

Chapter 22

Coaching in Sports: Implications for Researchers and Coaches



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Abstract Sports Coaching research continues to develop, although with a narrow spread of publication, mainly within Sports Psychology, and small impact across Sports Science journals. Nevertheless, Sports Coaching research potentially investigates an array of basic and applied research questions. Hence, there is an opportunity for improvement. Moreover, there is an increased awareness in several scientific areas, including Sports Science, about several problems pertaining to design, transparency, replicability, and trust of research practices. Particularly in Sports Coaching research, these problems include limited or inadequate validation of surrogate outcomes and lack of multidisciplinary designs, lack of longitudinal and replication studies, inappropriate data analysis and reporting, limited reporting of null or trivial results, and insufficient scientific transparency. In this chapter, we initially discuss the trends of publication in Sports Coaching, highlighting research problems as they pertain to their treatment in other disciplines, namely psychology. Lastly, we illustrate an example applied to Sport Coaching research with a repeated measures design and an interdisciplinary approach as a recommendation to promote transparency, replicability, and trust in Sports Coach research.

Keywords Sports coaching · Scholarly publishing · Open science · Reproducibility · Coaching practice

Sports Coaching research continues to develop (Gilbert & Trudel, 2004; Griffo, Jensen, Anthony, Baghurst, & Kulinna, 2019). Nevertheless, the initial argument in this chapter is that Sports Coaching Research still falls mostly within a narrow

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spread of publication, mainly within Sports Psychology, and with a small impact across Sports Science journals.

To support our argument, we examined the published Sports Coaching research between 2000 and 2019 in Sports Science journals indexed on Web of Science or Scopus. The records were retrieved limiting the keywords “coach, coaches and coaching” in the titles, abstracts, and keywords in English language manuscripts. The specific syntax for Web of Science or Scopus searches to reproduce our approach is available in a public repository (<https://osf.io/vw8yq/>). For convenience, we considered journal by main publication theme (Sports Coaching and Pedagogy, Sports Science, Applied Sports Science, Physiology and Nutrition, Biomechanics and Motor Control, Psychology, Social Sciences and Humanities, Sports and Exercise Medicine and Health). After removing duplicate entries, we used mapping analysis to examine on the fly the main trends of Sports Coaching publication. For this step, we used the bibliometrix package (Aria & Cuccurullo, 2017), in R statistical language (R Core Team, 2018). Furthermore, we fitted multilevel ordinal regressions to describe the frequency of Sports Coaching articles published in Sports Sciences journals from 2000 to 2019, adjusting for whether journals were indexed in the Journal of Citations Reports (JCR) in the Sport Sciences section, and for the journal main area of publication. We modeled the data using fully Bayesian methods with the “brms” package (Bürkner, 2017), which calls Stan (Carpenter et al., 2017), in R statistical language (R Core Team, 2018). The data, priors, model specification and computation details, and R codes are available as supplementary material (<https://osf.io/vw8yq/>).

The frequency of Sports Coaching articles published in Sports Sciences journals increased substantially after about 2009, apparently coincident with the increase of volume of non-JCR indexed publications (Fig. 22.1, upper panel). This indicates a trend of decrease in the proportion of Sports Coaching articles published in the JCR indexed journal, adjusting for journals’ main area of publication (Fig. 22.1, lower panel).

Our analysis is consistent with previous analysis of Coaching research (Griffo et al., 2019), as, within Sports Science journals, Psychology appears as the main target area, albeit the trend of increase of Social Sciences and Humanities, and Sports Coaching and Pedagogy areas (Fig. 22.2, upper panel). The latter in particular with the prominence of the *International Journal of Sports Science and Coaching*. Nowadays the proportion of published articles across these three areas appears to be similar (Fig. 22.2, lower panel). The trend of decrease in the proportion of published Sports Coaching articles in Sports Psychology journals became apparent after 2010. Overall, the impact of Sports Coaching research in the field of Sports Sciences is small.

Nevertheless, the inspection of the mapping analysis shows that psychology-related themes remain the main focus and influence of Sports Coaching research. The most frequent words in the abstract (to provide a deeper view of studies), summarized in a word map (Fig. 22.3), are consistently associated with Sports Psychology subjects, and with coach education, given the increase of Sports

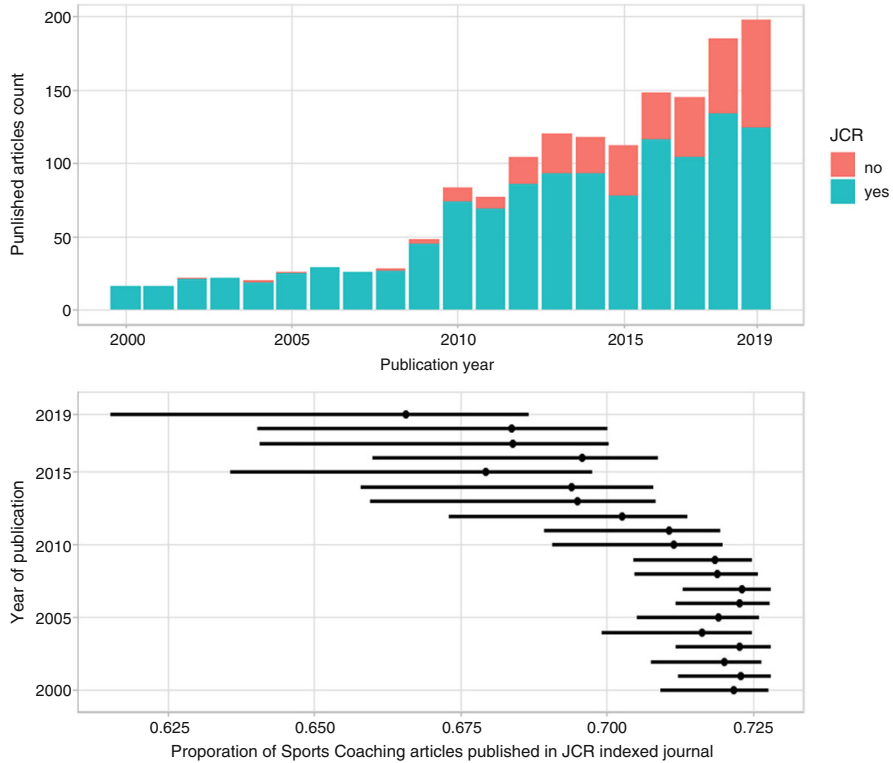


Fig. 22.1 Distribution of Sports Coaching articles across Science journals accounting for JCR from 2000 to 2019 (upper panel) and proportion of articles published adjusting for the area of publication in Sports Science journals (lower panel)

coaching articles in both Sports Coaching and Pedagogy, and Social Sciences and Humanities within Sports Science journals.

Despite the narrow spread of publication, the thematic analysis showed an apparent separation between themes across studies (Fig. 22.4). Considering a thematic map with five clusters with two main labels, it was identified as the main cluster that comprised themes such as coaching and sport (the main two labels), gender, education, expertise, pedagogy, self-determination theory, elite sport or swimming. There was a partial overlap with the second main cluster that identified youth sports and motivation as the main labels, comprised also themes such as self-determination theory, coach-athlete relationship, motivational climate, communication, support, autonomy, team sport, positive youth development or social support. The third cluster was more context-related (coach and soccer as main labels) such as performance, training, youth, or prevention, but there was also psychology associated themes such as leadership or stress. In a more distant quadrant and position, the smaller cluster was labeled as sport and athlete, including themes such as sport psychology, team sports, basketball attitude, burnout, performance analysis,

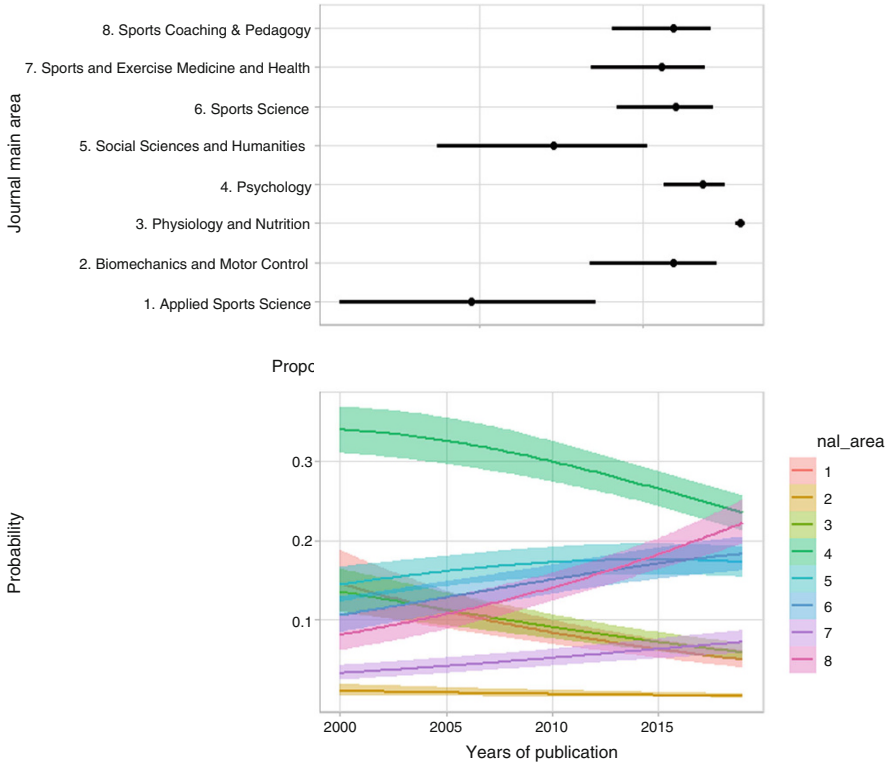


Fig. 22.2 Proportions of articles published in JCR journal by area of publication in Sports Science journals (upper panel), and by year of publication (lower panel)

coaching philosophy, or knowledge. Lastly, the most distant cluster from the three main clusters was identified with coach education and sports coaching as labels. The cluster included themes such as coach development, coach learning, professional development, mentoring, physical education, or qualitative analysis.

Our second argument lies in the increased awareness in several scientific areas (Gelman & Geurts, 2017; Pashler & Wagenmakers, 2012; Simmons, Nelson, & Simonsohn, 2011), including Sports Science (Halperin, Vigotsky, Foster, & Pyne, 2018; Knudson, 2017; Schweizer & Furley, 2016), about several problems of transparency, replicability, and trust of research practices. Note that there is also an intense discussion in medicine and health sciences (Bartell, 2019; Begley & Ioannidis, 2015; Gelman & Geurts, 2017). However, given the influence of Sports Psychology and Social Sciences and Humanities in Sports Coaching research, we can extrapolate that problems in our field may be similar. Particularly in Sports Science, these problems may include limited or inadequate validation of surrogate outcomes and lack of multidisciplinary designs, lack of longitudinal and replication studies, inappropriate data analysis and reporting, limited reporting of null or trivial results, and insufficient scientific transparency.

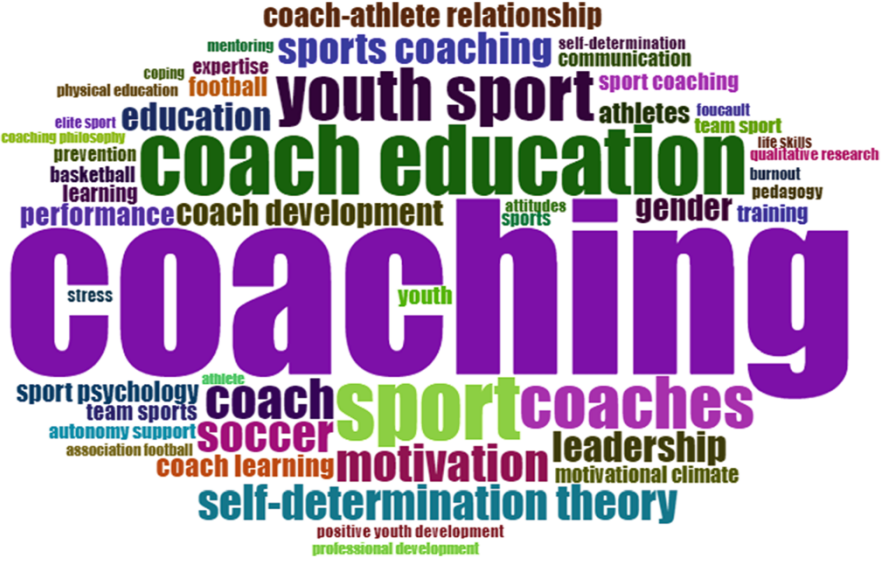


Fig. 22.3 Word map of most common words in the abstracts of Sports Coaching articles from 2000 to 2019

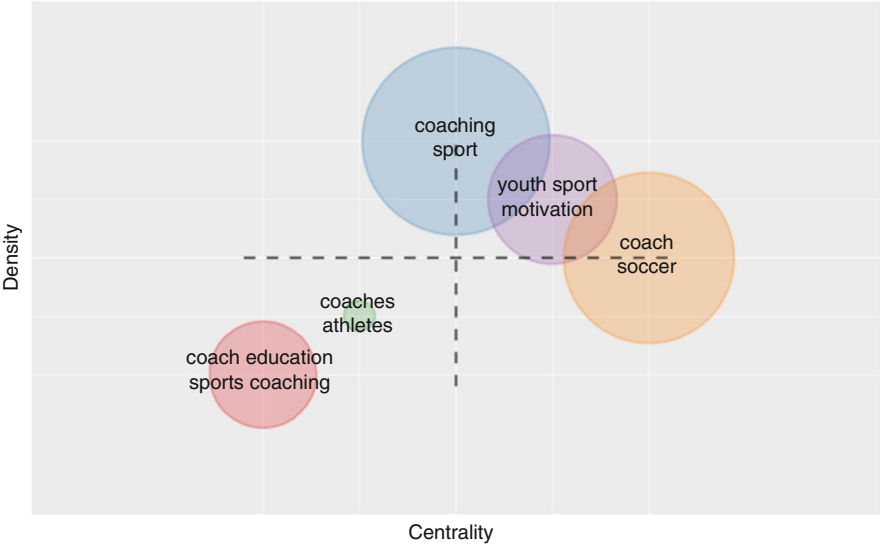


Fig. 22.4 Thematic map clustering the main themes across Sports Coaching articles from 2000 to 2019

The first reason to support our extrapolations lies in the lack of culture for replication studies in Sports Science, and by extension in Sports Coaching research. The awareness of potentially unreplicable findings in our field has likely risen with the discussion about the validity of a broadly used analytical approach in Sports Science, magnitude-based inference (Batterham & Hopkins, 2006), was noted (Sainani, 2018; Welsh & Knight, 2015). Incorrect statistical analysis and limited sample sizes, as often the case in Sports Science (Halperin et al., 2018; Knudson, 2017; Schweizer & Furley, 2016), and consequently the reporting of inaccurate inferences and inflated magnitude of effects can be common in our field.

Secondly, Sports Coaching research tends to be unidimensional, mostly based on cross-sectional observations, and comprising a narrow scope of behavioral characteristics and applied contexts. Not undervaluing the body of knowledge, sport is a living laboratory where diversity is the rule (Gonçalves, Carvalho, & Catarino, 2018). Coach practice and research deal with an extensive array of applied research questions. Often, the tension between biological and behavioral areas has been evident (Grecic & Collins, 2013; Jacobs, Claringbould, & Knoppers, 2016), and this situation likely limits researchers and coaches to develop a clear understanding of the coaching practice. Given the considerations about Sports Coaching research presented above, there is a clear need for interdisciplinary approaches to explore the interactions between individual learners/athletes exposed and responding to the coach's intervention within the different learning environments. Hence, research designs and analytical approaches need to adjust for different sources and levels of influence on individual learners/athletes' learnings and development, often requiring the assumption of limitations, whether theoretical, methodological, or practical (Gonçalves et al., 2018).

Lastly, we concur with the recent call in Sports Science for the adoption of more transparent research practices (Caldwell et al., 2020). In this case, we should follow examples from psychology where study preregistration, sharing of data, material, software, and code are helping to improve research transparency, albeit there is still a long way to go (Chambers, 2017). Code sharing allows for computational reproducibility, which promotes the ability to generate equivalent analytical outcomes from the same data set using the same code and software (Leek & Peng, 2015).

On the other hand, the traditional single-level analysis continues to be widely used for analysis and interpretation in Sports Science research and using null hypothesis testing and frequentist methods, albeit limitations being noted (Amrhein & Greenland, 2018; Amrhein, Greenland, & McShane, 2019a; Amrhein, Greenland, & McShane, 2019b; Gelman & Shalizi, 2013; McShane, Gal, Gelman, Robert, & Tackett, 2019). Bayesian methods, particularly within a multilevel framework, offer a very natural alternative, especially for accounting for different sources of inferential uncertainty when making estimations and predictions for a target population (Kennedy & Gelman, 2020; McElreath, 2015). Assuming a Bayesian perspective allow for direct probabilistic interpretations, by combining the available information with the observed data to update the knowledge, expressed as the posterior distribution (Lee & Wagenmakers, 2013). Bayesian estimates are

potentially valid for any sample size, given that plausible assumptions are stated (McElreath, 2015). Nevertheless, the process should be transparent and be inspected.

Practical Implications

Lastly, we illustrate an applied to Sport Coaching research with a repeated measures design and an interdisciplinary approach as a recommendation to promote transparency, replicability, and trust in Sports Coach research. Using simulated data based on an ongoing research project, we provide (as supplementary material) an application of analysis and interpretation of the coach intervention (different pedagogical coaching approaches) on athletes' physiological performance and behavioral characteristics across a competitive season period among adolescent players in a team sport (e.g., 11–16 years). Game-centered approaches are advocated to improve decision-making, skill execution, and physical fitness in sports coaching. However, available data is scarce. In this example, the researcher initially should consider the need to adjust for different levels and sources of variation on the outcomes, such as coach-level (e.g., age, previous experience as a coach and/ or with the pedagogical coach approach), player-level (e.g., chronological age, maturity status or accumulated experience) or environmental-level variation (e.g., club competitive level, competitive age group or youth sport program expectations). Measures include anthropometry, maturity status (estimated age at peak height velocity), a composite score of physiological capacity, scores from the motivation for deliberate practice, considering a context of talent development as an example, and a measure of collective-efficacy (collective efficacy questionnaire for sports). We simulated data for 6 teams of 12 players where three coaches used game-centered approaches and the other three used skill-based and coach-oriented approaches. To deal with the different levels and sources of variation we used Bayesian multilevel regressions to consider each measurement (level 1) within each player (level 2) nested by the coaching approach (Level 3). Furthermore, we illustrate individual and contextual variation accounting for the age group (U12, U14, U16), maturity status (early, on-time and later maturers), and the onset of sport-specific deliberate practice (pre-puberty, during puberty and late puberty) as group-level effects. The data generation, model specifications, priors, codes and computation details, and R codes are available as supplementary material, allowing for replication, manipulation of our example, and transparency in the interpretations (<https://osf.io/vw8yq/>).

Coaches interpret reality and make decisions based on several observable parameters, mediated by their knowledge of the sport, and by their philosophies (Gonçalves et al., 2018). The coach must know how to locate and rank the athlete among his/her peers and must track the personal development trajectory of the athletes he/she coaches. Longitudinal research designs considering multidimensional approaches and available advanced modeling are essential to advance Sports Coaching research. This may contribute to provide meaningful

information for coaching education/science exposure in academic settings and to develop research questions and designs applicable to applied coaching practice.

Key Points

Journal articles are the main means of disseminating Sports Coaching research. In our field, there is a growth in the body of knowledge, particularly in the last decade. Nevertheless, the range of topics remains mostly in the area of Sports Psychology and more recently growing in Social Sciences, and Coaching and Pedagogy. Hence, it will be key to increase interdisciplinary research in Sports Coaching research, which given the complexity of coaching practice should be the standard, as noted in general for Sports Sciences research (Burwitz, Moore, & Wilkinson, 1994; Piggott, Muller, Chivers, Papaluca, & Hoyne, 2018).

Moreover, there is a trend of an increase in non-JCR indexed publications, also in the last decade. This may partially reflect the positive trend of emergence of Sports Coaching specific journals (*International Journal of Sports Science and Coaching*, *Sports Coaching Review*, *International Sport Coaching Journal*). On the other hand, it may reflect an increased publication of less rigorous studies that would not be considered in many JCR indexed publications, in particular journals with a broader range of areas published in Sports Science.

Reproducibility and transparency are key issues as scientists across disciplines increasingly recognize the challenges of reproducing published results and the threats that irreproducible results pose to the scientific process (Powers & Hampton, 2019). Hence, this is a key point in our field, where researchers need to be aware that there may be a reproducibility crisis in Sports Coaching research. Scientific claims should not gain credence because of the status or authority of their originator but by the replicability of their supporting evidence (Open Science Collaboration, 2015). Hence, the estimation of reproducibility in Sports Coaching Science is an open area that warrants urgent attention. Furthermore, Sports Coaching researchers need more transparent research practices and reporting, as recently highlighted for Sports Sciences (Caldwell et al., 2020). This will require the incorporation and generalization of practices such as study pre-registration, sharing data and codes, and use of appropriate statistical analysis. Overall, there is much to do to improve the potential translation of Sports Coaching research to the field.

Conclusion

The chapter focused on the trends of published Sports Coaching Science in reference journals of Sports Sciences. We advocate the need to have a wider range of questions and to incorporate interdisciplinary approaches and longitudinal designs in Sports Coaching research. Like in other scientific areas, Sports Coaching research

potentially has problems of design, transparency, replicability, and trust of research practices. There is the need to advance on the examination of the reproducibility of the research in the field, as well as to adopt more transparent research practices that will allow developing trust in Sports Coach research.

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