing the significance of gender aspects and the concept of corporeality. The turquoise cluster concentrates on health outcomes and sports applications of physical education, including terms "health" (69 occurrences, link strength 219), "physical fitness" (27 occurrences, link strength 77), "sports" (97 occurrences, link strength 281), and "gymnastics" (21 occurrences, link strength 40), reflecting the applied orientation of research connecting physical education with specific sports and health indicators. The brown cluster focuses on psychological theories and motivation in physical education, uniting terms "self-determination theory" (90 occurrences, link strength 191), "self-efficacy" (24 occurrences, link strength 46), and "motivation" (108 occurrences, link strength 252). Research within this cluster develops theoretical foundations for understanding motivational mechanisms and psychological factors influencing the effectiveness of physical education. Analysis of the top 10 keywords by link strength is headed by terms "physical education," "physical activity,"

"curriculum," "pedagogy," and "gender," reflecting the multifaceted nature of the research field and the significance of both traditional and innovative concepts in the study of physical education.

The bibliometric map of keywords demonstrates the complexity and interdisciplinary nature of the research field related to improving the physical education of students, integrating pedagogical, psychological, sociological, and medical aspects. Based on the conducted analysis, the following main research topics in this field have been identified: pedagogical approaches and design of physical education curricula; teacher training and professional development of specialists; motivation and psychological factors of student engagement; inclusive and equitable physical education practices; health assessment and sports applications; sociocultural dimensions, including gender aspects and corporeality.

Conclusion

The problem of improving physical education of students in higher educational institutions acquires special relevance in modern conditions of technologization and informatization of society, when there is a critical decline in the level of physical activity among young people with various health deviations, chronic diseases, and low levels of physical fitness, indicating insufficient effectiveness of the existing system of physical education in universities. Under these conditions, bibliometric analysis of literature made it possible to identify the structure and dynamics of scientific research in the field of pedagogical conditions for improving physical education of students, determine the most cited works, influential authors, and leading scientific journals, creating a foundation for systematizing existing knowledge and determining key trends in the development of this field.

The results of bibliometric analysis of 5349 scientific articles indexed in Web of Science for the period 1975-2025 showed steady growth of research activity since 2008, interdisciplinary nature of publications concentrated in the categories "Education Educational Research" and "Sport Sciences," as well as domination of researchers from the USA, England, and Australia. Seven main research topics forming the conceptual map of the field were identified: pedagogical approaches and curriculum design; teacher training; motivational aspects; inclusive practices; health assessment; sociocultural dimensions; instructional teaching models.

The obtained results open significant prospects for subsequent research. First, the identified thematic clusters will allow researchers to more purposefully develop new scientific directions, filling existing gaps in the theory of physical education for students. Second, identification of leading scientific schools and centers contributes to establishing more productive international collaborations, integrating various approaches and methodologies. Third, analysis of the conceptual evolution of the studied field creates a methodological foundation for developing innovative pedagogical models that take into account modern trends of digitalization and personalization of the educational process. Fourth, the identified citation patterns contribute to more effective information exchange between researchers working in related fields. The research results will serve as a guide for educational policy in the field of physical education, providing a scientifically grounded approach to modernizing curricula and improving pedagogical conditions of physical education for students in higher educational institutions.

Research limitations

Within the framework of this research, it is necessary to note several limitations that should be taken into account when interpreting the obtained results. First, a significant limitation is the use of only one scientometric database, Web of Science, for extracting metadata of scientific publications. Even though Web of Science provides access to an extensive array of high-quality scientific articles and has strict indexing criteria, this does not allow covering the entire spectrum of publications on the research topic, especially works published in journals indexed in other databases such as Scopus, ERIC, SportsDiscus, or regional citation indexes. Second, this research focused exclusively on quantitative bibliometric indicators and did not include an in-depth qualitative analysis of the content of the publications themselves. Bibliometric analysis made it possible to identify structural patterns and trends in the research field, but it does not provide an opportunity to evaluate the methodological quality of research, the theoretical validity of conclusions, or the practical applicability of the obtained results.

Acknowledgments: None

Conflict of interest: None

Financial support: None

Ethics statement: None

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