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Mapping research trends in physical education pedagogies: a bibliometric analysis using scopus database

Cartografía de las tendencias de la investigación en pedagogías de la educación física: un análisis bibliométrico utilizando la base de datos scopus

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Abstract. This study aims to provide a comprehensive and systematic review of research trends in applying pedagogical models in physical education (PE) pedagogy. Furthermore, there are ongoing challenges facing teaching and learning in PE to deliver effective learning and achieve current learning objectives. This study used a bibliometric analysis approach by examining publication growth patterns, distribution of publication growth, distribution of authors, countries, affiliations, and network analysis based on the appearance of keywords. A search for articles in the Scopus database with specific keywords related to PE pedagogy yielded 419 relevant articles analyzed using CSV and VOSViewer applications. The results revealed a positive trend of increasing the number of published articles starting in 2018 and peaking in 2022. Keith Davids is a famous and influential author with the most publications and the highest citations. His article titled Algorithmic Skin: Health-tracking Technologies, Personal Analytics and the Biopedagogies of Digitized Health and Physical Education, written by Ben Williamson, was the most popular article with 123 citations. China has the most productive authors, and the United Kingdom is the country of origin for the most popular authors with the highest citation rates. The current and emerging trends demonstrate the integration of innovative teaching practices, alternative pedagogical approaches, and the promotion of holistic student development to cope with the development of PE. At the same time, the co-word analysis presents further research streams that include technology utilization and integrative approaches to transformative PE. In conclusion, this study has practical and theoretical implications in the research and practice of physical education pedagogies to identify integration and strategies and PE pedagogies.
Keywords: physical education pedagogy; the trend of research; the integration of innovative and alternative pedagogical approaches; technology utilization and integrative approaches

Resumen. Este estudio pretende ofrecer una revisión exhaustiva y sistemática de las tendencias de la investigación en la aplicación de modelos pedagógicos en la pedagogía de la educación física (EF). Además, la enseñanza y el aprendizaje de la educación física se enfrentan a retos constantes para ofrecer un aprendizaje eficaz y alcanzar los objetivos de aprendizaje actuales. Este estudio utilizó un enfoque de análisis bibliométrico mediante el examen de los patrones de crecimiento de las publicaciones, la distribución del crecimiento de las publicaciones, la distribución de los autores, los países, las afiliaciones y el análisis de redes basado en la aparición de palabras clave. Una búsqueda de artículos en la base de datos Scopus con palabras clave específicas relacionadas con la pedagogía de la educación física arrojó 419 artículos relevantes analizados mediante las aplicaciones CSV y VOSViewer. Los resultados revelaron una tendencia positiva de aumento del número de artículos publicados que comenzó en 2018 y alcanzó su punto máximo en 2022. Keith Davids es un autor famoso e influyente con el mayor número de publicaciones y las citas más altas. Su artículo titulado Algorithmic Skin: Health-tracking Technologies, Personal Analytics and the Biopedagogies of Digitized Health and Physical Education, escrito por Ben Williamson, fue el artículo más popular con 123 citas. China cuenta con los autores más productivos, y el Reino Unido es el país de origen de los autores más populares y con mayor índice de citas. Las tendencias actuales y emergentes demuestran la integración de prácticas docentes innovadoras, enfoques pedagógicos alternativos y la promoción del desarrollo holístico del estudiante para hacer frente al desarrollo de la EP. Al mismo tiempo, el análisis de co-palabras presenta nuevas corrientes de investigación que incluyen la utilización de la tecnología y los enfoques integradores de la educación física transformadora. En conclusión, este estudio tiene implicaciones prácticas y teóricas en la investigación y la práctica de las pedagogías de la educación física para identificar la integración y las estrategias y pedagogías de la educación física.
Palabras clave: la pedagogía de la educación física; la tendencia de la investigación; la integración de enfoques pedagógicos innovadores y alternativos; la utilización de la tecnología y los enfoques integradores

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Introduction

Physical education (PE) places the body at the center of attention as an embodiment of moving beyond the dualistic viewpoint of natural science (Aartun, 2022). Pedagogy in physical education views movement as the central principle and movement-based learning should be more responsive to the needs of all students and ensure equity in student movement and learning experiences and positively reflect gender diversity in student groups (Clark et al., 2023). At present, the teaching and learning of physical education in schools is undergoing significant challenges (MacPhail, 2020). Despite extensive efforts by researchers and scholars to investigate the effectiveness of different teaching methods, aligning educational goals with instructional strategies remains a major topic of inquiry (Kirk, 2014). Physical education has not been fully addressed by educational institutions due to the traditional paradigm of physical education being centered on multi-activity and sport techniques that result in students lacking skills, the use

of short learning sessions, and the pursuit of unachievable benefits for all student profiles (Casey & Kirk, 2020).

One of the main challenges is the use of conventional PE approaches based on multi-activities and sports techniques that result in the integration of students' relatively low skills, the use of short learning sessions, and failure to set goals to be achieved (Goodyear et al., 2017). PE has traditionally been taught with a command teaching style based on sport-based content and is undergoing a shift to decontextualized practice of sport techniques (Kirk, 2016). As a result, many learners experience difficulties in performing learning, and students also struggle in playing during games (Harvey et al., 2018). In light of this, PE learning practices have been replaced by model-based practices and provide alternative structures to enhance students' abilities (Casey & MacPhail, 2018). Students have diverse ways of learning according to their development and learning backgrounds, so a learning model that suits the situation and conditions is needed (Usra et al., 2023).

Extensive research has long upheld the educational value of students' lifelong participation in PE (Beni et al., 2018). Practitioners, researchers and educators have long focused their attention on teaching and learning in PE that aims to strongly connect students with the person and culture represented in sport and increase children's joy through participation in the collaborative achievement of motor and social goals (Araujo et al., 2016). Therefore, the approach to teaching sport in schools has changed to meet society's need for individuals who are critical, responsible and able to adjust to a rapidly changing environment. This differs from the traditional approach also known as teacher-centered approach changing to student-centered sports teaching (Gubacs-Collins, 2015).

Furthermore, several literature reviews have been conducted to find publication trends related to physical education pedagogies using the bibliometric approach of the Scopus database, Science Direct, and Taylor and Francis Online. Bibliometric reviews are carried out with the aim of providing research data that can be effectively used by researchers to improve the quality of their research (Ardiansyah et al., 2024). The results of the literature review obtained data on several bibliometric studies conducted such as trends in scientific production in the field of ICT and Physical Education (Ramos, 2019; Harding et al., 2021), conduct a bibliometric analysis of journal articles on educational technology in physical education (Perdima et al., 2022; Ramos, 2020; Trabelsi et al., 2022), analyze scientific publications on Physical Activity (PA) interventions and cognition in children and adolescents between 2009 and 2019 (Lemos et al., 2023), systematically and holistically analyze scientific publications on Physical Activity (PA) interventions and cognition in children and adolescents between 2009 and 2019 (Lemos et al., 2023), systematically and holistically reviewed and analyzed the critical thinking literature in primary education to clearly identify gaps and steps for future research (Aktoprak & Hursen, 2022), physical activity research trends for breast cancer (Patiño-Palma et al., 2023), and a bibliometric analysis of the 50 most cited review papers on physical activity and depression to identify important research topics and future research directions (Zhai & Xu, 2023). None of these bibliometric studies specifically addressed PE pedagogies. Therefore, it is necessary to conduct a study to trace the trend of publications related to PE pedagogies.

This bibliometric analysis was conducted to review the trend of Scopus database publications related to the application of pedagogical models in physical education teaching and learning. The analysis was conducted by tracing the trends of research that have been conducted by teachers and academics. Analysis was carried out by examining articles that contained the keyword PE pedagogies. The examination includes the pattern of publication growth, the distribution of publication growth, the distribution of authors doing publications and the distribution of countries and affiliations of origin of the authors, and network analysis based on the occurrence of keywords. The urgency of this article is to obtain a concrete picture of the implementation trend of physical education pedagogies and the best practices of PE teaching and learning. The analysis is expected to detect the development and expansion of physical education pedagogies and identify the scope of current and future studies.

Method

Bibliometric analysis is a scientific method used to summarise and synthesise literature through a qualitative and quantitative approach of analysis of published literature combined based on (Donthu et al., 2021; Alshater et al., 2021; Paul & Barari, 2022). The bibliometric analysis was carried out through several stages adopted from (Baako & Abroampa, 2023) such as collecting articles, processing data, creating visualizations and networks, and conducting analysis. Literature analysis can be by means of performance analysis such as the number of publications, citations, and publication productivity and science mapping such as network visualisation to identify relationships between studies combined (Tiberius et al., 2020). The bibliometric analysis in this study uses both methods by revealing publication growth, productive authors, author collaboration, affiliation, source, and author country of origin. Furthermore, science mapping was conducted using Bibliographic coupling and Co-occurrence analysis to reveal research trends.

In this study, each article analyzed is a research article on physical education pedagogies contained in the Scopus database. The selection of the Scopus database is due to the most prominent database globally used by researchers (Khan & Muktar, 2020). The coverage of citation indexes and digital publications owned by the Scopus database is also extensive so that access to research literature becomes easily utilized by researchers to examine publishing trends,

identify leading authors and affiliations, and gain insight into growth and development (Shaifudin et al., 2022).

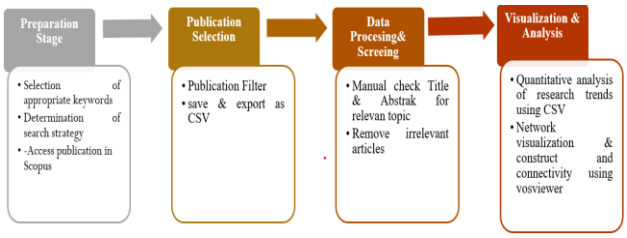

Figure 1. Bibliometric conceptual fram ework

The article search on the Scopus database was conducted on March 16, 2024 using the keywords "physical education pedagogies" OR "sport pedagogies" OR "physical education teaching" OR "physical education learning". The filters used include all open access, publication year range 2013-2023, document type articles, have passed the final process, limited to journals, and use English. The resulting logic operation TITLE-ABS-KEY ("physical education pedagogies" OR "sport pedagogies" OR "physical education teaching" OR "physical education learning") AND PUBYEAR > 2013 AND PUBYEAR < 2024 AND (LIMIT-TO (SRCTYPE , "j") AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")). As a result, 448 articles were obtained and exported in CSV format. Furthermore, screening was carried out based on the title and abstract so that there were 29 articles that were excluded in this analysis process because they explicitly discussed Physical Education Pedagogies. As a result, 419 articles were analysed.

Analysis was carried out using VOSViewer software version 1.6.20 to build a bibliometric map based on 419 articles that have been screened in the Scopus database. VOSViewer is a map-making tool developed by the Center for Science and Technology Studies (CWTS) at Leiden University by Nees Jan van Eck and Ludo Waltman to visualize a university's research profile, a disciplinary field, see topics of high impact, show collaboration between authors, groups, or universities and track citation relationships in the form of bibliometric network data (Wong, 2018).

Data analysis using CSV and VOSViewer. CSV was used to illustrate the growth of articles per year and the most popular articles. VOSViewer was used to visualize the results of bibliometric analysis by creating maps of co-citation networks, keyword co-occurrence, organizational citations, and author co-citations in the format of Network visualization maps. VOSViewer generated Maps and tables were interpreted to identify the most influential and impactful articles, countries, organizations and authors in the field of physical educational models based on citation metrics, publication data, network relationships, and trends in research.

Table 1.
Publication search criteria

Criteria	Description
Source Database	Scopus
Years	2013-2023
Search string	"Physical Education Pedagogies" OR "sport pedagogies" OR "physical education teaching" OR "physical education learning"
Source & Document type	Jurnal & Article
Publication Language	English
Publication stage	Final
Search in	Title, abstract, & Keywords
Articles obtained	448
Title and Abstract Screening	29
Processed articles	419

Result

Publication Growth Distribution

The publication growth analysis aims to find publication trends every year. The analysis was carried out by calculating the frequency of articles from 419 articles included in the analysis process based on the year of publication using the CSV application. Based on the results of the analysis of publication growth illustrated in graph 1, it shows that there has been a trend of publication of articles related to the scope of physical education pedagogie from 2014 to 2017 relatively stagnant ranging from eight to eleven article publications. The trend of increasing the number of publications began in 2018 with fifteen publications or an increase of six article publications from the previous year. The increasing trend that occurred was followed in 2019 with twenty-five publications, 2020 with forty-two publications, 2021 with eighty-three publications, and the peak in 2022 was a publication of 158 articles. The positive trend of increasing the number of publications decreased in 2023 with 59 articles and even lower than in 2021.

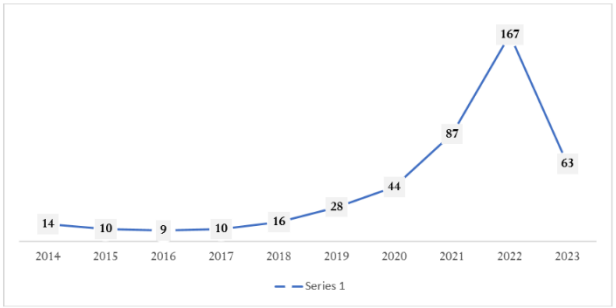

Figure 2. Distribution of the Number of Articles Published in the Year

Distribution of Authors Doing Publications

Analysis of the distribution of authors who published related to physical education pedagogies using VOSViewer analysis. VOSViewer analysis criteria use the Co-Authorship type, unit of analysis by author, using the fractional counting method, and the minimum number of published articles is at least one. As a result, the top 10 list of authors who published articles related to physical education pedagogies is shown in Table 2. Keith Davids and

David Kirk are the authors with the most publications with a total of eight published articles. However, Keith Davids is superior because the number of citations is more than David Kirk. Based on the ranking results of the ten authors with the most publications, it shows the most four to eight publications in the 2014-2023 time span or an average of producing one article in 1.25-2.25 years.

Furthermore, authors with the most citations are analyzed using VOSViewer using the Citation type, unit of analysis by Authors, and the minimum number of published articles is at least one. Based on the results of the analysis of authors with the highest number of citations (see table 3) shows Keith Davids is the author with the highest number of citations with 212 citations. In second position Mikael Quennerstedt with 189 citations and before occupying the sixth position based on the number of articles published. These results show that Keith Davids is an author who gets significant attention and recognition from other authors in physical education pedagogies. However, an important point to note from authors Ben Williamson, Kathleen M. Armour, and Victoria A. Goodyear is that although the ranking results are in positions seven to nine, the citations achieved are high. The results based on the number of articles published are only one but the citations achieved amount to 123 and 121. These results are certainly better than the results achieved by authors Keith Davids and Mikael Quennerstedt although the citations achieved are high but the number of articles published is also large.

Table 2.
Ten Authors with the Most Number of Article Publications

Rank	Author	Artikel	Cita-tions	Total Link Strength
1	Davids, Keith	8	212	8
2	Kirk, David	8	102	7
3	Penney, Dawn	7	123	7
4	Arias-Estero, José L.	6	35	6
5	Moy, Brendan	6	151	6
6	Quennerstedt, Mikael	6	189	4
7	Larsson, Håkan	5	59	4
8	Luguetti, Carla	5	43	5
9	Renshaw, Ian	5	149	5
10	Galatti, Larissa Rafaela	4	29	4

Table 3.
Ten Authors with the Most Citations

Rank	Author	Artikel	Citations	Total Link Strength
1	Davids, Keith	8	212	58
2	Quennerstedt, Mikael	6	189	20
3	Casey, Ashley	3	155	20
4	Moy, Brendan	6	151	60
5	Renshaw, Ian	5	149	55
6	Penney, Dawn	7	123	0
7	Williamson, Ben	1	123	6
8	Armour, Kathleen M.	1	121	13
9	Goodyear, Victoria A.	1	121	13
10	Kirk, David	8	102	15

Table 4 presents the data from the ranking analysis of articles with the highest number of citations using CSV. The results of the analysis obtained information that from ten articles with the most number of citations ranging from 45 to 123 citations. The article written by Ben Williamson with Algorithmic skin: health-tracking technologies, personal analytics and the biopedagogies of digitized health and physical education has been cited 123 times since it was published in 2015. The second ranked article written by Ashley Casey, Kathleen M. Armour, and Victoria A. Goodyear with the title Rethinking the relationship between pedagogies, technology and learning in health and physical education with 121 citations. These results are in line with the results of the analysis conducted on the authors with the most citations (see table 3). The article with the title Physical education and the art of teaching: transformative learning and teaching in physical education and sports pedagogies written by Mikael Quennerstedt is the mean article citations achieved every year.

Table 1.
Ten Articles With The Most Citations

Rank	Authors	Title	Year	Cited by
1	(Williamson, 2015)	Algorithmic skin: health-tracking technologies, personal analytics and the bi-opedagogies of digitized health and physical education	2015	123
2	(Casey, 2017)	Rethinking the relationship between pedagogies, technology and learning in health and physical education	2017	121
3	(Quennerstedt, 2019b)	Physical education and the art of teaching: transformative learning and teaching in physical education and sports pedagogies	2019	99
4	(Y. Ding et al., 2020)	Application of Internet of Things and Virtual Reality Technology in College Physical Education	2020	70
5	(Moy, 2016)	The impact of nonlinear pedagogies on physical education teacher education students' intrinsic motivation	2016	58
6	(Zhang & Min, 2020)	Analysis on the Construction of Personalized Physical Education Teaching System Based on a Cloud Computing Platform	2020	49
7	(Gil-Arias, 2020)	Autonomy support, motivational climate, enjoyment and perceived compe-tence in physical education: Impact of a hybrid teaching games for under-standing/sport education unit	2020	48

8	(Quennerstedt, 2019a)	Healthying physical education - on the possibility of learning health	2019	48
9	(Roberts, 2019)	Application of a constraints-led approach to pedagogies in schools: embarking on a journey to nurture physical literacy in primary physical education	2019	47
10	(Jones & Thomas, 2015)	Coaching as 'scaffolded' practice: further insights into sport pedagogies	2015	45

Analysis of the distribution of the country of origin of authors who published related to physical education pedagogies using VOSViewer analysis which is presented in the table 5. VOSViewer analysis criteria use the Co-Authorship type, unit of analysis by Country, using the fractional counting method, and the minimum number of published articles is at least one. The most productive country in publishing articles is China with 175 articles in the 2014-2023 period or with an average of 17.5 articles per year. This was followed by Indonesia with 58 articles or 5.8 articles per year. Of the top 10 countries with the most publications, at least fourteen articles or 1.4 articles per year were published. These results show that the top ten countries produce a minimum of 1.4 articles and a maximum of 17.5 articles. Countries located in the Asian region (China, Indonesia, and South Korea) have the most publications, followed by the European region (United Kingdom, Spain, Sweden, and Italy), America (Brazil and United States), and Australia. This shows that publications related to physical education pedagogies are mostly produced by countries in the Asian region.

Analysis of the country of origin of authors with the highest number of citations using VOSViewer uses the type Citation, unit of analysis by Countries, and the minimum number of published articles is at least one (see table 6). The top ten countries with the most citations show at least 103 citations. The United Kingdom is the country of origin of the most cited author with 950 citations. The second position is followed by China with 626 citations. Reviewing the average number of citations per article shows that articles published by authors from Ireland are most cited with an average of 21 citations per article, United Kingdom with an average of 18 citations per article, Sweden with an average of 17 citations per article, and the least Indonesia with an average of 3 citations per article. These results show that authors from the United Kingdom are the most popular of authors from other countries. In addition, countries in the European region are the countries with the most popular authors compared to other regions.

Table 5.
Top ten countries by number of publications

Rank	Country	Artikel	Citations	Total Link Strength
1	China	175	626	19
2	Indonesia	58	198	8
3	United Kingdom	52	950	40
4	Spain	37	310	15
5	Australia	33	462	23
6	Brazil	26	125	8
7	United States	20	305	12
8	Sweden	19	318	4
9	Italy	18	136	6
10	South Korea	14	103	11

Table 6.
Distribution of top ten countries by number of citations

Rank	Country	Artikel	Citations	Total Link Strength
1	United Kingdom	52	950	51
2	China	175	626	6
3	Australia	33	462	42
4	Sweden	19	318	12
5	Spain	37	310	12
6	United States	20	305	8
7	Indonesia	58	198	20
8	Ireland	9	193	15
9	Italy	18	136	4
10	Brazil	26	125	1

Furthermore, the analysis of the affiliations of the authors who published the most using VOSViewer uses the type Citation, the unit of analysis by Organization, and the minimum number of articles published is at least one presented in table 7. In general, the affiliations of the authors who published the most were affiliations from Australia, followed by the United Kingdom, Sweden, Indonesia, and China. Institute of Health and Biomedical Innovation, Human Health and Wellbeing Domain, Queensland University of Technology, Brisbane, Australia and School of Exercise and Nutrition Sciences, Queensland University of Technology, Brisbane, Australia are affiliations that publish the most articles, namely five articles each.

Table 7.
Distribution of ten affiliations of the most published authors

Rank	Organization	Article	Citations	Total Link Strength
1	Institute Of Health and Biomedical Innovation, Human Health and Wellbeing Domain, Queensland University Of Technology, Brisbane, Australia	5	124	11
2	School Of Exercise and Nutrition Sciences, Queensland University of Technology, Brisbane, Australia	5	124	11
3	Institute For Health and Sport, Victoria University, Melbourne, Australia	4	33	5
4	School Of Education, Edith Cowan University, Perth, Australia	4	56	5
5	Centre For Sports Engineering Research, Sheffield Hallam University, Sheffield, United Kingdom	3	91	10
6	Dalarna University, Sweden	3	23	5
7	Department Of Physical Education, Universitas Negeri Jakarta, Indonesia	3	4	6
8	Department Of Sport, Exercise and Rehabilitation, Northumbria University, Newcastle Upon Tyne, United Kingdom	3	40	3
9	Guizhou University of Commerce, Guiyang, China	3	13	0
10	Institute Of Sport and Physical Activity Research, University of Bedfordshire, Bedford, United Kingdom	3	78	14

Bibliografic Coupling Analysis

Bibliographic coupling analysis is a technique that assumes two publications with the same references and shows a list of papers that list the same references so that the higher the bibliographic relationship formed shows the more the same references are used (Budler et al., 2021). Bibliographic coupling analysis aims to understand the trend of theme development in the current research field (Donthu et al., 2021). Bibliographic coupling analysis using the same database from 419 documents, the minimum citations number of a document is 25 with meet the threshold of 59. The determination of the threshold is based on the results of testing several levels until adequate and robust clusters are found so that they are found not overlapping. Bibliographic coupling analysis results in the form of network visualisation shown in figure 2. The network map illustrates that there are six Clusters that are closely interconnected. Furthermore, labels are given based on the author's qualitative interpretation for each cluster according to the items that appear;

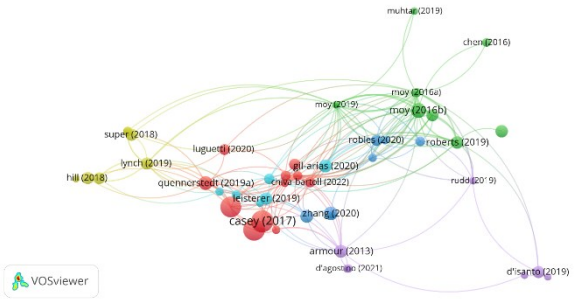

Figure *3* Network visualization of bibliographic coupling

- Cluster 1 (red) consists of 11 items labelled 'strengthening studies related to PE teaching practices". Study related to physical education and sport pedagogy (PESP) that refers to practice, programmatic approaches, and interdisciplinary research still lacks influence and impact (Kirk, 2014). This statement is reinforced by the opinion of Luguetti (2020) revealing the need to strengthen the understanding of pre-service teachers (PSTs) related to teaching and learning student-centred pedagogy. In addition, Serving leaning whose main theme is learning by serving and considering experiential, critical and transformative principles and its main focus is the affective and social domains (Chiva-Bartoll & Fernández-Rio, 2022).
- Cluster 2 (green) consists of 8 items labelled 'Application of Alternative Approaches in PETE'. PETE educators are expected to be able to change students' beliefs about alternative approaches to teaching games in accordance with curriculum documents (Moy, 2014). In the application process, alternative approaches must be operationalized in a research-based pedagogical learning design so as to facilitate students' perceptions of the effectiveness of these approaches through experience and or observation (Moy et al., 2016). The Constraints-Led Approach (CLA) is a game-based approach to an inclusive and purposeful learning environment (Roberts, 2019). Furthermore, CLA develops a more functional and intrinsically motivating pedagogical climate during learning (Moy, 2016).
- Cluster 3 (blue) consists of 7 items labelled 'Implementation of tactical approaches in PE teaching'. In PE teaching, it is recommended to use a tactical approach to teach games and sports in order to develop technique, understanding, tactical knowledge, and decision-making, which are required in the game (Abad Robles et al., 2020). This approach is useful for teachers and coaches in developing students' game skills. One form of tactical approach that can be used is TGfU which can improve students' game performance, knowledge, and psychosocial variables (Arias-Estero et al., 2020). However, obstacles that are currently occurring in the application process are that some studies use criteria that are not validated, not all consider tactical levels, most studies use indices that mask results, individual observation units are used to assess global tactical learning outcomes, and many of the instruments used are not validated (Barquero-Ruiz et al., 2019).
- Cluster 4 (yellow) consists of 7 items labelled 'Integrating Social Justice in Physical Education Teacher Education'. Students are encouraged to develop critical awareness, appreciate multiple perspectives, and engage in action to improve social justice as a form of recommended response from the substantial literature base of physical education teacher education (PETE). This is because pre-service teachers (PSTs) differ in their articulation of social justice and thus need to acquire tools to enact social justice or address sociocultural issues (Hill et al., 2018). There are three pedagogical approaches and strategies used by PETE faculty to address and educate PSTs on social justice and sociocultural issues, namely by using intentional and explicit pedagogical themes, teachable moments, and resistance and constraints (Walton-Fisette, 2018). It is also possible to implement specialised coaching strategies such as meaningful sporting experiences that help young people learn to overcome everyday social challenges, which can be beneficial throughout their lifetimes and in various social domains (Super et al., 2018).
- Cluster 5 (purple) consists of 7 items labelled "the role of PE in motor skill development, promoting health and lifelong physical activity". PE can support the development of basic motor skills (FMS) that are important for long-term health and physical activity, as well as strategies to overcome limitations in the learning process. These skills are particularly important as they have been shown to have a higher influence on academic achievement than IQ (Rudd, 2019). Furthermore, there is much evidence to understand the role of schools in developing FMS and planning teaching-learning strategies (Schembri et al., 2019). FMS skills promote physical activities and attain the recommended moderate-to-vigorous physical activity (MVPA) time (M. Wang & Wang, 2018) and have positive effects on student engagement, academic achievement, and improved levels of health and physical fitness (Mercan & Varol Selçuk,

2024).

- Cluster 6 (cyan) consisting of 7 items labelled 'The role of emotions in PE to build a foundation for lifelong physical activity'. The positive and negative emotions that students experience in physical education can be used to facilitate long-term engagement in physical activity, as well as strategies to create motivating learning experiences. Promoting social skills, cultural understanding and knowledge relating to the environment, alongside movement skills, is important in enabling participants to engage, and sustain their engagement in informal participation (O'Connor & Penney, 2020). Students reported a wide range of positive and negative emotions triggered by task attraction, social belonging, competence and autonomy that can be used to build a foundation for lifelong physical activity (Leisterer, 2019). Study results revealed the use of TGfU/SE hybrid units encouraged students to assume responsibility and make decisions independently, increasing enjoyment and competence compared to traditional direct teaching models (Gil-Arias et al., 2018).

Co-word analysis

Co-word analysis aims to decipher the content of each thematic cluster and can provide predictions for future research (Donthu et al., 2021). Co-word analysis was conducted in the same way as Bibliographic coupling analysis. The co-word analysis of as many as 55 met the threshold of 2333 with a minimum cooccurrence of keywords of 10. As a result, the network visualization depicted in Figure 3 and representative keywords (see Table 8) were obtained from 3 clusters, namely clusters 1 (red), 2 (green), and 3 (yellow).

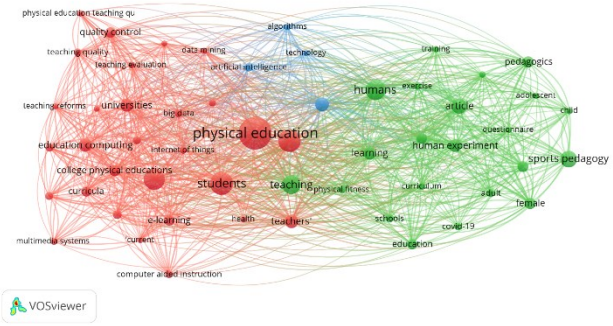

Figure 3. Network Visualization Co-Occurrence All Keywords Analyse

Table 8.
Co-word analysis on PE pedagogies

Cluster No and colour	Cluster label	Number of keywords	Representative Keywords
1 (Red)	"Integrating Technology and Reform for Enhanced Physical Education Learning in Universities"	29	physical education teaching, teaching reform, teacher, student, universities, learning systems, elearning, education computing
2 (Green)	"Integrative Approaches in Sport Pedagogy for Physical Fitness and Activity Across Lifespan and Genders"	22	sport pedagogy, teaching, learning, curriculum, physical fitness, physical activity, exercise, schools, adult, adolencent, child, male, female
3 (Blue)	"Transforming Physical Education and Training Through Technology and AI "	4	Physical education and training, technology, artificial intelegency, algorithms

- Cluster 1 is red with 29 items labelled 'Integrating technology and reform for enhanced physical education learning in universities". Modern learning systems and technology can revolutionise teaching methodologies, increase student engagement, and support teachers in delivering more effective and dynamic education. The integration of modern information technology helps students to participate in the process of sports practice and form a comprehensive understanding of the value of dual education in PE (Jin & Zou, 2022). Reform efforts can be utilised to improve evolving teaching practices and meet student needs and Education standards. Sargent and Calderón (2021) state used as a substitute for teachers rather than transformative in teaching and learning. Gawrisch, Richards, and Killian (2020) recommend a four-phase approach to assist teacher candidates in implementing technology-integrated teaching: building knowledge and learning to appreciate technology, observing and exploring through instructor modelling and integration, experimenting and collaborating with mentoring and scaffolding, and discovering through innovation and utilization.

- Cluster 2 (green) with 22 items labeled "Integrative Approaches in Sport Pedagogy for Physical Fitness and Activity Across Lifespan and Genders". Sport pedagogy can be used to develop effective teaching and learning strategies within the school curriculum to promote physical fitness and activity. The development of sport pedagogy can consider the unique needs and experiences of different age groups aiming to create inclusive and engaging physical education programs. Practical applications of life skills coaching are implicitly and explicitly implemented. Developing a philosophy for positive youth development (PYD) coaching, using a strengths-based approach, building a prosocial team culture, promoting positive relationships, and supporting youth autonomy are some examples of implicit and explicit life skills coaching practices. In addition, explicit coaching practices include talking about and teaching life skills, providing opportunities to participate in sport, offering opportunities to participate in sport, and providing immediate feedback to improve life skills transfer (Newman et al., 2023). Both implicitly and explicitly selected by coaches for the life-skills development and transfer process (Martin & Camiré, 2020). Regular exercise such as resistance training has been shown to have significant positive

effects on physical health, cognitive function and academic performance (Fraile-Martinez et al., 2024).

- Cluster 3 (blue) with 4 items "Transforming Physical Education and Training Through Technology and AI". Advancements in technology, artificial intelligence, and algorithms are revolutionizing physical education and training. It examines the potential of these tools to enhance teaching methods, personalize training programs, and optimize performance in both educational and athletic settings. These transformations require the development and implementation of new approaches to education (Chodzko-Zajko, 2023). Optimizing PE in the digital age requires not only embracing technological advances, but also addressing its complexities involving educational management, cooperative and blended learning, and curriculum innovation (Mulato et al., 2024). Furthermore, technology in PE has made tremendous progress but there are challenges in its application (Yao, 2023).

Discussion

Trend Research

This bibliometric analysis was conducted to review the trend of Scopus database publications related to the application of pedagogical models in PE teaching and learning. This analysis is important because it is useful for institutions related to research to determine policies related to funding allocation and compare scientific input and output. The results of the analysis of the distribution of publication growth show that the trend of publication of articles related to the scope of physical education pedagogie is relatively fluctuating. The number of publications produced had experienced a decline and began to increase in 2018 and peaked in 2022. ranging from eight to eleven article publications. Keith Davids is the most productive author in producing papers related to PE pedagogies both in terms of the number of articles and citations. The articles that have been published by Keith Davids include the changing conceptions of the teaching and learning process (Moy et al., 2019) and physical education recruits' experiences of an alternative pedagogical approach to games teaching (Moy et al., 2016)).

Based on the analysis of the distribution of the author's country of origin, China is the country that produces the most article publications with a total of 175 articles related to PE learning implemented with online, hybrid, and digital approaches (Cui, 2022; X. Ding et al., 2022; Guo, 2022; Li & Wang, 2022; Meng, 2021; F. Wang, 2021; G. Wang, 2022; H. Wang & Huang, 2021; Yu, 2022). Furthermore, based on the number of citations, United Kindom is the country of origin of the author with the highest number of citations. Authors from the United Kingdom focus on research related to PE teaching practices by pre-service and in-service teachers (Carter-Roberts et al., 2021; Durden-Myers & Keegan, 2019; Johnson et al., 2018; Lamb & King, 2021; Makopoulou et al., 2022; O'Leary et al., 2020).

Bibliographic coupling analysis revealed that current research trends focus on the integration of innovative teaching practices, alternative pedagogical approaches, and the promotion of holistic student development in order to cope with the evolving PE. In order for teaching practices to continue to evolve, it is important for PETE educators to provide opportunities for PETE students to progressively develop their experiential knowledge and conceptual understanding of the exploratory learning processes underpinning the nonlinear approach (Moy et al., 2019). The approach is designed to reshape students' perceptions and beliefs, fostering a more inclusive and motivating learning environment that is in line with contemporary educational goals. The application of the Tactical Approach in PE emphasizes the importance of methodology in developing critical game-related skills, tactical knowledge, and decision-making ability. Several studies revealed that tactical approaches through games can promote PA levels especially in primary schools (Breed et al., 2024), positively impact student engagement, academic achievement, and improved levels of health and physical fitness (Mercan & Varol Selçuk, 2024), increase learning engagement and game performance (Mahardhika et al., 2024), and improve learning outcomes (Molina-Torres et al., 2021).

The role of PE in developing motor skills and promoting health is critical to promoting long-term health, academic success and lifelong physical activity. In this case, Schools have a very important role through determining well-planned teaching-learning strategies to overcome barriers in the learning process. This is because primary school age is a time when FMS increases with age, especially locomotor skills compared to object control skills (Bolger et al., 2021). Quality and quantity-based PE interventions can be associated with improvements in fitness components and basic motor skills by considering the level of active learning time and balanced with opportunities for instruction, feedback, and reflection (García-Hermoso et al., 2020).

The co-word analysis revealed that future research trends focus on utilizing technology and integrative approaches for transformative PE. Technology and integrative approaches can make PE teaching more effective, inclusive, and adaptable to the needs of modern learners to promote lifelong physical fitness and well-being. Integrating modern information technology and systematic reforms is not only a replacement for traditional teaching methods but also a transformative tool that enhances student engagement and supports dynamic educational experiences. Study results by Sargent and Casey (2019) revealed that the use of flipped learning and DigiTech supports teachers' teaching because it can optimize lesson time to support their PE students' exams. In addition, the use of virtual reality systems in college PE has good applicability and promotion effects (Y. Ding et al., 2020). The development of AI technologies such as AR, VR, and the Internet of Things removes the limitations in PE, individualized learning, and customized education, thereby improving students' learning performance. In addition, AI effectively identifies each student's athletic ability,

compiles data, and provides real-time feedback to produce optimal results. Furthermore, AI encourages student interest and maintains student learning motivation (Lee & Lee, 2021).

Future research implication

The findings obtained from Bibliographic coupling analysis provide new trends related to PE pedagogies. As indicated by cluster 1, there is a need to strengthen the study of PE teaching practices related to student-centered teaching and learning, especially for pre-service teachers (PSTs). This strengthening needs to be done by implementing alternative approaches in PETE' (cluster 2). PETE programs need to explicitly present social justice and educate PSTs on sociocultural and social justice issues (cluster 4). Moy et al. (2019) recommends the need to develop exploratory learning underpinned by a nonlinear approach to progressively develop knowledge, experience and conceptual understanding. In addition, strengthening PE teaching practices related to student-centered teaching and learning can be done by implementing a tactical approach (cluster 3). The tactical approach has a positive impact on the achievement of student learning outcomes, but in the application process many teachers are still difficult to change. (Casey & MacPhail, 2018) and lacking in keeping up with technological developments and weak in collaboration (Bodsworth, 2017). For this reason, a study is needed that can provide to generate more scientific evidence based on its application in the classroom (Hernando-Garijo et al., 2021). Furthermore, Barquero-Ruiz et al. (2019) recommends that researchers should use validated instruments following the guidelines that have been determined.

New trends resulting from the Bibliography merge analysis related to the role of PE in motor skill development, promoting lifelong health and physical activity (cluster 5) and the role of emotions in PE learning (cluster 6). These findings reinforce the need for motor skills interventions in early education settings as motor skills are positively associated with physical activity and other health outcomes (Bolger et al., 2021). Interventions can be conducted using a play approach as it can increase perceived competence in learning, enjoyment and motivation, decision-making, and understanding (Cocca et al., 2020; Morales-Belando et al., 2022), increase moderate and vigorous physical activity and fitness (Wang & Wang, 2018; Segovia & Gutiérrez, 2022), and contribute to shaping behaviour (Sarmantayev et al., 2020).

Future trends discovered in the co-word analysis should focus on utilizing technology and artificial intelligence as integrative approaches for transformative PE. Integrating modern information technologies and systematic reforms in PE at the university level are revolutionizing teaching methodologies as transformative tools that enhance student engagement and support dynamic educational experiences (cluster 1). Sport pedagogy is critical in developing inclusive and engaging physical education programs that meet individuals' physical fitness and activity needs across different age groups and genders (cluster 2). Integration of AI in PE teaching (cluster 3). These three clusters present a forward-looking perspective on how the use of technology and integrative approaches can shape PE pedagogies to be more effective, inclusive, and adaptable to the needs of modern students. Future studies could further examine the effectiveness of online teaching and learning and research supporting the PETE programs to prepare PSTs for online teaching (Murtagh et al., 2023). Experimental studies are also needed to make quantitative comparisons and validation through comparative studies of traditional PE that do not use AI (Lee & Lee, 2021).

Conclusion

A bibliometric approach was used to review articles related to physical education pedagogies. The study involved 419 relevant articles from the Scopus database published between 2014-2023. Analysis of publication growth patterns, distribution of publication growth, distribution of authors conducting publications and distribution of country and affiliation of origin of authors, and network analysis based on keyword occurrence to identify research trends related to physical education pedagogies. The study concluded that the contribution of research on physical education pedagogies in the period 2014-2023 shows that there has been a positive trend of increasing the number of published articles starting in 2018 and peaking in 2022. This finding also shows that research related to PE pedagogies has been carried out by many researchers around the world. Based on the bibliography analysis, the themes that emerged as current trends related to the integration of innovative teaching practices, alternative pedagogical approaches, and the promotion of holistic student development in order to cope with the development of PE. At the same time, the co-word analysis reveals further research streams that include technology utilisation and integrative approaches to transformative PE. Combining technological advancements with pedagogical strategies allows PE to evolve to meet the demands of the digital age while promoting lifelong physical fitness and well-being. The findings of this study have practical and theoretical implications for the research and practice of physical education pedagogies. The findings regarding research trends can be an input for researchers and educators to identify integration and strategies related to physical education pedagogies. The study conducted has limitations in only analyzing articles on the Scopus database. This is based on VOSViewer's limited use of bibliographic data from one database at a time. In addition, each database has different bibliographic patterns making it difficult to combine and analyze using the application. Future research can be done by trying to perform bibliometric analysis on the combined data set to overcome this limitation..

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