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PHYSICAL EDUCATION AND SPORTS: BIBLIOMETRIC ANALYSIS OF THE ERIC DATABASE

Research article

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Abstract

In respect to the growing interest in physical education and sports, the state of this large number of scientific literature and the bibliometric analysis has not been conducted. The purpose of this study to investigate the literature involved physical education and sports topics regarding the descriptive bibliometric analysis. We gathered the open-access data from ERIC within the permission of this database for non-commercial data usages. After a systematic query whole, ERIC database scrapped between the 2010-2019 year and retrieved a total of 365861 journal articles considered of 25573 articles as physical education and sports-related. There were 7581 articles published at the top 25journals (% 29.64). Subjects analysis according to "Physical education" was the commonly associated topic in this field. The findings of this study observed that the ERIC database covered a huge number of articles regarding PE and sports topics. Dynamics of the research literature suggest the US was the first contributor country to both authors and articles. Hence, we conducted a descriptive analysis of the literature indexed in the ERIC database theme include physical education and sports. This study provided a bibliometric analysis of an enormous number of articles after filtering the biggest education basis database.

Keywords: bibliometric analysis, physical education, sports, ERIC database

1. Introduction

The Education Resources Information Center (ERIC) is an online digital library for educational studies and information sponsored by a public institute (Institute of Education Sciences of the United States Department of Education) since 1966. The coverage of the ERIC database provides variety's types of publications such as journal articles, books, conference papers, thesis, reports, etc. This extensive education database includes over 1000 journals, 1.6 million items and 350,000 accessible full-text materials (Rudner, 1999). However, this tremendous amount of materials considered as "grey literature" because of a portion of reports and conference papers. Therefore, it is important to bibliometric analysis of this growing literature to understanding trend topics in the related area and impacts to both journals and researchers ("National Center for Education Evaluation and Regional Assistance (NCEE)

Home Page, a part of the U.S. Department of Education.," 2020). The ERIC index is essential for education researchers related to physical education (PE) and sports cause of vulnerable contribution to the area with underlining the importance of physical activity and revelation of the standards for PE (Young, 1997). Bibliometric analysis affords priority and tendency of the researchers, which is useful information to the indicator of the subject impacts of published articles in these journals. Moreover, the in-depth analysis is also useful to determine if it may achieve the major topics or trends in the area to develop and implementation of education goals regarding PE and sports (Shilbury, 2011). Previous studies conducted to the analysis of the literature for the sport management by the searching Web of Science (Belfiore, Iovino, & Tafuri, 2019; Shilbury, 2011). The study investigated by Khoo et al., applied a variation of the methodology, which focused on citations of the publications for bibliometric analysis in disability sport (Khoo, Li, Ansari, & skills, 2018). In another research paper, Završnik et al., analyzed the literature based on sports education to identify the most productive research topics regarding a special sports education model that used in curriculums of the elementary and high school (E. Zavrsnik, Kokol, Pisot, Blazun, & Sport, 2015). However, this study performed the searching keywords in the Scopus database (Scopus, Elsevier) is a commercial database service. Further, there is a wide application of the bibliometric analysis in special references to different sports disciplines such as judo, badminton, and soccer (Blanca-Torres, Ortega, Nikolaidis, & Torres-Luque, 2020; Brito, Nassis, Seabra, Figueiredo, & medicine, 2018; Peset Mancebo et al., 2013). Nevertheless, to date, there is a not linked or unified gap of analyzed literature throughout the widely published scientific articles in the area of physical education and sports regarding ERIC database which is one of most inclusionary educational databases. The aim of this study is to identify of the literature involved physical education and sports topics regarding the descriptive bibliometric analysis.

2. Method

We gathered the open-access data from ERIC within the permission of this database for non-commercial data usages. We applied a custom-made query because of the ERIC database covered other educational studies. ERIC indexed materials in ERIC gains title, authors, subjects, publishers, sponsors (if exists), type (journal articles, books, dissertations, reports, conference papers, etc.), sources (journal name, publishers), and year information.

We excluded the other resources and searched for only articles. After a systematic query whole ERIC database scrapped between2010-2019 year and collected a total of 365861 journal articles. Twentynine mandatory and 71 sports science-related subjects determined and keywords from the area created (Table 1). Including criteria of articles based on our query rules “Selected sports science-related topics AND Related keywords in abstracts) OR Selected mandatory topics” as shown in Figure 1.

Table 1 *The subjects and keywords used throughout the selection of articles*

Mandatory subjects	Related subjects	Keywords	
Physical Education	Skill Development	Athlete	Drop jump
Training	Performance Factors	Athletes	Body fat
Physical Activities	Health Promotion	Athletic	Muscle
Coaching (Performance)	Evaluation	Swimming	Skeletal muscle
Athletics	Measurement	Athletics	Slow twitch
Physical Activity Level	Measurement Techniques	Coach *	Glycogen
Team Sports	Health Education	Coaching *	Creatine kinase
Athletes	Child Health	Detraining	ATP
Intramural Athletics	Teaching Skills	Exercise *	Tennis
Physical Health	Performance	Exercise physiology	Creatine phosphate
Physical Fitness	Public Health	Fitness	Agility
College Athletics	Physiology	Health-related	Wrestling
Athletic Coaches	Health	Camps	Biomechanics
Exercise Physiology	Exercise	Physical activity	Biochemistry
Health Related Fitness	Skill Analysis	Physical education	Injury
Aquatic Sports	Measurement Equipment	Recreation	Heart rate
Team Training	Medicine	Sport	Cardiac output
Sports	Decision Making Skills	Sports	Running
Sport Psychology	Performance Technology	Team sports	Distance covered
Racquet Sports	Physical Therapy	Training *	Badminton
Sports Medicine	Fatigue (Biology)	Soccer	Pretest *
Sportsmanship	Medical Evaluation	Handball	Pre-test *
Women's Athletics	Cognitive Measurement	Basketball	Wearable
Student Athletes	Health Sciences	Volleyball	IMU
Extramural Athletics	Physical Characteristics	Olympic	Acceleration
Adapted Physical Education	Therapeutic Recreation	Countermovement jump	Football
	Student Eval. of Teacher Perf.		
Physical Recreation Programs	Student Teacher Evaluation	Athletic performance	Netball
Physical Education Facilities	Physical Mobility	Aerobic	Adenosine triphosphate
Physical Education Teachers	Test Coaching	Anaerobic	Change of direction
	Volunteer Training	Kinesiology	
	Retraining	Anthropometric	
	Health Activities	VO2max	
	Vocational Training Centers	Lactate	
	Preventive Medicine	Endurance	
	Teacher Skills	Strength *	
	Recreational Activities	Power *	
	Recreation	Resistance Training	
	Physical Development	Plates	
	School Recreational Programs	Throwing	
	Ppysical Performance	Gymnastic	

* Although being essential keywords, we excluded those because of confused with other educational technical terms and retrieved unrelated materials.

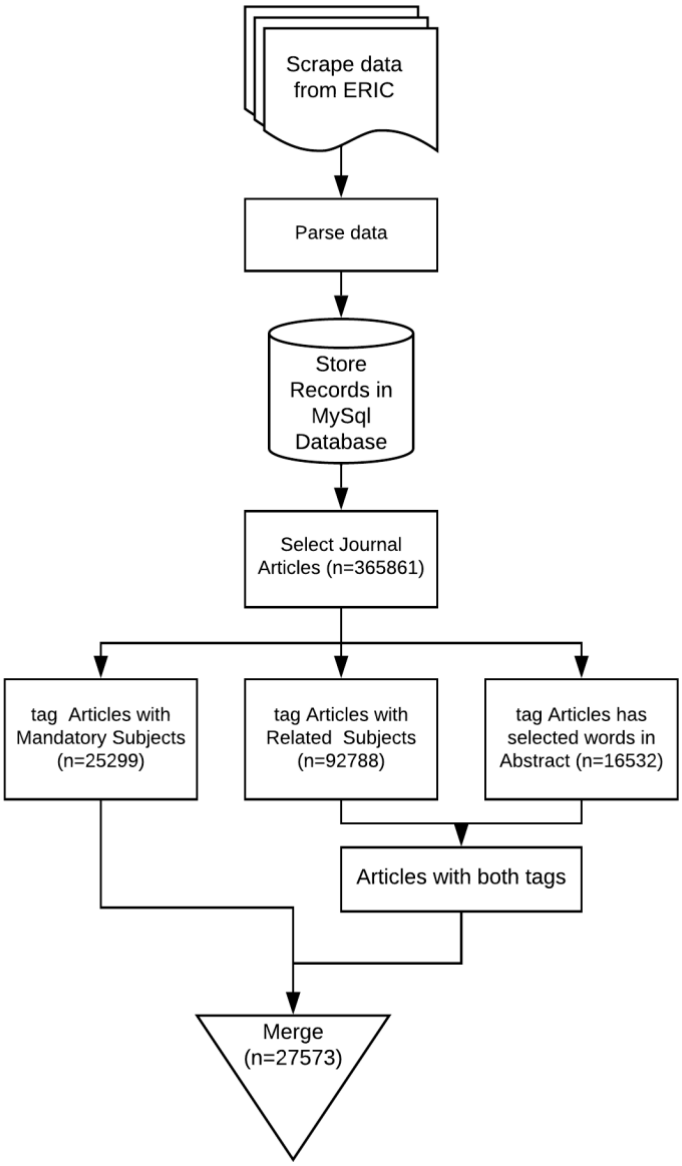

Figure 1 The searching algorithm of the ERIC database.

We performed a distribution of articles for each year along 10-year. The most article published journals generated and top 25 journals considered as most preferred sources. During the publishing, the article most set out topics found, and top 25 subjects listed. We performed a distribution of subjects for each year along 10-year. Top 25 country listed from geographic data processed articles from our database (n=16398). Number of owned articles of authors listed top 25 authors included for most influential authors. Country and institutional information provided from web-based searching for each author. In this study we visualized by creating the word cloud for subjects and titles of included articles. Word cloud sorts of the words the selected text according to most frequently used words and displays that words bigger and closer to the center of cloud. During the word cloud process for the title we exclude the propositions, conjunctions, pronouns, numbers, definite articles.

3. Results

In this study, we retrieved total 365861 journal articles for 10 years period and considered of 25573 articles as physical education and sports related. The number of articles published each year was similar whereas the fewest articles in 2013 and the highest one in 2017.

When we examine the source of the articles, there were 1542 different journals. There were 7581 articles published at the top 25 journals (% 29.64). In this ranking Research Quarterly for Exercise and Sport was the first journal with 644 articles (Table2).

Table 2 *Geographical and source analysis of articles: The countries and journals top 25.*

Country	Number of articles	Journals as source	Number of articles
United States	5031	Research Quarterly for Exercise and Sport	644
United Kingdom	1582	Sport, Education and Society	528
Australia	1199	Journal of Leadership Education	447
Turkey	1130	Strategies: A Journal for Physical and Sport Educators	446
Canada	863	Journal of Physical Education, Recreation & Dance	443
China	336	European Physical Education Review	408
Spain	290	Physical Educator	380
New Zealand	288	Physical Education and Sport Pedagogy	362
Germany	271	Journal of School Health	336
Sweden	256	Journal of Teaching in Physical Education	324
Netherlands	230	Journal of Education and Training Studies	319
South Africa	217	Athletic Training Education Journal	308
Ireland	190	Health Education & Behavior	247
Finland	173	Quest	245
Norway	172	Journal of Social Work Education	230
Taiwan	149	Measurement in Physical Education and Exercise Science	226
Hong Kong	147	Journal of Extension	226
Greece	142	Health Education Journal	212
France	141	Health Education Research	210
Georgia	138	Universal Journal of Educational Research	190
Russia	134	Educational Research and Reviews	185
Brazil	126	Counselor Education and Supervision	175
Iran	126	Online Submission	173
India	117	Research in Developmental Disabilities: A Multidisciplinary Journal	160
Korea	115	Journal of Physical Education, Recreation & Dance (JOPERD)	157

The most common geographical contribution on the topic observed from United States. Following countries were the United Kingdom and Australia and Turkey which took part with more than one thousand articles. The top 25 countries associated a total of 13563 articles which covered more than % 53 of generally published articles (Table 2).

Subjects analysis according to years indicated that "Physical education" was the commonly associated topic in this field. Physical education assigned as the first subject in six of ten years whereas found place in the top three in these exceptional years (Table 3).

Table 3 *Subjects distribution of the published articles according to the years.*

2010 (2452 articles)		**2011 (2867 articles)**		**2012 (2892 articles)**		**2013 (1515 articles)**		**2014 (3016 articles)**	
Subjects	*No*	*Subjects*	*No*	*Subjects*	*No*	*Subjects*	*No*	*Subjects*	*No*
Evaluation Methods	425	Physical Education	513	Physical Education	418	Physical Activities	227	Physical Education	529
Physical Activities	340	Physical Activities	446	Physical Activities	382	Physical Education	176	Physical Activities	369
Physical Education	315	Evaluation Methods	384	Evaluation Methods	283	Counselor Training	162	Skill Development	342
Evaluation	264	Training	273	Training	280	Training	161	Training	291
Skill Development	222	Skill Development	247	Leadership Training	271	Transfer of Training	135	Program Evaluation	254
Counselor Training	211	Mental Health	235	Skill Development	271	Skill Development	121	Physical Education Teachers	245
Mental Health	204	Athletics	233	Performance Factors	242	Mental Health	99	Physical Activity Level	243
Training	196	Health Promotion	205	Counselor Training	234	Program Evaluation	98	Transfer of Training	224
Health Promotion	186	Performance Factors	198	Training Methods	222	Coaching (Performance)	93	Leadership Training	223
Program Evaluation	186	Evaluation	197	Mental Health	209	Health Promotion	92	Health Promotion	218
Student Evaluation	177	Counselor Training	196	Program Evaluation	199	Evaluation Methods	89	Coaching (Performance)	216
Physical Activity Level	164	Physical Activity Level	195	Athletics	195	Physical Education Teachers	84	Student Evaluation	215
Leadership Training	161	Leadership Training	191	Transfer of Training	176	Athletics	83	Athletics	213
Physical Health	155	Physical Education Teachers	189	Physical Education Teachers	175	Leadership Training	83	Evaluation Methods	207
Health Behavior	141	Program Evaluation	186	Physical Activity Level	171	Physical Activity Level	81	Health Behavior	207
Athletics	140	Transfer of Training	168	Health Education	149	Performance Factors	79	Counselor Training	195
Transfer of Training	140	Training Methods	165	Health Promotion	149	Evaluation	76	Health Education	171

Performance Factors	132	Physical Health	148	Student Evaluation	147	Training Methods	74	Mental Health	151
Physical Education Teachers	131	Health Behavior	144	Coaching (Performance)	146	Health Behavior	72	Team Sports	140
Health Education	129	Health Education	142	Physical Health	143	Measurement	71	Performance Factors	135
Training Methods	116	Student Evaluation	139	Measurement	140	Student Evaluation	70	Training Methods	132
Child Health	115	Health Services	131	Evaluation	136	Team Sports	70	Physical Fitness	115
Team Sports	114	Team Sports	112	Athletes	125	Physical Health	67	Athletes	114
Athletes	110	Physical Fitness	110	Health Behavior	111	Athletes	66	Child Health	114
Measurement Techniques	103	Measurement	109	Team Sports	109	Physical Fitness	58	Exercise	106

2015 (2832 articles)		**2016 (2912 articles)**		**2017 (3128 articles)**		**2018 (2951 articles)**		**2019 (3008 articles)**	
Subjects	No	Subjects	No	Subjects	No	Subjects	No	Subjects	No
Skill Development	467	Physical Education	452	Leadership Training	568	Physical Education	508	Physical Education	464
Physical Education	405	Skill Development	421	Skill Development	454	Physical Activities	364	Skill Development	434
Training	341	Training	352	Physical Education	405	Skill Development	361	Training	378
Physical Activities	294	Physical Activities	315	Training	372	Training	334	Physical Activities	347
Program Evaluation	264	Athletics	260	Physical Activities	289	Athletics	331	Athletics	330
Transfer of Training	246	Transfer of Training	232	Athletics	242	Team Sports	256	Leadership Training	271
Leadership Training	243	Leadership Training	224	Evaluation Methods	227	Physical Education Teachers	242	Transfer of Training	250
Coaching (Performance)	242	Program Evaluation	211	Coaching (Performance)	224	Athletes	237	Physical Education Teachers	234
Athletics	226	Coaching (Performance)	200	Transfer of Training	224	Leadership Training	236	Coaching (Performance)	225
Evaluation Methods	210	Health Promotion	194	Physical Education Teachers	219	Physical Activity Level	206	Physical Activity Level	220
Health Promotion	210	Physical Activity Level	191	Training Methods	207	Coaching (Performance)	196	Team Sports	214
Physical Activity Level	204	Evaluation Methods	180	Program Evaluation	203	Transfer of Training	195	Mental Health	197

Student Evaluation	200	Physical Education Teachers	178	Physical Activity Level	178	Counselor Training	167	Counselor Training	187
Training Methods	200	Counselor Training	172	Student Evaluation	173	Evaluation Methods	153	Athletes	177
Physical Education Teachers	179	Student Evaluation	171	Counselor Training	145	Health Promotion	149	Health Promotion	175
Counselor Training	169	Training Methods	166	Mental Health	136	Program Evaluation	148	Health Behavior	167
Health Behavior	150	Mental Health	152	Athletes	130	Exercise	144	Student Evaluation	159
Health Education	131	Athletes	151	Team Sports	126	Student Evaluation	141	Evaluation Methods	142
Performance Factors	125	Health Behavior	139	Health Promotion	125	Health Behavior	139	Program Evaluation	131
Self Evaluation (Individuals)	115	Team Sports	135	Health Behavior	117	Mental Health	136	Exercise	125
Teaching Skills	104	Health Education	126	Teaching Skills	117	Health Education	114	Physical Fitness	108
Mental Health	100	Exercise	113	Health Education	111	Training Methods	108	Performance	104
Athletes	97	Self Evaluation (Individuals)	98	Formative Evaluation	104	Physical Fitness	103	Athletic Coaches	93
Exercise	94	Physical Fitness	97	Performance Factors	93	Measurement	96	Health Education	91
Measurement Techniques	94	Formative Evaluation	93	Self Evaluation (Individuals)	93	Performance	96	Physiology	87

The prominent subjects of all 10 years period were “Teaching methods and Student attitudes” (Figure 2).

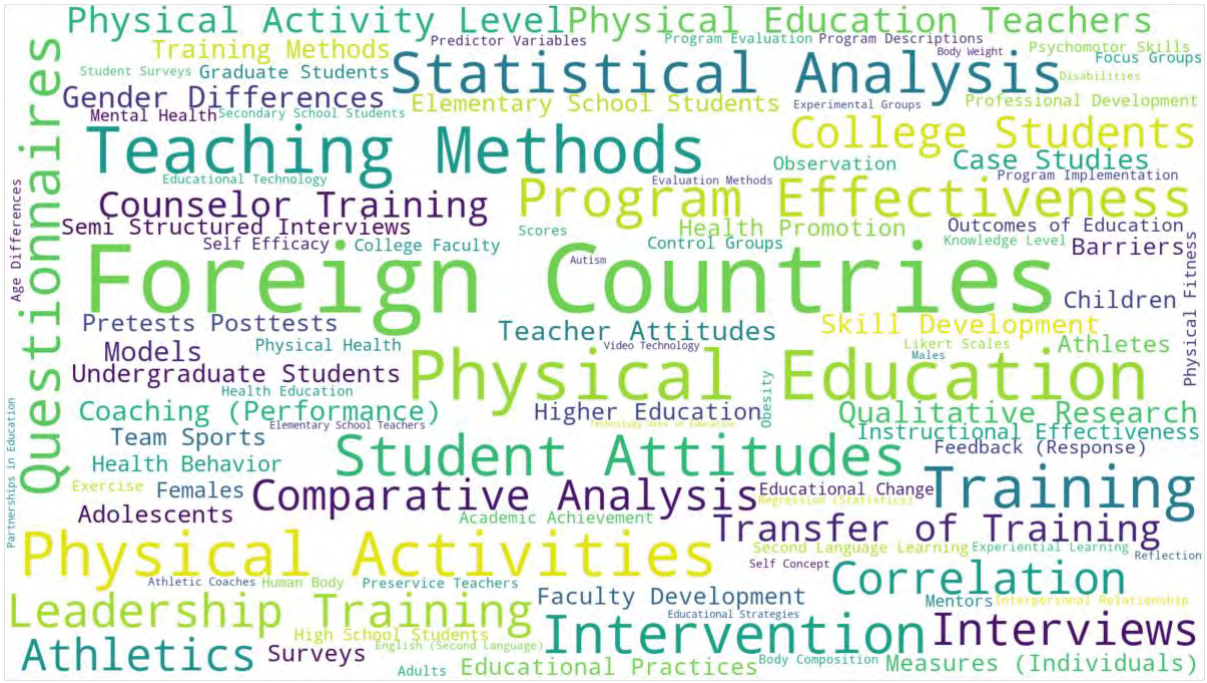

Figure 2 Word cloud of subjects of the all articles retrieved for 10-year.

Numbers of contributed authors on the sports science's topic found that 58083. As illustrated at the table 4, first 25 ranked authors published a total of 813 articles and most productive author has 67 articles. Investigation of the institutional analysis of the authors showed the domination of universities from the United States (18/25).

Table 4. *The most influential authors, number of articles and affiliations.*

Author	Articles no	Institution	Department	Country
Richards, K. Andrew R.	67	University of Illinois at Urbana-Champaign	Kinesiology and Community Health	United States
Mazerolle, Stephanie M.	53	University of Connecticut	Department of Kinesiology	United States
MacPhail, Ann	46	University of Limerick	Department of Physical Education and Sport Sciences	Ireland
Haegele, Justin A.	39	Old Dominion University	Department of Human Movement Sciences	United States
Penney, Dawn	37	Edith Cowan University.	School of Education	Australia
Kirk, David	35	University of Strathclyde	School of Education	Scotland
Ward, Phillip	34	The Ohio State University	Department of Human Sciences	United States
Bowman, Thomas G.	31	University of Lynchburg	*Athletic Training*	United States
Kulinna, Pamela Hodges	31	Arizona State University,	Mary Lou Fulton Teachers College	United States
Hastie, Peter A.	30	Auburn University	School of Kinesiology	United States
Quennerstedt, Mikael	30	Örebro University	School of Health Sciences	Sweden
Zhu, Xihe	30	Old Dominion University	Department of Human Movement Sciences	United States
Harvey, Stephen	30	Ohio University	Recreation and Sports Pedagogy	United States
Cardinal, Bradley J.	29	Oregon State University	College of Public Health and Human Sciences	United States
Macdonald, Doune	29	University of Queensland	School of Human Movement Studies	Australia
Casey, Ashley	29	Loughborough University	School of Sport, Exercise and Health Sciences	United Kingdom
Li, Weidong	28	The Ohio State University	Department of Human Sciences	United States
Pill, Shane	28	Flinders University	College of Education	Australia
Sato, Takahiro	27	Kent State University	School of Teaching	United States
van der Mars, Hans	27	Arizona State University,	Mary Lou Fulton Teachers College	United States
Webster, Collin A.	27	University of South Carolina	College of Education,Physical Education	United States
McCaughtry, Nate	24	Wayne State University	Kinesiology, Health and Sport Studies	United States
Xiang, Ping	24	Texas A&M University	College of Education and Human Development	United States
Beighle, Aaron	24	University of Kentucky	College of Education	United States
Judge, Lawrence W.	24	Ball State University	School of Kinesiology	United States

We performed further analysis to understand real attitude of the articles, words counted in the titles of the publications. As shown in the word cloud (Figure 3) most frequently words used in the titles were "Physical education; Physical activity; Training; Learning; Development; Student and Teacher".

Figure 3 Visualization of most frequently take part words in the title.

4. Discussion

The current study was carried out to highlight the current knowledge on a solidify topic (PE and sports) within its tendency that useful to guide the researchers for future studies. One of the importance of this study considering that no bibliometric research in sports science for the ERIC database. The findings of this study observed that the ERIC database covered a huge number of articles regarding PE and sports topics. Dynamics of the research literature suggest the US was the first contributor country to both authors and articles. In addition, physical education and physical activity and educational basis topics more attractive subjects compared to athletic performance.

Research subject distribution and title word analysis results showed that major topics in the ERIC database was physical education, physical activities, physical activity level, learning, teaching, and coaching in the last 10 years. This may be partly explained by the educational basis index covers more publications in relation with program developing, teaching or students attitudes and behaviors in physical education. Similarly, there was a high network density of title and abstract in terms of education thematic analysis in sport entrepreneurship (González-Serrano, Jones, & Llanos-Contrera, 2019). Current journal analysis also supported the educational priority in the ERIC publications. We observed that journals namely "*Sport, Education and Society; Strategies: A Journal for Physical and Sport Educators; Journal of Physical Education, Recreation & Dance; European Physical Education Review; Physical Educator; Physical Education and Sport Pedagogy; Journal of Teaching in Physical Education, and Journal of Education and Training Studies*" have placed in top 25. However, we did not consider the languages except English. Moreover, the current study did not take into account the other publication types except original articles. One of the methodological differences of this study was an article commonly assigned over one subject by the ERIC database.

Current study considered the last decade of PE and sports-related publications, authors, journals, and subjects in the ERIC database. Interestingly, the first ranking country that

contributed to the PE and sports area was the United States. Moreover, the most productive authors' in this study were also US residential institutions. An explanation for this result was education and sports are restricted related in the US, with common high schools and colleges have organized sports team determined by the cultural contexts (Pot & van Hilvoorde, 2013). College football and basketball tournaments are very famous organizations in the US that performed under the National Collegiate Athletic Association (NCAA). Therefore, it is not a surprise to these teams, athletes, and students demanding more scientific knowledge and more employment of the sports scientists produce more articles. Another possible explanation to this result was countries that giving more importance to the athletic programs and Olympic, also more active in the academic publishing in the PE and sports area. In a supporting study, researchers analyzed on technological usage in PE focused on Web of Science publications and found that articles merge in last 5-year. In agreement with our results, the United States was an efficient contributor country in the technology area, whereas Spain was the most influential one on virtual or augmented reality studies (Calabuig-Moreno, González-Serrano, Fombona, & García-Tascón, 2020). Further, in the bibliometric study of combat sports US dominance on scientific contribution revealed similar with current findings (Gutiérrez García, Pérez Gutiérrez, & Calderón Tuero, 2011). In the study that sport, education and society based bibliometric analysis querying from the Scopus database Završnik et al., showed that US occupied the first rank for most productive country (J. Zavrsnik et al., 2016).

The previous studies focused on bibliometric analysis for the sports science area regarding the country, continent, or society. In the study researched the development of Chinese sports sciences literature, Zhang emphasized the importance of academic thesis and increased multidisciplinary collaboration. However, they found that social and psychology subjects covered most of the literature instead of a lower percentage of physical education (Zhang & Education, 2017). This result may be explained by searching only Chinese databases. Similarly, Andrade et al., investigated another geographical based bibliometric analysis on South American sports sciences literature (Andrade, López, Ramírez-Campillo, Beltrán, & Rodríguez, 2013). Contradictory to our results, they found that most of the scientific papers from this continent were sports medicine related topics such as physiology, orthopedic and rehabilitation (Andrade et al., 2013). However, their searching algorithm included Web of Science and excluded other databases. In another study, Fares et al., took attention to sport and exercise medicine regarding the last 15 years for Arab society. They demonstrated that growing literature and scientific productivity is related to sport and exercise medicine (Fares, Fares, Baydoun, Fares, & medicine, 2017). We could not compare with current findings because they did not analyze the topics. Most published number of articles from Qatar and Tunisia first ranked country respect to the articles per average gross domestic product. These countries have no association with ERIC database materials where current analysis got five articles for Qatar and six for Tunisia.

5. Limitations and conclusion

Current findings limited to 10-year period and ERIC database for PE and sports-related topics and keywords. Further research needed to analyze the author's network and citation interactions to understand what quantities required for being addressed in an effective publication. Last decade researches consolidate to citation analysis in this kind of bibliometric study (Müller, 2015). Hence, we conducted a descriptive analysis of the literature indexed in the ERIC database between the 2010-2019 theme include physical education and sports. This study provided a bibliometric analysis of an enormous number of articles after filtering the biggest education basis database.

6. Conflict of Interest

The authors declare that there is no conflict of interest.

7. Ethics Committee Approval

The authors confirm that the study does not need ethics committee approval according to the research integrity rules in their country.

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