Journal of Pedagogical Research
Volume 6, Issue 3, 2022
https://doi.org/10.33902/JPR.202214054

Review Article

A bibliometric analysis informed reading list for physical educators

James D. Wyant[1], Adam Keath[2] and Jun-Hyung Baek[3]

[1]*West Virginia University, United States (ORCID: 0000-0002-8608-8685)*
[2]*Winthrop University, United States (ORCID: 0000-0001-5196-3403)*
[3]*Gyeongin National University of Education, South Korea (ORCID: 0000-0001-7423-8634)*

Since the inception of the Every Student Succeeds Act [ESSA] of 2016, the US has brought focus to the role that research and evidence should play into the decision-making process of stakeholders [ESSA, 2015]. As members of the field turn to research and the knowledge base at large to shape practice, there is incentive to explore the knowledge base to pinpoint influential publications retrospectively. To that end, the focus of this study was to generate a summary of the key characteristics of the top-cited publications that pertain to different categories (e.g., cross-disciplinary, learners and learning, diversity and differences, teachers, teaching and teacher education, and physical education curriculum) relating to physical education (PE). Specifically, the focus was to create lists of the top 20 cited publications on different PE research categories. A systematic search on the Web of Science [WoS] was enacted using keywords related to PE. The research team independently reviewed the results and screened the top 20 lists. Extracted data provided points for further examination of the sum of citations, type of study, journal, authorship, and country of publication. As of September 15th, 2021, the top 20 lists have been cited 25,617 times. These publications have been disseminated across 48 different journals. On average, each publication had 3.6 authors, the USA and England as the leaders in terms of country of publication. In creating these top 20 lists of the top-cited publications involving PE, the research team hopes to provide members of the PE field with an easy to consume reading list of top-cited research and a concise summary of the publication characteristics.

Keywords: Physical education; Bibliometric analysis; Top-cited publications

Article History: Submitted 7 December 2021; Revised 7 March 2022; Published online 26 May 2022

1. Introduction

Since the inception of the Every Student Succeeds Act [ESSA] of 2016, the US has brought focus to the role that research and evidence should play into the decision-making process of stakeholders (ESSA, 2015). Implicit to this expectation is an increasing relevance of the connection between researchers and practitioners. More to this point, ESSA places a priority on schools and practitioners leveraging evidence-based programming. Specifically, ESSA's definition of evidence-based programming mentions the utilizing experiments, quasi-experiments, and theoretically informed practices to enhance student learning outcomes (ESSA, 2015). An unspoken, albeit emerging reality of the ESSA, is that the intended audience for scholarly products, such as research

Address of Corresponding Author

James D. Wyant, PhD, West Virginia University, College of Physical Activity and Sport Sciences, Coaching and Teaching Studies, 375 Birch Street/P.O. Box 6116, Morgantown, WV 26506, United States.

✉ jwyant2@mail.wvu.edu

How to cite: Wyant, J. D., Keath, A., & Baek, J. H. (2022). A bibliometric analysis informed reading list for physical educators. *Journal of Pedagogical Research, 6*(3), 1-16. https://doi.org/10.33902/JPR.202214054

articles, is evolving under current policy landscape. For academics who explore topics involving PE the intended audience now could range from professors to practitioners. Under the guidance of the ESSA, physical educators are encouraged to seek out research-based, theoretically informed programs to inform their practice. The challenge now may be for academics to consider how research products can be broadly accessible to members of the field. A goal, as other scholars have previously emphasized is for research to help those within the educational sphere (Farley-Ripple et al., 2017).

To further explicate the aim of this article imagine you are a physical educator who has been challenged to adopt research-informed practices more intentionally. The following questions may invariably need to be answered. Who are influential researchers in Physical Education [PE]? What research publications involving PE should members of the field seek out to inform their curriculum, pedagogical practices, and other essential matters related to teaching? What journal outlets are publishing research that involves PE? It can be argued that easy to decipher lists that provide insights into these questions could prove immensely helpful for members of the field. Moreover, what is at focus with this article is making research products easily accessible to the intended audience.

From a consumption perspective, the business world has long understood the value of lists. There are top lists for travel destinations, restaurants, vehicles, and universities, to name a few. Such lists allow people to find the information they are looking for quickly. There is evidentiary support for why people have an affinity toward lists. People tend to find ranked lists informative (Isaac et al., 2014), and the positional ranking on lists can influence the purchasing behavior of consumers (Sorensen, 2007). Thus, lists can be considered valuable tools to digest content and influence the behavior of individuals because people find them informative.

The incentive for creating lists can be further rationalized when considering recent estimates indicate that there are 2.5 million articles published each year (Warren, 2017). The notion of growth is further evident in PE where scholar have previously noted how researchers specializing in PE have grown over time (Marttinen et al., 2017; Silverman & Ennis, 2003). These researchers examine a range of specific categories such as curriculum, student learning, and teacher education, which are outlined in the Handbook of Physical Education [HPE] (Kirk et al., 2006), have been explored over the last few decades. Paralleling the broadening interest of topics is a more apparent cross-disciplinary scholarship in PE. For perspective, consider the increased presence of public health research and researchers in PE. As the scope of research topics involving PE has broadened, so have efforts to analyze the knowledge base retrospectively. From this perspective, questions arise around how scholars sort through large amounts of information. Therein lies the premise of this article, to create rank-ordered top 20 lists of top-cited PE research articles that focus on key topics that underpin the field as well as a product that caters to the consumption preferences of people.

The creation of lists of PE research is commonly in the form of review papers. From a general perspective, conducting a review is worthwhile as it offers a snapshot of the knowledge base (Hulland & Houston, 2020). More specific to PE, Kullina et al. (2009) lauded reviews of the knowledge base because they can provide members of the field with differential perspectives on what we know and do not know about a topic. Recent examples of scholars who have reviewed the PE knowledge base include a review of teacher socialization research (Richards et al., 2019), online and blended instruction (Killian et al., 2019) and cooperative learning (Casey et al., 2015). Review papers provide scholars with a list of relevant research.

A bibliometric analysis [BA], at its core, provides a snapshot of published research, trends, and the overall status of a research domain. Moreover, the bibliometric approach enables researchers to sort through large datasets to pinpoint influential articles (Priem, 2013). Specifically, the BA approach to reviewing the literature can identify top-cited publications, influential publications, active authors, geographical location, interest in topics, and methodological approaches (Fahimnia et al., 2015). The bibliometric approach has been previously adopted to analyze literature in medicine (De Felice et al., 2020), physical activity (Müller et al., 2018), and education (Huang et al.,

2020). In PE, Calabuig and colleagues (2020) used a BA to explore technology integration. Although several researchers implemented the BA to review literature in various fields, there is little research applying BA that identifies overarching topics, influential publications, active authors, and methodological approaches in PE. Therefore, this study aimed to determine the top-cited 20 research articles in categories of the knowledge base that have been described by Kirk et al. (2006). Assuming the BA approach will help provide a broad understanding of top-cited publications, most active authors, topics of interest, and likely trends in the literature. More importantly, the creation of top 20 lists will help organize top-cited PE research publications in a consolidated manner.

2. Method

A BA shaped formulation of the top 20 lists of influential research involving PE and use of the BA enables the research team to extract key characteristics of the publications. Specifically, the bibliometric approach can help to pinpoint information relating to the number of citations, publication outlet, topic, type of paper (i.e., review paper, quasi-experimental paper), and country of origin. The BA is also applicable when exploring a broad topic of interest (Donthu et al., 2021). The researchers assumed a citation analysis approach to inform the bibliometric approach further (Zupic & Cater, 2015). A citation analysis focuses on the number of citations, citations over time, average citations per year a publication has generated.

2.1. Research Data Platform

The research team selected the Web of Science (WoS; a product of Clarivate Analytics) Core Collection to conduct the BA. The selection of WoS as the data platform was largely shaped by it being a commonly adopted platform for BA studies (Leng et al., 2013). In addition, the WoS platform provides access to over 30,000 journals published worldwide (Clarivate, 2021). Another critical feature of WoS is creating Boolean operators, which can help specify the search strategy. For the purposes of this study, the research team was able to narrow the focus to publications that involved PE by using simple words, such as AND, OR, NOT, or AND NOT. Using the Boolean operator helps thwart erroneous publication inclusion when you search (Clarivate, 2021).

2.2. Bibliometric Data Collection

For this study, the research team focused on articles that included PE in the abstract, title, and/or the keywords using the field tag (TS – Topic and TI – Title) to pinpoint relevant research articles. While the Boolean operators mainly help to include relevant articles, there is potential for non-relevant articles in the dataset (Zupic & Cater, 2015). Therefore, settling on specific inclusion criteria is critical to counter this point. The inclusion criteria for this study were studies that involved PE, articles written in English, and peer-reviewed articles. Exclusion criteria were articles that did not clearly involve PE, articles written in non-English, and articles that were not peer-reviewed.

With the inclusion criteria guiding the search process, the research team collected articles involving PE within the WoS database. The initial search totaled 19,641 articles. Once collected, the dataset was sorted by total citations with the articles accumulating the most citations being at the top of the list. From here, the top 1000 articles were exported into a Microsoft Excel spreadsheet for further analysis and independent review by each member of the research team. The exported WoS data included the following information: author(s), title, journal, title, date of publication, geographical location, and the abstract.

2.3. Data Analysis

To promote the practical and material relevance of the data analysis approach, the research team used the HPE (Kirk et al., 2006) to formulate lists of influential articles that span topics of interest. Specifically, the research team deductively coded the top-cited articles based on Kirk et al.'s (2006) categories: (a) cross-disciplinary, (b) learners and learning, (c) teachers, teaching, and teacher

education, (d) PE curriculum, and (e) differences and diversity (see Table 1 for definitions and codes). It is important to note that theoretical perspectives, a category in the HPE, were not included in the data coding because there was a relative dearth of research articles exclusively focused on this topic.

Table 1
Definition of the HPE Categories (Kirk et al., 2006)

Category	*Definition*
Cross-disciplinary	Studies which have emphasis on different disciplines (e.g., public health, sociology) that research issues in the PE setting.
Learners and learning	Studies looked at student learning with specific regard toward the relationship between PE and its various components.
Teachers, teaching, and teacher education	Teachers, teaching, and teacher education explicitly examines issues related to teachers, teacher educators, and teacher education.
PE curriculum	Studies that examined and featured matters related to PE curriculum.
Differences and diversity	Studies looked at differences and diversity include research those that prioritize issues related to diversity, equity, and inclusion.

The data coding process to deductively place each research article into a category started with an independent review by each research team member. Then, the researchers began reviewing the top 1,000 articles, which were sorted by the most cited articles being at the top of the list. Finally, each article was assigned a code based on the categories from the HPE, or it was deemed not to meet the inclusion criteria. The coding process aimed to identify the top 20 most cited articles for each HPE category.

A four-step process was followed to ensure inter-rater reliability of the coded articles.

(a) Initially, each member of the research settled on mutual agreement for the definitions of each category from the HPE.
(b) Three researchers analyzed twenty articles together to categorize and code them. When disagreement occurred, the three researchers reviewed the HPE category definitions and discussed until 100% consensus was reached.
(c) Third, the three researchers independently coded ten articles and compared the results. When disagreement occurred, the researchers discussed until 100% consensus was reached.
(d) Lastly, the three research team members then independently coded the rest of the articles and compared the results.

Again, the goal of the coding process was to arrive at the top 20 most cited articles for each category of the HPE. To this end, the research team collectively coded 368 research articles. Among these articles, 90 publications were deemed not to meet the inclusion criteria. A common thread to these excluded articles is that they did not clearly involve PE. The final product for the coding process was a top 20 list of the most cited articles for each HPE category. The three researchers successfully established 100% agreement for each top 20 list as well as the articles that did not meet the inclusion criteria.

Once the top 20 lists were in place for each category, each article's bibliometric data points of interest were compiled. The following data points were extracted for further analysis: total citations per article, number of citations per year, the average number of citations per year, title, journal, type of publication, date of publication, geographical location, and the abstract. Descriptive statistics were applied to conduct the citation analysis of the top 20 lists. In addition, frequency counts were compiled to describe information relative to journals, country of origin, and authors. The abstracts for each of the articles were also examined to describe the methodological approach that was used.

3. Results

Results of the BA were organized into the following sections: (a) cross-disciplinary, (b) learners and learning, (c) teachers, teaching, and teacher education, (d) PE curriculum, and (e) differences and diversity. Within each section, attention was directed to the citation analysis as well as other bibliometric points of emphasis to help summarize the characteristics of the top 20 lists.

3.1. Cross-Disciplinary Research

As of September 15th 2021, the top 20 cited cross-disciplinary articles were cited a total of 10,672 times, with an average of 534 citations per article ($SD = 275.89$). See Table 2 for a complete overview of the top 20 list for cross-disciplinary research. The top 20 list in the cross-disciplinary category list has averaged 34.04 citations per year ($SD = 21.99$). The peak year for the number of citations the list accumulated was 2015, with 772 citations. Kahn et al.'s (2002) article that explored the effectiveness of interventions to improve physical activity has accumulated 1,338 citations. In total, 9 articles (45%) have more than 500 citations. Donnelly et al.'s (2016) article examining physical activity and its relationship with cognitive function have an average of 100.33 citations per year since publication, making it the highest for this metric.

Cross-disciplinary research articles were published in 10 journals. Two journals accounted for eight (40%) of the publications: The American Journal of Preventive Medicine [AJPM] and Medicine and Science in Sports and Exercise [MSSE]. Of note, AJPM tabulated 3,268 citations (31% of the total citations for this list). For 2020, the journal has an impact factor of 5.043. Contributing authors for the list ranged from two to 12 authors. There were 5.7 authors per paper (SD= 2.85). Regarding the type of paper, there were a total of 10 review papers (50%). Randomized, controlled field trials accounted for the next most common type, with four (20%).

Authors of the cross-disciplinary articles hailed from ten countries. The USA contributed to the highest proportion ($n = 14$). The Netherlands and Australia contributed three and two respectively. More specifically, seven authors were involved with at least two publications. Stone was a lead author on one publication and a contributing author to two publications. Brownson, Elder, Heath, Lee, McKenzie, and Van Mechelen authored two publications. Regarding content, a vast majority of the publications focused to some degree on physical activity ($n = 18, 90\%$). Other areas of related emphasis within the top 20 list were obesity and academic achievement. The PE foci of the top 20 list primarily stemmed from its contextual relevance for promoting physical activity.

3.2. Learners and Learning Research

Per the data collection date of September 15th, 2021, the top 20 articles in the learners and learning category were collectively cited 5,384 times (See Table 3). The average number of citations per article was 269.2 ($SD = 136.1$). The 20 articles for this category accumulated the most citations in 2020 ($n = 616$) and 2019 ($n = 497$). These two specific years account for 20.67% of the total citations for this category. Another bibliometric datapoint of intrigue pertains to means citations per year. For the top 20 list, there have been on average 14.27 ($SD = 9.77$) citations per year. Among the top 20 list, six articles have accumulated more than 300 citations. In total, these six articles have tallied 2,727 citations, which accounts for 50.65% of the total number of citations for this category. Ntoumanis's 2001 article that discussed self-determination theory and its applicability to PE has accumulated the most citations with 538. Concerning mean citations per year, Haerens et al.'s (2015) article that examined PE students' motivational experiences has averaged 41.14 citations per year since publication.

Table 2
Top 20 list of cross-disciplinary research

Rank	Article	Times Cited	Mean Citations per Year
1.	Kahn, E. B., Ramsey, L. T., Brownson, R. C., Heath, G. W., Howze, E. H., Powell, K. E., ... & Corso, P. (2002). The effectiveness of interventions to increase physical activity: a systematic review. *American Journal of Preventive Medicine*, *22*(4), 73-107.	1,338	66.9
2.	Gortmaker, S. L., Peterson, K., Wiecha, J., Sobol, A. M., Dixit, S., Fox, M. K., & Laird, N. (1999). Reducing obesity via a school-based interdisciplinary intervention among youth: Planet Health. *Archives of Pediatrics & Adolescent Medicine*, *153*(4), 409-418.	921	40.04
3.	Van Der Horst, K., Paw, M. J. C. A., Twisk, J. W., & Van Mechelen, W. (2007). A brief review on correlates of physical activity and sedentariness in youth. *Medicine & Science in Sports & Exercise*, *39*(8), 1241-1250.	856	57.07
4.	Luepker, R. V., Perry, C. L., McKinlay, S. M., Nader, P. R., Parcel, G. S., Stone, E. J., ... & Verter, J. (1996). Outcomes of a field trial to improve children's dietary patterns and physical activity: the Child and Adolescent Trial for Cardiovascular Health (CATCH). *JAMA, 275*(10), 768-776.	755	29.04
5.	Van Sluijs, E. M., McMinn, A. M., & Griffin, S. J. (2007). Effectiveness of interventions to promote physical activity in children and adolescents: systematic review of controlled trials. *BMJ, 335*(7622), 703.	649	43.27
6.	Baranowski, T., Anderson, C., & Carmack, C. (1998). Mediating variable framework in physical activity interventions: How are we doing? How might we do better? *American Journal of Preventive Medicine*, *15*(4), 266-297.	647	26.96
7.	Gordon-Larsen, P., McMurray, R. G., & Popkin, B. M. (2000). Determinants of adolescent physical activity and inactivity patterns. *Pediatrics*, *105*(6), e83.	617	28.05
8.	Donnelly, J. E., Hillman, C. H., Castelli, D., Etnier, J. L., Lee, S., Tomporowski, P., ... & Szabo-Reed, A. N. (2016). Physical activity, fitness, cognitive function, and academic achievement in children: a systematic review. *Medicine and Science in Sports and Exercise*, *48*(6), 1197-1222.	602	100.33
9.	Heath, G. W., Parra, D. C., Sarmiento, O. L., Andersen, L. B., Owen, N., Goenka, S., ... & Lancet Physical Activity Series Working Group. (2012). Evidence-based intervention in physical activity: lessons from around the world. *The Lancet*, *380*(9838), 272-281.	600	60
10.	Doak, C. M., Visscher, T. L. S., Renders, C. M., & Seidell, J. C. (2006). The prevention of overweight and obesity in children and adolescents: a review of interventions and programmes. *Obesity Reviews*, *7*(1), 111-136.	456	28.5
11.	Trudeau, F., & Shephard, R. J. (2008). Physical education, school physical activity, school sports and academic performance. *International Journal of Behavioral Nutrition and Physical Activity*, *5*(1), 1-12.	368	26.29
12.	Sallis, J. F., McKenzie, T. L., Conway, T. L., Elder, J. P., Prochaska, J. J., Brown, M., ... & Alcaraz, J. E. (2003). Environmental interventions for eating and physical activity: a randomized controlled trial in middle schools. *American Journal of Preventive Medicine*, *24*(3), 209-217.	349	18.37
13.	Motl, R. W., Dishman, R. K., Saunders, R., Dowda, M., Felton, G., & Pate, R. R. (2001). Measuring enjoyment of physical activity in adolescent girls. *American Journal of Preventive Medicine*, *21*(2), 110-117.	333	15.86
14.	Coe, D. P., Pivarnik, J. M., Womack, C. J., Reeves, M. J., & Malina, R. M. (2006). Effect of physical education and activity levels on academic achievement in children. *Medicine and Science in Sports and Exercise*, *38*(8), 1515.	331	20.69
15.	Rasberry, C. N., Lee, S. M., Robin, L., Laris, B. A., Russell, L. A., Coyle, K. K., & Nihiser, A. J. (2011). The association between school-based physical activity, including physical education, and academic performance: a systematic review of the literature. *Preventive Medicine*, *52*, 10-20.	325	29.55
16.	Story, M., Kaphingst, K. M., & French, S. (2006). The role of schools in obesity prevention. *The Future of Children*, 109-142.	320	20
17.	Kriemler, S., Zahner, L., Schindler, C., Meyer, U., Hartmann, T., Hebestreit, H., ... & Puder, J. J. (2010). Effect of school based physical activity programme (KISS) on fitness and adiposity in primary schoolchildren: cluster randomised controlled trial. *BMJ*, *340*, c785.	305	25.42
18.	Stone, E. J., McKenzie, T. L., Welk, G. J., & Booth, M. L. (1998). Effects of physical activity interventions in youth: review and synthesis. *American Journal of Preventive Medicine*, *15*(4), 298-315.	301	12.54
19.	Telama, R., Yang, X., Laakso, L., & Viikari, J. (1997). Physical activity in childhood and adolescence as predictor of physical activity in young adulthood. *American Journal of Preventive Medicine*, *13*(4), 317-323.	300	12
20.	Lee, S. M., Burgeson, C. R., Fulton, J. E., & Spain, C. G. (2007). Physical education and physical activity: results from the School Health Policies and Programs Study 2006. *Journal of School Health*, *77*(8), 435-463.	299	19.93

Table 3
Top 20 list of learners and learning research

Rank	Article	Times Cited	Mean Citations per Year
1.	Ntoumanis, N. (2001). A self-determination approach to the understanding of motivation in physical education. *British Journal of Educational Psychology*, *71*(2), 225-242.	538	25.62
2.	Standage, M., Duda, J. L., & Ntoumanis, N. (2005). A test of self-determination theory in school physical education. *British Journal of Educational Psychology*, *75*(3), 411-433.	535	31.47
3.	Standage, M., Duda, J. L., & Ntoumanis, N. (2003). A model of contextual motivation in physical education: Using constructs from self-determination and achievement goal theories to predict physical activity intentions. *Journal of Educational Psychology*, *95*(1), 97.	506	26.63
4.	Ntoumanis, N. (2005). A prospective study of participation in optional school physical education using a self-determination theory framework. *Journal of Educational Psychology*, *97*(3), 444.	434	5.63
5.	Goudas, M., Biddle, S., & Fox, K. (1994). Perceived locus of causality, goal orientations, and perceived competence in school physical education classes. *British Journal of Educational Psychology*, *64*(3), 453-463.	379	13.54
6.	Hagger, M. S., Chatzisarantis, N. L., Culverhouse, T., & Biddle, S. J. (2003). The processes by which perceived autonomy support in physical education promotes leisure-time physical activity intentions and behavior: A trans-contextual model. *Journal of Educational Psychology*, *95*(4), 784.	335	7.63
7.	Haerens, L., Aelterman, N., Vansteenkiste, M., Soenens, B., & Van Petegem, S. (2015). Do perceived autonomy-supportive and controlling teaching relate to physical education students' motivational experiences through unique pathways? Distinguishing between the bright and dark side of motivation. *Psychology of Sport and Exercise*, *16*, 26-36.	288	41.14
8.	Standage, M., Duda, J. L., & Ntoumanis, N. (2006). Students' motivational processes and their relationship to teacher ratings in school physical education: A self-determination theory approach. *Research Quarterly for Exercise and Sport*, *77*(1), 100-110.	257	6.06
9.	Ferrer-Caja, E., & Weiss, M. R. (2000). Predictors of intrinsic motivation among adolescent students in physical education. *Research Quarterly for Exercise and Sport*, *71*(3), 267-279.	210	9.55
10.	Standage, M., Gillison, F. B., Ntoumanis, N., & Treasure, D. C. (2012). Predicting students' physical activity and health-related well-being: A prospective cross-domain investigation of motivation across school physical education and exercise settings. *Journal of Sport and Exercise Psychology*, *34*(1), 37-60.	199	19.9
11.	Carlson, T. B. (1995). We hate gym: Student alienation from physical education. *Journal of Teaching in Physical Education*.	198	7.33
12.	McKenzie, T. L., Marshall, S. J., Sallis, J. F., & Conway, T. L. (2000). Student activity levels, lesson context, and teacher behavior during middle school physical education. *Research Quarterly for Exercise and Sport*, *71*(3), 249-259.	189	8.59
13.	Taylor, I. M., Ntoumanis, N., Standage, M., & Spray, C. M. (2010). Motivational predictors of physical education students' effort, exercise intentions, and leisure-time physical activity: A multilevel linear growth analysis. *Journal of Sport and Exercise Psychology*, *32*(1), 99-120.	185	15.42
14.	Hagger, M. S., Chatzisarantis, N. L., Barkoukis, V., Wang, C. K. J., & Baranowski, J. (2005). Perceived autonomy support in physical education and leisure-time physical activity: a cross-cultural evaluation of the trans-contextual model. *Journal of Educational Psychology*, *97*(3), 376.	173	10.18
15.	Papaioannou, A. (1994). Development of a questionnaire to measure achievement orientations in physical education. *Research Quarterly for Exercise and Sport*, *65*(1), 11-20.	172	6.14
16.	Cox, A., & Williams, L. (2008). The roles of perceived teacher support, motivational climate, and psychological need satisfaction in students' physical education motivation. *Journal of Sport and Exercise Psychology*, *30*(2), 222-239.	167	11.93
17.	McKenzie, T. L., Feldman, H., Woods, S. E., Romero, K. A., Dahlstrom, V., Stone, E. J., Strikmiller, P. K., Williston, J.M., Harsha, D. W. (1995). Children's physical activity levels and lesson context during third-grade physical education. *Research Quarterly for Exercise and Sport*, *66*(3), 184-193.	163	6.04
18.	Cox, A. E., Smith, A. L., & Williams, L. (2008). Change in physical education motivation and physical activity behavior during middle school. *Journal of Adolescent Health*, *43*(5), 506-513.	153	10.93
19.	Moreno Murcia, J. A., Gonzalez-Cutre Coll, D., Chillon Garzon, M., & Parra Rojas, N. (2008). Adaptation of the basic psychological needs in exercise scale to physical education. *Revista Mexicana de Psicología*, *25*(2), 295-303.	152	10.86
20.	Boiché, J., Sarrazin, P. G., Grouzet, F. M., Pelletier, L. G., & Chanal, J. P. (2008). Students' motivational profiles and achievement outcomes in physical education: A self-determination perspective. *Journal of Educational Psychology*, *100*(3), 688.	151	10.79

The top 20 list of the learners and learning category were published in eight journals. Half of the publications were published in two journals: The Journal of Educational Psychology (n = 5) and Research Quarterly for Exercise and Sport [RQES] (n = 5). In terms of impact factor, the Journal of Educational Psychology's 2020 rating was 5.805, while RQES was 2.239. These two journals account for 53.03% of the total number of citations for this category. The number of authors on each article ranged from 1 to 9, with a mean of 3.35 (SD= 1.89). All but three articles used a questionnaire as the primary tool to gather data. The next most common method was a descriptive study.

Authors for the top 20 list were from ten countries. England led the way with 11 authors. The USA was the next leading contributor with five. Authors from Greece contributed two publications, and the remaining countries contributed one publication. More interestingly, two authors, Ntoumanis and Standage, were active authors on seven and five articles, respectively. These scholars were lead authors on the four top-cited articles. In fact, these four publications totaled 2,013 citations, which equates to 37.49% of the total citations for this category. Student motivation in PE was the primary topic for the learners and learning category.

3.3. Teaching, Teachers, and Teacher Education Research

On September 15th 2021, the top 20 cited articles related to teaching, teachers, and teacher education accumulated 2,847 citations, with an average of 142. 35 ($SD = 31.28$) citations per publication. See Table 4 for a complete overview of the top 20 list for learner and learning research. The citation frequency for publications of this category was the highest in 2019 ($n = 324$) and 2020 ($n = 319$). These two years represent 22.59% of the total number of citations for this category. Six publications have more than 150 citations. These six publications account for 38.92% of the total citations. Tessier et al. (2010) published the highest cited article and have averaged 17.42 citations per year. A central focus of their work was to help PE teachers' interpersonal skills with the hope of improving student motivation. For the entire top 20 list, the mean citations per year were 10.08 ($SD = 5.43$). Concerning mean citations per year, Van den Berghe et al.'s (2014) publication has averaged 20.88, making it the highest in this category for this bibliometric point of interest. The researchers in this study broadly explored the relevance of self-determination to PE.

The top 20 most cited articles for teaching, teachers, and teacher education were published in 12 journals. The Journal of Sport and Exercise Psychology, Quest, and Sport, Education and Society each accounted for three publications. In 2020, the Journal of Sport and Exercise Psychology recorded an impact factor of 4.119. Quest's impact factor in 2020 was 2.844. These three journals have accumulated 1,226 citations, equating to 43.06% of the total. In terms of authorship, contributing authors ranged from one to six. On average, each publication averaged 2.4 authors. The top 20 most cited publications used a mix of approaches in terms of methodology. Conceptual papers ($n = 6$), experimental designs ($n = 5$), and surveys ($n = 4$) were the most types of methods for crafting the articles.

The authors of this top 20 category hailed from eight different countries. USA ($n = 7$) and England ($n = 5$) were the leading countries for authorship. Australia and Belgium were the next most common country of origin, contributing three articles. Another emergent finding concerning authorship is that of presence. Eight researchers shared authorship on at least two articles for the top 20 list. Vansteenkiste contributed to three publications, which were the most for this category. Curtner-Smith was the only scholar who was the lead author for more than one publication. Finally, motivation was a prominent topic of interest for the top 20 list. In exploring motivation, researchers of the top 20 examined this topic differently. Still, a common thread was seeking to help PE teachers facilitate a teaching-learning environment conducive to student motivation.

Table 4
Top 20 list of teachers, teaching, and teacher education research

Rank	Article	Times Cited	Mean Citations per Year
1.	Tessier, D., Sarrazin, P., & Ntoumanis, N. (2010). The effect of an intervention to improve newly qualified teachers' interpersonal style, students motivation and psychological need satisfaction in sport-based physical education. *Contemporary Educational Psychology*, *35*(4), 242-253.	209	17.42
2.	Cheon, S. H., Reeve, J., & Moon, I. S. (2012). Experimentally based, longitudinally designed, teacher-focused intervention to help physical education teachers be more autonomy supportive toward their students. *Journal of Sport and Exercise Psychology*, *34*(3), 365-396.	204	20.4
3.	Taylor, I. M., & Ntoumanis, N. (2007). Teacher motivational strategies and student self-determination in physical education. *Journal of Educational Psychology*, *99*(4), 747.	197	13.13
4.	Mouratidis, A., Vansteenkiste, M., Lens, W., & Sideridis, G. (2008). The motivating role of positive feedback in sport and physical education: Evidence for a motivational model. *Journal of Sport and Exercise Psychology*, *30*(2), 240-268.	177	12.64
5.	Van den Berghe, L., Vansteenkiste, M., Cardon, G., Kirk, D., & Haerens, L. (2014). Research on self-determination in physical education: Key findings and proposals for future research. *Physical Education and Sport Pedagogy*, *19*(1), 97-121.	167	20.88
6.	Morgan, P. J., & Hansen, V. (2008). Classroom teachers' perceptions of the impact of barriers to teaching physical education on the quality of physical education programs. *Research Quarterly for Exercise and Sport*, *79*(4), 506-516.	154	11
7.	Armour, K. M., & Yelling, M. (2007). Effective professional development for physical education teachers: The role of informal, collaborative learning. *Journal of Teaching in Physical Education*, *26*(2), 177-200.	137	9.13
8.	O'Brien, K. S., Hunter, J. A., & Banks, M. (2007). Implicit anti-fat bias in physical educators: Physical attributes, ideology and socialization. *International Journal of Obesity*, *31*(2), 308-314.	135	9
9.	Neumark-Sztainer, D., Story, M., & Harris, T. (1999). Beliefs and attitudes about obesity among teachers and school health care providers working with adolescents. *Journal of Nutrition Education*, *31*(1), 3-9.	133	5.78
10.	Curtner-Smith, M. D. (1999). The more things change the more they stay the same: Factors influencing teachers' interpretations and delivery of national curriculum physical education. *Sport, Education and Society*, *4*(1), 75-97.	132	5.74
11.	Haerens, L., Aelterman, N., Van den Berghe, L., De Meyer, J., Soenens, B., & Vansteenkiste, M. (2013). Observing physical education teachers' need-supportive interactions in classroom settings. *Journal of Sport and Exercise Psychology*, *35*(1), 3-17.	126	14
12.	Kirk, D., & MacDonald, D. (2001). Teacher voice and ownership of curriculum change. *Journal of Curriculum Studies*, *33*(5), 551-567.	126	6
13.	Curtner-Smith, M. D. (2001). The occupational socialization of a first-year physical education teacher with a teaching orientation. *Sport, Education and Society*, *6*(1), 81-105.	125	5.95
14.	Siedentop, D. (2002). Content knowledge for physical education. *Journal of Teaching in Physical Education*, *21*(4), 368-77.	123	6.15
15.	Cheon, S. H., & Reeve, J. (2015). A classroom-based intervention to help teachers decrease students' amotivation. *Contemporary Educational Psychology*, *40*, 99-111.	120	17.14
16.	Digelidis, N., Papaioannou, A., Laparidis, K., & Christodoulidis, T. (2003). A one-year intervention in 7th grade physical education classes aiming to change motivational climate and attitudes towards exercise. *Psychology of Sport and exercise*, *4*(3), 195-210.	120	6.32
17.	Lawson, H. A. (2005). Empowering people, facilitating community development, and contributing to sustainable development: The social work of sport, exercise, and physical education programs. *Sport, Education and Society*, *10*(1), 135-160.	119	7
18.	Treasure, D. C., & Roberts, G. C. (1995). Applications of achievement goal theory to physical education: Implications for enhancing motivation. *Quest*, *47*(4), 475-489.	119	4.41
19.	Tinning, R. (2002). Toward a "modest pedagogy": Reflections on the problematics of critical pedagogy. *Quest*, *54*(3), 224-240.	112	5.6
20.	Landin, D. (1994). The role of verbal cues in skill learning. *Quest*, *46*(3), 299-313.	112	4

3.4. Physical Education Curriculum Research

The top 20 cited publications, as of September 15th 2021, for PE curriculum research, tallied 4,383 citations (See Table 5). The average number of citations for this category was 219.15 ($SD = 111.86$). These articles have, on average, yielded 13.19 citations a year. Nine articles have accumulated more than 200 citations. These articles account for 2,701 citations, which translates to 61.62% of citations. 2020 ($n = 418$) and 2017 ($n = 413$) were when the PE curriculum articles accumulated the most citations. Years 2020 and 2017 represent 18.96% of the total citations. Sallis and colleagues' (1997) research that examined Sport, Play, and Active Recreation for Kids' impact on children is the most cited. This article has also averaged 23.8 citations per year since 1997, making it the highest for this bibliometric datapoint.

The PE curriculum articles have been published in 13 journals. The Journal of Teaching in Physical Education [JTPE] has five articles. In 2020, JTPE tallied an impact factor of 4.155. These five publications have amassed 798 citations, representing 18.21% of citations. Next in line is Research Quarterly for Exercise and Sport [RQES], with three articles. The number of authors on the top 20 list of PE curriculum ranged from 1 to 6, with an average of 2.95 ($SD = 1.82$) authors. Review papers were the majority in terms of the type of paper. Eleven of the publications were review papers. Intervention-based experimental designs were the next most common approach, with six papers using this methodological approach.

The USA ($n = 11$) and England ($n = 7$) were the leaders for this category concerning author affiliation. Ten countries altogether contributed authorship. Another interesting finding from curriculum research is the authors who contributed to this category. The most active author is Kirk, the lead author on three publications and a contributing author of two additional publications. All total, his work has generated 954 citations, which equals 21.77% of the total citations. The next top-cited authors were McKenzie and Sallis. These two scholars shared authorship on four publications. Their work has accumulated 1,258 citations and accounts for 28.7% of citations. Finally, Bailey is a lead author on three publications. His work has tallied 843 citations, representing 19.23% of the total citations. The prominent topics explored in this category pertained to models-based instruction in PE, curriculum as a tool to promote physical activity, and ways to augment curriculum (i.e., technology, dance).

3.5. Differences and Diversity Research

On the September 15th 2021, the top 20 cited publications for the differences and diversity category accumulated 2,331 citations (See Table 6). The average number of citations across the top 20 list was 116.55 ($SD = 37.58$). On an annual basis, the differences and diversity articles mean citations per year is 7.14 ($SD = 2.24$). Among the top 20 list, four publications have 150 or more citations and account for 31.96% of the total citations. These publications have been cited the most in 2019 ($n = 272$) and 2020 ($n = 246$). In 2019 and 2020, the citations totaled 518, which is 22.22% of the total number of citations for this category. Flintoff's (2001) article that explored young womens' experiences with physical activity and PE leads this category with 212 citations. While Block and Obrusnikova's (2007) publication, a review of literature that focused on inclusion in PE has maintained 11.33 mean citations per year, making it the leader for this bibliometric data point.

The top 20 list for differences and diversity research has been published in 10 journals. Sport, Education, and Society [SES] ($n = 6$) and the Adapted Physical Activity Quarterly [APAQ] ($n = 5$) are the two largest contributors to the list. SES's 2020 impact factor was 4.119, while the APAQ reached 2.929. These two journals have totaled 1,432 citations, 61.43% of the total citations. The number of authors for the top list ranged from one to nine. On average, there were 2.45 ($SD = 1.88$) authors for the list. Qualitative research methods were the commonly adopted approach to gather data for the top 20 list. All total, eight articles used qualitative research methods. Survey research was the next most common method, with four articles adopting this approach.

Table 5
Top 20 list of physical education curriculum research

Rank	Article	Times Cited	Mean Citations per Year
1.	Sallis, J. F., McKenzie, T. L., Alcaraz, J. E., Kolody, B., Faucette, N., & Hovell, M. F. (1997). The effects of a 2-year physical education program (SPARK) on physical activity and fitness in elementary school students. Sports, Play and Active Recreation for Kids. *American Journal of Public Health*, *87*(8), 1328-1334.	595	23.8
2.	Bailey, R. (2006). Physical education and sport in schools: A review of benefits and outcomes. *Journal of School Health*, *76*(8), 397-401.	374	23.38
3.	Sallis, J. F., McKenzie, T. L., Kolody, B., Lewis, M., Marshall, S., & Rosengard, P. (1999). Effects of health-related physical education on academic achievement: Project SPARK. *Research Quarterly for Exercise and Sport*, *70*(2), 127-134.	310	13.48
4.	Papastergiou, M. (2009). Exploring the potential of computer and video games for health and physical education: A literature review. *Computers & Education*, *53*(3), 603-622.	286	22
5.	Bailey, R., Armour, K., Kirk, D., Jess, M., Pickup, I., Sandford, R., & Education, B. P. (2009). The educational benefits claimed for physical education and school sport: an academic review. *Research Papers in Education*, *24*(1), 1-27.	283	21.77
6.	McKenzie, T. L., Sallis, J. F., & Nader, P. R. (1992). SOFIT: System for observing fitness instruction time. *Journal of Teaching in Physical Education*, *11*(2), 195-205.	236	7.87
7.	Oslin, J. L., Mitchell, S. A., & Griffin, L. L. (1998). The game performance assessment instrument (GPAI): Development and preliminary validation. *Journal of Teaching in Physical Education*, *17*(2), 231-243.	211	8.79
8.	Staiano, A. E., & Calvert, S. L. (2011). Exergames for physical education courses: Physical, social, and cognitive benefits. *Child Development Perspectives*, *5*(2), 93-98.	205	18.64
9.	Kirk, D., & MacPhail, A. (2002). Teaching games for understanding and situated learning: Rethinking the Bunker-Thorpe model. *Journal of Teaching in Physical Education*, *21*(2), 177-192.	201	10.05
10.	Kirk, D., & Macdonald, D. (1998). Situated learning in physical education. *Journal of Teaching in Physical education*, *17*(3), 376-387.	188	7.83
11.	Bailey, R. (2005). Evaluating the relationship between physical education, sport and social inclusion. *Educational Review*, *57*(1), 71-90.	186	18.67
12.	Kirk, D. (2013). Educational value and models-based practice in physical education. *Educational Philosophy and Theory*, *45*(9), 973-986.	168	18.67
13.	Dyson, B., Griffin, L. L., & Hastie, P. (2004). Sport education, tactical games, and cooperative learning: Theoretical and pedagogical considerations. *Quest*, *56*(2), 226-240.	165	9.17
14.	Wallhead, T. L., & Ntoumanis, N. (2004). Effects of a sport education intervention on students' motivational responses in physical education. *Journal of Teaching in Physical Education*, *23*(1), 4-18.	163	9.06
15.	Hastie, P. A., de Ojeda, D. M., & Luquin, A. C. (2011). A review of research on Sport Education: 2004 to the present. *Physical Education and Sport Pedagogy*, *16*(2), 103-132.	161	14.64
16.	Chow, J. Y., Davids, K., Button, C., Shuttleworth, R., Renshaw, I., & Araújo, D. (2007). The role of nonlinear pedagogy in physical education. *Review of Educational Research*, *77*(3), 251-278.	156	10.4
17.	Flores, R. (1995). Dance for health: improving fitness in African American and Hispanic adolescents. *Public Health Reports*, *110*(2), 189.	134	4.96
18.	Turner, A. P., & Martinek, T. J. (1999). An investigation into teaching games for understanding: Effects on skill, knowledge, and game play. *Research Quarterly for Exercise and Sport*, *70*(3), 286-296.	130	5.65
19.	McKenzie, T. L., Sallis, J. F., Kolody, B., & Faucette, F. N. (1997). Long-term effects of a physical education curriculum and staff development program: SPARK. *Research Quarterly for Exercise and Sport*, *68*(4), 280-291.	117	4.68
20.	Haerens, L., Kirk, D., Cardon, G., & De Bourdeaudhuij, I. (2011). Toward the development of a pedagogical model for health-based physical education. *Quest*, *63*(3), 321-338.	114	10.36

Table 6
Top 20 list of differences and diversity research

Rank	Article	Times Cited	Mean Citations per Year
1.	Flintoff, A., & Scraton, S. (2001). Stepping into active leisure? Young women's perceptions of active lifestyles and their experiences of school physical education. *Sport, Education and Society*, *6*(1), 5-21.	212	10.1
2.	Ennis, C. D. (1999). Creating a culturally relevant curriculum for disengaged girls. *Sport, Education and Society*, *4*(1), 31-49.	198	8.61
3.	Block, M. E., & Obrusnikova, I. (2007). Inclusion in physical education: A review of the literature from 1995-2005. *Adapted Physical Activity Quarterly*, *24*(2), 103-124.	170	11.33
4.	Goodwin, D. L., & Watkinson, E. J. (2000). Inclusive physical education from the perspective of students with physical disabilities. *Adapted Physical Activity Quarterly*, *17*(2), 144-160.	165	7.5
5.	Azzarito, L., & Solomon, M. A. (2005). A reconceptualization of physical education: The intersection of gender/race/social class. *Sport, Education and Society*, *10*(1), 25-47.	121	7.12
6.	Cairney, J., Kwan, M. Y., Velduizen, S., Hay, J., Bray, S. R., & Faught, B. E. (2012). Gender, perceived competence and the enjoyment of physical education in children: A longitudinal examination. *International Journal of Behavioral Nutrition and Physical Activity*, *9*(1), 1-8.	107	10.7
7.	Enright, E., & O'Sullivan, M. (2010). 'Can I do it in my pyjamas?'Negotiating a physical education curriculum with teenage girls. *European Physical Education Review*, *16*(3), 203-222.	107	8.92
8.	Gorely, T., Holroyd, R., & Kirk, D. (2003). Muscularity, the habitus and the social construction of gender: towards a gender-relevant physical education. *British Journal of Sociology of Education*, *24*(4), 429-448.	104	5.47
9.	Luke, M. D., & Sinclair, G. D. (1991). Gender differences in adolescents' attitudes toward school physical education. *Journal of Teaching in Physical Education*, *11*(1), 31-46.	104	3.35
10.	Taylor, I. M., & Lonsdale, C. (2010). Cultural differences in the relationships among autonomy support, psychological need satisfaction, subjective vitality, and effort in British and Chinese physical education. *Journal of Sport and Exercise Psychology*, *32*(5), 655-673.	103	8.58
11.	Klomsten, A. T., Marsh, H. W., & Skaalvik, E. M. (2005). Adolescents' perceptions of masculine and feminine values in sport and physical education: A study of gender differences. *Sex Roles*, *52*(9), 625-636.	101	5.94
12.	Garrett, R. (2004). Negotiating a physical identity: Girls, bodies and physical education. *Sport, Education and Society*, *9*(2), 223-237.	97	5.39
13.	Hunter, L. (2004). Bourdieu and the social space of the PE class: Reproduction of doxa through practice. *Sport, Education and Society*, *9*(2), 175-192.	96	5.33
14.	Spencer-Cavaliere, N., & Watkinson, E. J. (2010). Inclusion understood from the perspectives of children with disability. *Adapted Physical Activity Quarterly*, *27*(4), 275-293.	94	7.83
15.	Slininger, D., Sherrill, C., & Jankowski, C. M. (2000). Children's attitudes toward peers with severe disabilities: Revisiting contact theory. *Adapted Physical Activity Quarterly*, *17*(2), 176-196.	94	4.27
16.	Connell, R. (2008). Masculinity construction and sports in boys' education: A framework for thinking about the issue. *Sport, Education and Society*, *13*(2), 131-145.	93	6.64
17.	Qi, J., & Ha, A. S. (2012). Inclusion in physical education: A review of literature. *International Journal of Disability, Development and Education*, *59*(3), 257-281.	92	9.2
18.	Place, K., & Hodge, S. R. (2001). Social inclusion of students with physical disabilities in general physical education: A behavioral analysis. *Adapted Physical Activity Quarterly*, *18*(4), 389-404.	92	4.38
19.	Barr-Anderson, D. J., Neumark-Sztainer, D., Lytle, L., Schmitz, K. H., Ward, D. S., Conway, T. L., Pratt, C., Baggett, C. D., & Pate, R. R. (2008). But I like PE: Factors associated with enjoyment of physical education class in middle school girls. *Research Quarterly for exercise and Sport*, *79*(1), 18-27.	91	6.5
20.	Azzarito, L., Solmon, M. A., & Harrison Jr, L. (2006). "... If I had a choice, I would...." A feminist poststructuralist perspective on girls in physical education. *Research Quarterly for exercise and Sport*, *77*(2), 222-239.	90	5.63

Authors of this top 20 list were from seven countries. Four countries were responsible for a large proportion of research: USA ($n = 7$), Australia ($n = 5$), Canada ($n = 4$), and England ($n = 4$). Concerning contributions, Azzarito was the lead author of two publications. In one publication, she explored gender and students' perceptions toward PE. Watkinson was a contributing author to two publications that focused on the role of inclusion in PE. The topical focus for the top list featured authors who have explored inclusion, and more broadly, the intersectionality of gender, culture, physical activity, sport, and PE.

4. Discussion

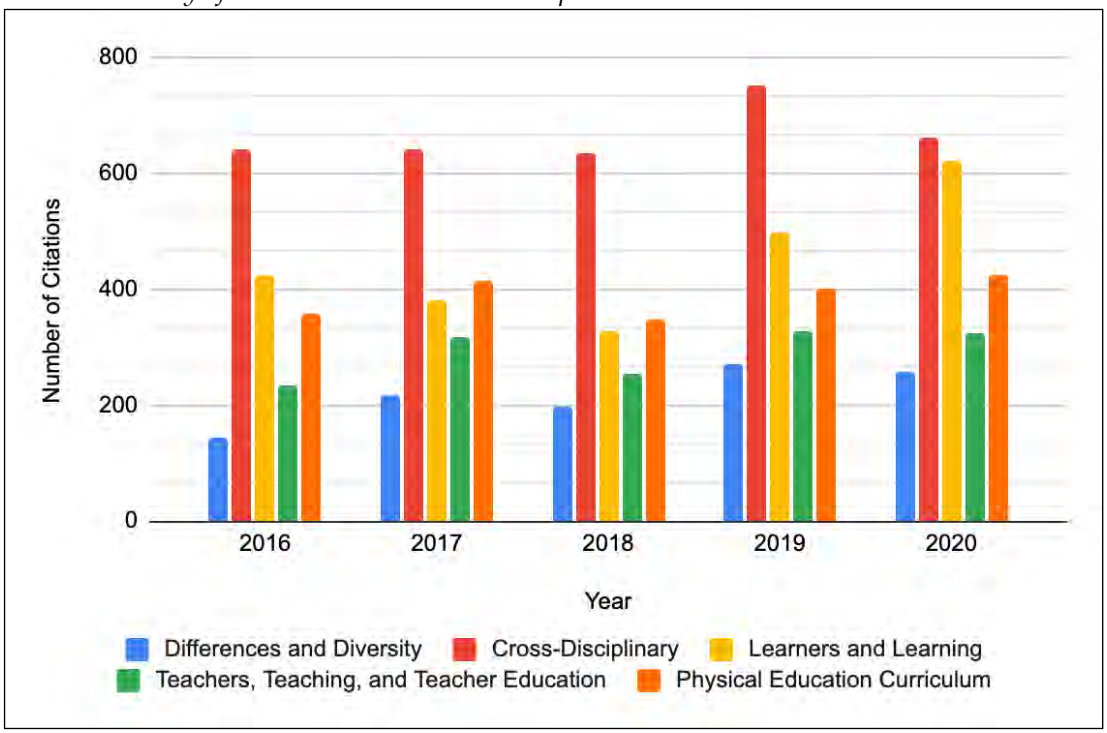
With this BA, the authors have presented lists of the top 20 cited articles related to categories from the HPE (Kirk et al., 2006). The resulting analysis provides insights into the research that involved PE and highlights trends in the knowledge base at large.

A central takeaway from this BA is that interest in PE research is increasing; thus, supporting what other scholars have found (Marttinen et al., 2017). Across the top 20 lists, the articles have accumulated 25,617 citations. In support of the notion of increasing interest and growth, consider that across four of the top 20 lists, years 2019 and 2020 represented the time when these publications tallied the most citations, with the exception being cross-disciplinary research. Moreover, between 2016-2020 all the articles in this BA generated 7,032 citations, translating to 27.45% of the total citations. See Figure 1 for a visual breakdown on the citation trends across the top 20 lists.

The articles across the top 20 lists were published in 48 journals. Of particular interest are the journals that accounted for the most publications in each of the respective categories. These leading journals (e.g., AJPM, Quest, JTPE) all had an impact factor over in 2020. In fact, across all the top 20 lists, there were journals with an impact factor of over 4. Consider that in 2018-2019 over 70% of the approximate 13,000 journals had an impact factor under 1 (Joannah, 2021). It can be gleaned from this finding that researchers who have examined issues about PE are disseminating their work in quality, peer-reviewed journals. Results of this BA have produced a guidepost for members of the field to look to when searching for PE research articles.

Figure 1

Visual summary of citation trends across the top lists between 2016-2020



Within the HPE categories, authors explored a range of topics. Among the top cited works, a typical backdrop for the work centered on public health matters (i.e., PE as a tool to promote PA). The cross-disciplinary category explicitly highlights this trend. Cross-disciplinary publications accounted for 41.48% of the top 20 lists' total citations. Focus on public health was also evident in the PE curriculum category with the work of Sallis and McKenzie (1991). The alignment with public health indicates that scholars have catalyzed the idea that school-based PE is a context that can play a role in promoting PA and combatting the ill effects of sedentary behavior and obesity. It also reflects those researchers who have responded to calls for action in promoting PE's role in supporting the public health agenda (Sallis & McKenzie, 1991). Another topic of prominence was that of motivation. Ntoumanis and Standage's scholarship are reflective of this focus. Examining the role of motivation in the teaching-learning environment is a popular topic, evidenced by the number of citations that publications have generated. Factors influencing the teaching-learning environment also explored the intersectionality of gender, culture, sport, society, and PE. Focus on this topic was prominent in the Diversity and Differences category. Flintoff, Azzarito, and Ennis are scholars whose work well represents this research focus. Collectively, these topics and influential scholars have made valuable contributions to an emerging knowledge base that underpins PE.

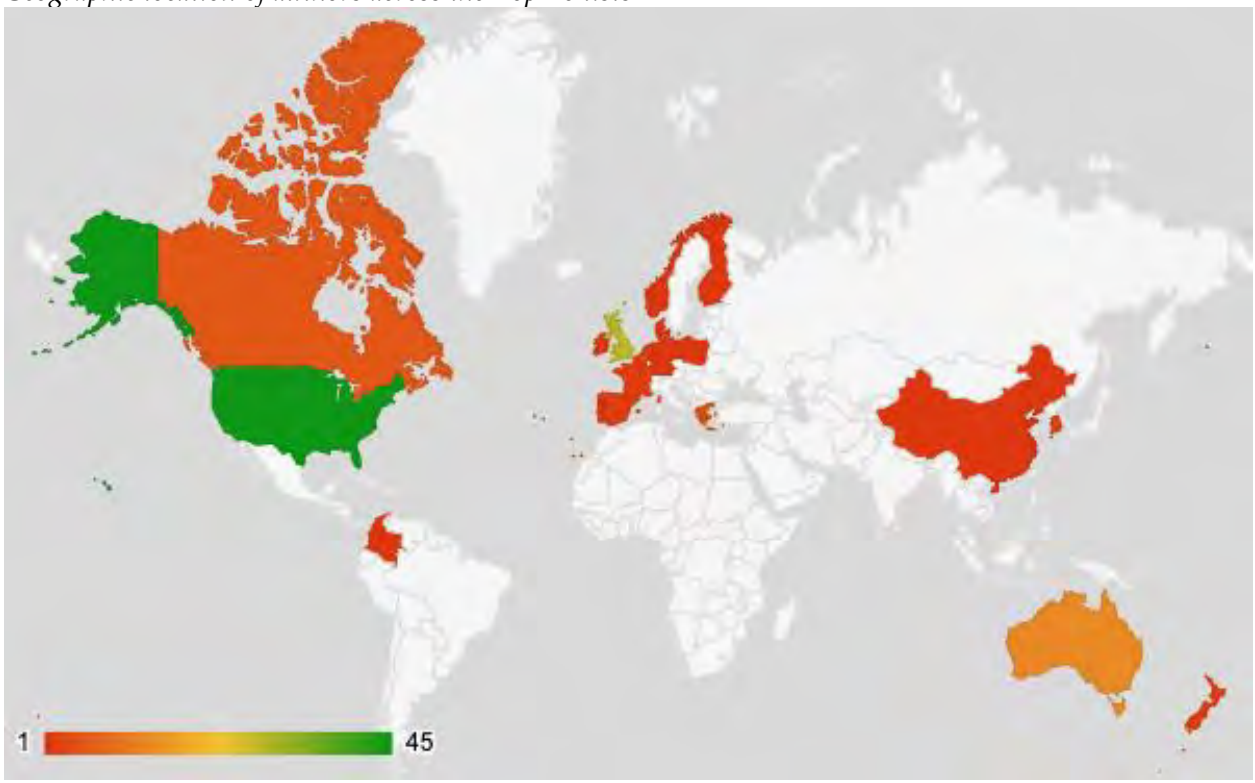
The BA also yielded insights into the methodological approaches that scholars assumed to examine topics relating to PE. An interesting finding from this analysis is a diversity of methods (e.g., experimental, reviews, surveys, qualitative) that scholars have used to explore PE topics. There also appears to be a clear emphasis on specific methodologies with respective categories. Review papers were seen across different categories. Experimental designs were most common in cross-disciplinary and the teacher, teaching, and teacher education categories. Questionnaires were most publications for the learners and learning category. We believe it warrants investigation to understand further the different methodological approaches used to explore specific topics relating to PE.

Our analysis revealed that, on average, each publication across the top 20 lists had 3.38 authors, which underlines the importance of partnership in studying topics relating to PE. Closely related to this finding is that authors who resided in the USA and England comprised a significant proportion of the authorship at the time of publication. Furthermore, the USA or England were the leaders of each category in terms of representation. See Figure 2 for an illustrative depiction of the countries for all authors across all every top 20 list. The finding warrants further investigation. We believe it could be worthwhile to examine PE research and common topics of interest at the country and even the regional levels. In addition, it could be fruitful to understand what issues scholars are focusing on in different regions of the world.

5. Limitations

This BA has some limitations. The first limitation related to only focusing on the WoS database. The decision to focus exclusively on WoS was grounded by it being the most used tool to conduct bibliometric analyses (Leng et al., 2013). Another limitation pertains to the bibliometric approach itself. Citations can be influenced by the location of the authors, language used, and self-citations. While imperfect, given the focus of this research project was on creating the top 20 lists of publications involving PE and citation frequency is a logical factor in isolating that help identify influential research. Another limitation is the date of publication. The length of time a publication has been in press will increase the opportunity to get cited. To help counter this limitation, the mean citation per year data point can help control for the publication’s date.

Figure 2
Geographic location of authors across the Top 20 lists



6. Conclusion

The current study presents a broad BA of publications involving PE. In creating top 20 lists that coincide with the HPE, consumers of PE scholarship have a concise means whereby to look to influential PE research and researchers. In today's environment, catering to the consumption preferences of consumers served as a guide to this study, and the resulting rank-ordered top 20 lists of publications provides a degree of material relevance for the field. Consumers of PE research can use these top 20 lists to identify top-cited articles quickly. Importantly, as research activity grows, members of the field must work to remain current with the knowledge base. Remaining abreast the knowledge base is further magnified with the currently education policy climate that governs US education (ESSA, 2015). The introduction of the ESSA now places a responsibility on all members of the field of PE to stay current with the knowledge base. There is now share expectation to use research and theoretically informed practices within PE. With this BA paper and the series of top 20 lists, represents one tool that members of the field can leverage to efficiently access relevant literature. The use of the BA provides researchers with an additional tool to navigate and make sense of a burgeoning knowledge base of PE research.

Author contributions: All authors have sufficiently contributed to the study, and agreed with the results and conclusions.

Funding: No funding source is reported for this study.

Declaration of interest: No conflict of interest is declared by authors.

References

Calabuig-Moreno, F., González-Serrano, M. H., Fombona, J., & García-Tascón, M. (2020). The emergence of technology in physical education: A general bibliometric analysis with a focus on virtual and augmented reality. *Sustainability*, *12*(7), 2728. https://doi.org/10.3390/su12072728

Casey, A., & Goodyear, V. A. (2015). Can cooperative learning achieve the four learning outcomes of physical education? A review of literature. *Quest*, *67*(1), 56-72. https://doi.org/10.1080/00336297.2014.984733

Clarivate (n.d.). Web of Science Core Collection. Retrieved from http://apps.webofknowledge.com/WOS_GeneralSearch_input.do?product=WOS&search_mode=GeneralSearch&SID=8EDQvGRhamHbq2PdNDx&preferencesSaved=

De Felice, F., & Polimeni, A. (2020). Coronavirus disease (COVID-19): a machine learning bibliometric analysis. *In Vivo*, *34*(3), 1613-1617. https://doi.org/10.21873/invivo.11951

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, *133*, 285-296. https://doi.org/10.1016/j.jbusres.2021.04.070

Every Student Succeeds Act. (2015). S. 1177 — 114th Congress. Retrieved from https://www.gpo.gov/fdsys/pkg/BILLS-114s1177enr/pdf/BILLS-114s1177enr.pdf

Fahimnia, B., Sarkis, J., &Davarzani, H. (2015). Green supply chain management: A review and bibliometric analysis. *International Journal of Production Economics*, *162*, 101-114. https://doi.org/10.1016/j.ijpe.2015.01.003

Farley-Ripple, E., Karpyn, A., McDonough, K., & Tilley, K. (2017). Defining how we get from research to practice: A model framework for schools. In Eryaman, M., & Schneider, B. (Eds.), *Evidence and public good in educational policy, research and practice* (pp. 79–95). Springer.

Huang, C., Yang, C., Wang, S., Wu, W., Su, J., & Liang, C. (2020). Evolution of topics in education research: A systematic review using bibliometric analysis. *Educational Review*, *72*(3), 281-297. https://doi.org/10.1080/00131911.2019.1566212

Hulland, J., & Houston, M. B. (2020). Why systematic review papers and meta-analyses matter: An introduction to the special issue on generalizations in marketing. *Journal of the Academy of Marketing Science, 48,* 351-359. https://doi.org/10.1007/s11747-020-00721-7

Isaac, M. S., & Schindler, R. M. (2014). The top-ten effect: Consumers' subjective categorization of ranked lists. *Journal of Consumer Research*, *40*(6), 1181-1202. https://doi.org/10.1086/674546

Joannah,W. (2021). *What's a good impact factor & why it matters (with 2018/2019 impact factor rankings in 27 categories).* Retrieved from https://www.scijournal.org/articles/good-impact-factor

Killian, C. M., Kinder, C. J., & Woods, A. M. (2019). Online and blended instruction in K–12 physical education: A scoping review. *Kinesiology Review*, *8*(2), 110-129. https://doi.org/10.1123/kr.2019-0003

Kirk, D., MacDonald, D., & O'Sullivan, M. (Eds.). (2006). *Handbook of physical education*. Sage.

Kulinna, P. H., Scrabis-Fletcher, K., Kodish, S., Phillips, S., & Silverman, S. (2009). A decade of research literature in physical education pedagogy. *Journal of Teaching in Physical Education*, *28*(2), 119-140. https://doi.org/10.1123/jtpe.28.2.119

Leng, Z., He, X., Li, H., Wang, D., & Cao, K. (2013). Olfactory ensheathing cell transplantation for spinal cord injury: An 18-year bibliometric analysis based on the Web of Science. *Neural Regeneration Research*, *8*(14), 1286-1296.

Marttinen, R. H. J., McLoughlin, G., Fredrick III, R., & Novak, D. (2017). Integration and physical education: A review of research. *Quest*, *69*(1), 37-49. https://doi.org/10.1080/00336297.2016.1150864

Müller, A. M., Ansari, P., Ebrahim, N. A., & Khoo, S. (2016). Physical activity and aging research: A bibliometric analysis. *Journal of aging and physical activity*, *24*(3), 476-483.

Priem, J. (2013). Scholarship: Beyond the paper. *Nature*, *495*(7442), 437-440. https://doi.org/10.1038/495437a.PMID:23538811

Richards, K. A. R., Pennington, C. G., & Sinelnikov, O. A. (2019). Teacher socialization in physical education: A scoping review of literature. *Kinesiology Review*, *8*(2), 86-99.

Sallis, J. F., & McKenzie, T. L. (1991). Physical education's role in public health. *Research Quarterly for Exercise and Sport*, *62*(2), 124-137. https://doi.org/10.1080/02701367.1991.10608701

Silverman, S. J., & Ennis, C. D. (2003). *Student learning in physical education: Applying research to enhance instruction*. Human kinetics.

Sorensen, A. T. (2007). Bestseller lists and product variety. *The Journal of Industrial Economics*, *55*(4), 715-738. https://doi.org/10.1111/j.1467-6451.2007.00327.x

Warren, H. R., Raison, N., & Dasgupta, P. (2017). The rise of altmetrics. *JAMA*, *317*(2), 131-132. https://doi.org/10.1001/jama.2016.18346

Zupic, I., &Čater, T. (2015). Bibliometric methods in management and organization. *Organizational Research Methods*, *18*(3), 429-472. https://doi.org/10.1177/1094428114562629