

KNOWLEDGE TRANSFER FROM SPORT SCIENCE TO COACHING: A SOUTH AFRICAN COACH'S PERSPECTIVE

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ABSTRACT

This study examined the extent to which sport science knowledge translates to coaching. The sample consisted of 202 South African sport coaches (174 males; 28 females; mean age=31.56±8.85 years; coaching experience mean: 6.22±5.13 years). Data were collected using a validated questionnaire. The results showed that injury prevention and recovery, fitness/conditioning, individual skill development, training programmes (strength, endurance, etc.), tactics/strategy, nutrition and mental training and preparation were most likely to be of interest to sport coaches. Coaches reported that they were more likely to interact with other coaches, watch sport coaching videos, attend conferences/workshops, consult mentors and experiment with new ideas in order to obtain new information. This study underscores the need for coaches and sport scientists to collaborate directly in order to communicate and disseminate knowledge effectively between sport science and coaching.

Keywords: Coaches; Knowledge transfer; Performance; Sport Science.

INTRODUCTION

Sport science is a discipline which deals with the improvement of athletic performance through the use of scientific methods (Haff, 2010). Therefore, it is the role of a sport scientist to discover the most impactful gaps in current knowledge and to implement unique training programmes supported by construct scientific principles (Haff, 2010). As such, a collaboration between sport scientists and coaches is crucial, as only research findings leading to practices that can be adopted would be expected to enhance the performance of athletes (Bishop, 2008). Acquiring sound sport science knowledge is also fundamentally critical for coaches enabling them to make effective informed decisions based on rapid problem solving (Abraham *et al.*, 2006).

Despite having a positive and significant impact on the knowledge of coaches, there is a general consensus that the transfer of sport science knowledge into coaching practice is relatively poor (Bishop, 2008; Martindale & Nash, 2013) and does not meet the needs of coaches (Williams & Kendall, 2007). This could be because sport scientists have often focused on the context of their own disciplines, be that as a biokineticist, physiologist or psychologist, whereas a coach needs to solve a problem specific to an individual athlete (Williams & Kendall, 2007). Sport scientists are also criticised for conducting research that is irrelevant and often limited to high-performance athletes only (Bishop, 2008; Kubayi, 2018).

Williams (2005) further confirmed that much of the research conducted in the area of sport science has a limited application and practicality for coaches in preparing their athletes. This could be attributed to fact that the findings of such research are presented in inappropriate language that is, in reality, too formal, technical, and difficult to digest (Kubayi *et al.*, 2018). Therefore, coaches with little knowledge of sport science may be unable to readily interpret and apply information in the absence of sport scientists, clearly articulating instructional content in practical terms (Williams & Kendall, 2007; Reade *et al.*, 2008a). This has left the dissemination and use of sport science for most coaches to be second-hand and *ad hoc* means (Martindale & Nash, 2013). The coach requires the ability to communicate openly with sport scientists in order to understand and apply research findings speedily, allowing for swift implementation of training modifications when needed. Without these associated features of sport science research, this knowledge is of little or no use to coaches (Stone & Gray, 2010).

It is currently unknown, however, whether the knowledge created by sport scientists is transferred effectively, translated and acquired by coaches (Reade *et al.*, 2008b). It is possible that certain coaches prefer to consult other sources of information as opposed to relying on sport science (Martindale & Nash, 2013). For example, a number of Canadian studies (Erickson *et al.*, 2008; Reade *et al.*, 2008a) found that coaches preferred to learn from other coaches as a primary source of knowledge. Similarly, Mesquita *et al.* (2010) found that among Portuguese expert coaches, learning by doing and attending seminars/clinics were regarded as the most important sources of coaching knowledge. Morris-Eyton and Coopoo (2014) also noted that South African coaches tend to acquire knowledge through personal experience and by observing other coaches. Other studies have similarly reported that coaches generally acquire knowledge through their own previous experience as athletes and through mentoring from other coaches (Gilbert *et al.*, 2006; Koh *et al.*, 2014).

Erickson *et al.* (2008) suggested that an effective mentor can help a coach to develop his or her own coaching style and philosophy. Despite this, mentorship does not necessarily address the question of how and where coaches initially arrive at new ideas or specific knowledge of sport science. Perhaps knowledge of sport science is acquired as communicated to coaches from mentors while attending coaching clinics and conferences (Reade *et al.*, 2008a). In this context, more research needs to be conducted in order to advance the understanding of how knowledge of sport science can be effectively and efficiently disseminated to coaches (Martindale & Nash, 2013), as this could contribute to an all-around improvement in athlete development and success.

Whilst research on understanding the level of interest that coaches have in sport science is essential, the extent to which coaches interact with sport scientists has not been investigated sufficiently (Reade *et al.*, 2008b). Therefore, because coaches in South Africa tend to encounter unique demands related to coaching culture that are not noticeable in more developed countries (Kubayi *et al.*, 2018), it is important to investigate how and to what extent sport science knowledge is transferrable to coaching. There is a need for more research in this area so that coaches would be able to keep up to date with the latest developments and training methods if they are to optimise the performance of athletes (Williams & Kendall, 2007).

PURPOSE OF THE STUDY

Consistent with previous research (Reade *et al.*, 2008a), the present study sought to answer the following questions: (1) How do South African coaches perceive sport science research? (2) What sources of sport science information do South African coaches consult when looking for

new ideas in coaching? (3) What barriers do South African coaches experience in accessing sport science information? The results of this study may serve to help provide information regarding the concepts and skills coaches require in terms of transferring sport science knowledge. Advancing the understanding of basic knowledge of sport science may assist coaches in readily applying the latest scientific information in the training of their athletes (Haff, 2010).

METHODOLOGY

Participants

The participants were 202 sport coaches (174 males; 28 females) aged 18 to 60 years (mean age: 31.56 ±8.85 years) with coaching experience ranging from 1 to 36 years (mean: 6.22±5.13 years). Participants were coaches in at least one of the following sports: cricket (n=67, 33.2%), rugby (n=59, 29.2%), soccer (n=51, 25.2%), hockey (n=16, 7.9%) and netball (n=9, 4.5%). For the purpose of this study, coaches were regarded as belonging to one of the following categories: participation, development or high-performance orientated coaches (Mallett, 2013). Participation orientated coaches generally work in community contexts in which there is a low level of competition. Development orientated coaches are those that work in formal competitive environments, such as schools and sport clubs. The high-performance orientated coaches operate in elite sporting environments, such as university, provincial and national levels, as well as the Olympics (Reade & Rodgers, 2009; Mallett, 2013).

Research instrument

An adapted version of the questionnaire developed by Reade *et al.* (2008a) was used to collect data. The questionnaire assesses knowledge-transfer issues between sport scientists and coaches using closed-ended questions. The questionnaire was designed to define new ideas that coaches have about sport-performance enhancement, as well as the role that sport science research findings plays in coaching. All items were anchored on a five-point Likert scale ranging from 1 to 5. A pilot study was conducted to ensure that the questionnaire had no ambiguity or confusion regarding the understanding of the questions. Consequently, no changes were made to the questionnaire used in the main survey. The Cronbach alpha coefficient was computed to test the internal consistency of the instrument. The overall reliability of 0.83 for the questionnaire was higher than the benchmark of 0.70 proposed by Nunnally and Bernstein (1994).

Data collection procedure

Ethical clearance (Ref no: REC-01-23-2016) to conduct the study was obtained from the Faculty Research Ethics Committee of the University of Johannesburg. Coaches participated in the study after informed consent was obtained. Coaches were informed that their participation in this study was entirely voluntary and anonymous and that they had the right to withdraw at any stage without any prejudice or future disadvantage. Participants were assured that their withdrawal would in no way influence their continued relationship with their sport club and that they were not waiving any legal claims, rights, or remedies because of their participation in the study. The principal researcher administered the questionnaire to the participants. Participants were identified during coaching courses, seminars, and workshops

organised by various sport federations in South Africa. The questionnaires took approximately 5 to 10 minutes to complete.

Statistical analysis

Data were reported as means and standard deviations ($M \pm SD$). One-way analysis of variance (ANOVA) was applied to assess significant differences based on coaching level. The Tukey HSD *post hoc* method was used for further analysis where significance of the *F*-ratio was set at $p \leq 0.05$. Data were analysed using the Statistical Package for the Social Sciences (SPSS), version 24.0.

RESULTS

Table 1 shows the areas that sport coaches are more likely to look for new ideas. The results showed that “Injury prevention and recovery” (4.42 ± 0.86), “Fitness/conditioning” (4.37 ± 0.75); “Individual skill development” (4.30 ± 0.85); “Training programmes (strength, endurance, etc.)” (4.27 ± 0.76); “Tactics/strategy” (4.25 ± 0.86); “Nutrition” (4.23 ± 0.86); “Mental training and preparation” (4.22 ± 0.95); “Sport technology” (4.15 ± 0.86); and “Match analysis” (4.12 ± 0.89) were most likely to be of interest to sport coaches. No significant ($p > 0.05$) differences were found between mean values for participation coaches, development coaches and high-performance coaches.

Table 1. AREAS COACHES CONSULT FOR NEW COACHING IDEAS

Variable	All (n=202) M±SD	PC (n=98) M±SD	DC (n=60) M±SD	HPC (n=44) M±SD	Sign.
Injury prev. & recovery	4.42±0.86	4.42±0.85	4.56±0.66	4.19±1.09	0.10
Fitness/conditioning	4.37±0.75	4.35±0.79	4.40±0.73	4.38±0.73	0.92
Individual skill dev.	4.30±0.85	4.31±0.84	4.30±0.78	4.26±0.96	0.96
Training programmes	4.27±0.76	4.27±0.78	4.28±0.67	4.26±0.86	0.99
Tactics/strategy	4.25±0.86	4.21±0.83	4.34±0.83	4.20±0.98	0.59
Nutrition	4.23±0.86	4.14±0.97	4.28±0.81	4.37±0.66	0.30
Mental training & prep.	4.22±0.95	4.17±0.90	4.29±0.93	4.23±1.09	0.75
Sport technology	4.15±0.86	4.05±0.83	4.36±0.74	4.07±1.02	0.08
Match analysis	4.12±0.89	4.09±0.90	4.22±0.82	4.07±0.96	0.53
Periodisation	3.86±0.86	3.71±0.79	3.93±0.81	4.02±1.01	0.09

PC=Participation Coaches

DC=Development Coaches

HPC=High-Performance Coaches

prev.=prevention

dev.=development

prep.=preparation

* Sign.=Significant $p < 0.05$.

The most preferred sources for acquiring sport science knowledge reported by coaches were “Learning from other coaches” (4.24 ± 1.01); “Watch sport coaching videos” (4.15 ± 0.96); “Attend conferences/workshops” (4.05 ± 1.08); “Consult my mentor” (3.97 ± 1.05); and “Just experiment with new ideas” (3.70 ± 1.13) (Table 2). A significant difference was found regarding the following variable: “Watch sport coaching videos” ($F_{2, 189} = 4.850$; $p = 0.00$). Tukey

HSD *post-hoc* test revealed that the mean value of participation coaches (3.97 ± 1.04) was significantly different from that of high-performance coaches (4.51 ± 0.71). Development coaches (4.19 ± 0.90) did not differ significantly from either participation or high-performance coaches in this regard.

Table 2. SOURCES OF SPORT SCIENCE KNOWLEDGE CONSULTED

Variable	All (n=202) M±SD	PC (n=98) M±SD	DC (n=60) M±SD	HPC (n=44) M±SD	Sign.
Learning from other coaches	4.24±1.01	4.27±0.99	4.20±0.89	4.24±1.21	0.91
Watch sport coaching videos	4.15±0.96	3.97±1.04	4.19±0.90	4.51±0.71	0.00*
Attend conferences/workshops	4.05±1.08	4.00±1.17	4.14±0.99	4.02±1.01	0.75
Consult my mentor	3.97±1.05	3.94±1.05	4.05±1.02	3.93±1.10	0.77
Experiment with new ideas	3.70±1.13	3.69±1.10	3.86±1.11	3.51±1.19	0.28
Consult SSR/academics	3.52±1.19	3.45±1.21	3.69±1.13	3.40±1.21	0.34
Read reviewed journal articles	3.45±1.15	3.29±1.16	3.63±1.19	3.56±1.05	0.17
Read sport magazines	3.24±1.22	3.06±1.17	3.41±1.30	3.39±1.20	0.16

PC=Participation Coaches

DC=Development Coaches

HPC=High-Performance Coaches

SSR=Sport Science Researchers

* Sign.=Significant $p < 0.05$.

Coaches reported that they have access to sport researchers/scientists when trying to solve coaching problems, but the research is not presented in a manner that they can use easily (Table 3).

Table 3. COACHES' PERCEPTIONS OF RELEVANCE AND CONTRIBUTION OF SPORT SCIENCE RESEARCH

Variable	All (n=202) M±SD	PC (n=98) M±SD	DC (n=60) M±SD	HPC (n=44) M±SD	Sign.
I have access to SSR when solving coaching problems	3.00±1.26	2.91±1.21	3.36±1.20	2.70±1.37	0.02*
Research is not presented in a manner that I can use easily	2.99±1.14	3.14±1.09	2.86±1.23	2.86±1.10	0.23
I regularly utilise the services of SSR with my athletes	2.88±1.19	2.86±1.17	3.15±1.14	2.53±1.22	0.03*
I cannot access research being conducted	2.81±1.24	2.97± 1.20	2.69±1.32	2.62±1.17	0.22
Research not relevant to questions of athletes & myself	2.75±1.15	2.80±1.12	2.81±1.22	2.56±1.12	0.46
No research is being conducted in my sport specifically	2.59±1.19	2.68±1.11	2.64±1.34	2.35±1.13	0.30

PC=Participation Coaches

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HPC=High-Performance Coaches

SSR=Sport Science Researchers

* Sign.=Significant $p < 0.05$.

There were statistically significant differences between coaches concerning the following variables: “I have access to sport researchers/scientists when trying to solve coaching problems” ($F_{2, 192}=3.897$; $p=0.02$) and “I regularly utilise the services of sport science researchers/scientists with my athletes” ($F_{2, 191}=4.772$; $p=0.03$). For both variables, the Tukey HSD test indicated that the mean score of development coaches was significantly higher than that of high-performance coaches. Neither development nor high-performance coaches differed significantly from participation coaches.

Table 4 presents the barriers coaches experience when accessing sport science information. Coaches reported “Finding out where the information is” (3.37 ± 1.11); “Access to funding to cover costs of getting information” (3.33 ± 1.18); “Lack of resources” (3.32 ± 1.20); and “Translating the information from sport science into applied coaching situations” (3.32 ± 1.09) as major constraints in accessing sport science information. No significant ($p>0.05$) differences were observed between the mean scores of participation coaches, development coaches and high-performance coaches.

Table 4. BARRIERS COACHES EXPERIENCE IN ACCESSING SPORT SCIENCE INFORMATION

Variable	All (n=202) M±SD	PC (n=98) M±SD	DC (n=60) M±SD	HPC (n=44) M±SD	Sign.
Finding out where information is	3.37±1.11	3.48±1.07	3.27±1.20	3.29±1.07	0.45
Access to funding for finding information	3.33±1.18	3.31±1.17	3.26±1.13	3.48±1.29	0.65
Lack of resources	3.32±1.20	3.62±1.27	3.10±1.37	3.33±1.02	0.10
Translating information from SS and apply to coaching	3.32±1.09	3.39±0.97	3.17±1.15	3.37±0.89	0.41
Lack of time	3.27±1.15	3.34±1.15	3.14±1.14	3.29±1.19	0.56
Pressure of coaching duties	3.26±1.12	3.33±1.04	3.08±1.16	3.36±1.21	0.35

PC=Participation Coaches
SS=Sport Science

DC=Development Coaches
* Sign.=Significant $p<0.05$.

HPC=High-Performance Coaches

DISCUSSION

This study found that coaches looked for new ideas in a variety of areas of sport science, such as injury prevention and recovery, fitness/conditioning, individual skill development and training programmes (strength, endurance, etc.). These findings demonstrate the tendency among South African coaches to emphasise technical skill aspects of coaching programmes to the detriment of fitness/physical conditioning and sport medicines (Morris-Eyton & Coopoo, 2014; Kubayi *et al.*, 2016). Therefore, it is recommended that sport science courses should be incorporated into coaching education programmes in order to facilitate knowledge transfer, especially in the areas of conditioning and sport physiology. The finding that sport coaches preferred to look for new ideas in the area of tactics/strategy is consistent with that of Reade *et*

al. (2008a). A possible explanation for this finding could be because all the participating coaches were coaching team sports (cricket, hockey, and netball). They were more interested in procuring information related to tactics/strategy than other aspects of coaching.

High-performance coaches also prioritised the need for new ideas in the area of mental training and preparation when compared to participation coaches. Indeed, previous research (Jedlic *et al.*, 2007) has highlighted that high-performance coaches have a propensity to incorporate mental imagery in their training programmes in order to improve athletic performance. This could be attributed to the fact that high-performance coaches usually work closely with sport psychologists compared to their amateur counterparts who could not afford such services. In contrast, it is likely that coaches who coach lower competitive level athletes (grassroots level athletes) may be less concerned with enhancing performance and, therefore, may be less likely to use information pertaining to sport psychology research (Pope *et al.*, 2015). Consequently, this study suggests that there is a great need for sport coaches to work with sport psychologists, especially at a grassroots level, as it would facilitate the knowledge transfer between them.

Nutrition was also reported as another important need of sport coaches. The science behind sport nutrition is one of the most important areas of sport coaching and performance, and yet the potential of this area is generally not realised in the applied field (Stone & Gray, 2010). Sport technology was reported as another source of coaching knowledge. Vargas-Tonsing (2007) also found that sport coaches were more likely to pursue further coaching education, if it was available online. Mesquita *et al.* (2010) were of the view that coaching knowledge could be improved by the information available on the Internet. Murray (2011) also confirmed that advancement of technology has provided personal access to seemingly unlimited amounts of information. Therefore, it is not surprising that many coaches regard the Internet as a potential source of information to supplement their coaching knowledge.

It was found that coaches often looked for new ideas from various sources of sport science knowledge. The primary source of knowledge reported in the present study was learning from other coaches. This finding is consistent with those of previous studies (Gilbert & Trudel, 2005; Werthner & Trudel, 2006; Erickson *et al.*, 2008; Reade *et al.*, 2008b; Sherwin *et al.*, 2017), which reported that coaches use unmediated learning strategies to obtain new ideas from their colleagues. The preponderance of watching sport videos and attending conferences/workshops were also reported as main sources of coaching knowledge. This finding was more apparent among high-performance coaches. It is noteworthy that coaches who are at high-performance centres are close to the top of the knowledge pyramid, so they have to go outside the coach-to-coach circle for new information (Reade *et al.*, 2008b). More specifically, previous research (Vince, 2016) has demonstrated that watching videos is beneficial to coaches, because they see the pictures and diagrams on the Internet which, in turn, facilitate the learning process.

Sport coaches further reported that they “Just experiment with new ideas” as another essential source of coaching knowledge. This result corroborates the findings of MacDonald *et al.* (2016), who reported that the majority of Canadian coaches identified learning by doing as a source of coaching knowledge. Erickson *et al.* (2008) also reported that coaches prefer to learn by trial and error. For instance, Vince (2016) reported that coaches in the United Kingdom preferred to learn from their own mistakes and from the things that went well during the coaching process. Furthermore, reading sport magazines and peer-reviewed sport journals were rated as the least useful sources of coaching knowledge.

These findings support those conveyed by González-Rivera *et al.* (2017) and Kilic and Ince (2015) reporting that the least used sources of coaching knowledge were academic

journals, books or magazines. These outlets are readily available sources of coaching knowledge for high-performance coaches, especially those based in universities, because of the close proximity between them and sport scientists and also scientific journals, magazines, and newsletters freely available in university libraries. However, the highly experienced and educated coaches may be uninterested in the knowledge created by sport scientists (Reade *et al.*, 2008b).

Sport coaches reported that they have access to sport scientists when trying to solve coaching problems, but the research is not presented in such a manner they can easily understand. In fact, previous studies (Williams & Kendall, 2007; Martindale & Nash, 2013) have indicated that sport scientists are often criticised for using jargon to communicate technical information with coaches. Sport scientists should be able to communicate their ideas and research findings to the lay population in a user-friendly way. The major barrier reported by sport coaches was being unable to find the source of information. This finding demonstrates that sport coaches are not interested in performing an extensive review of literature in order to obtain new ideas in coaching. Therefore, it is apparent that there is a need for a strategy to promote knowledge transfer between the sport scientists and coaches (Reade *et al.*, 2008a).

Limited access to funding to cover costs of getting new information was identified as a hindrance to sport coaches. This is probably because the organisations where coaches work do not provide funds for the collection of information (Reade *et al.*, 2008a). Insufficient funding was another constraint identified by coaches. As Kilic and Ince (2015) argued, it is difficult to obtain financial support to cover the expenses of sport science research. Lack of resources was identified as another barrier on sport coaches. This barrier was more noticeable among participation coaches than their high-performance counterpart. This could be attributed to the fact that it is very difficult for sport coaches who are not associated with universities or high-performance centres to access sport science information.

Most of the sport coaches working at an amateur level do not have the equipment required to improve athletic performance. Whilst most of the sport coaches staying in economically deprived areas cannot afford to buy the necessary equipment for training and conducting research, those who are based in universities and/or high-performance centres tend to have more resources because researchers traditionally target internationally recognised athletes (Amusa & Toriola, 2004).

Sport coaches further reported that they struggled to translate sport science information into applied coaching situations. Kilic and Ince (2015) also reported similar findings in which Turkish coaches were less likely to be able to transfer knowledge they obtained from sport science to their specific coaching situations effectively. Therefore, it is important that sport scientists translate sport science information in such a way that it is easily understandable, accessible to sport coaches and applicable to their coaching situations.

Time constraint was another obstacle reported by sport coaches. Reade *et al.* (2008b) stated that time is always a function of setting priorities, and if a motivated coach sees an urgent problem to be addressed, he/she will make the time to solve the problem by setting aside other tasks. This may be the reason why sport coaches in the present study preferred to obtain new ideas from other coaches, as it is much easier to acquire information effectively, efficiently and swiftly from a source that they have access to and feel they can trust. The finding can also explain the aspiration of sport coaches to have access to a sport scientist that they can consult directly for advice without taking the time to read and comprehend written information (Reade *et al.*, 2008b).

CONCLUSIONS

This study showed that sport science areas, such as injury prevention and recovery, fitness/conditioning, individual skill development, training programmes, tactics/strategy, nutrition, mental training and preparation, sport technology and match analysis were most likely to be of interest to sport coaches. Learning from other coaches, watching sport videos, attending conferences/workshops and consulting mentors were reported as the most preferred sources of sport science knowledge by coaches. It was further reported that sport scientists should conduct research that is relevant and directly applicable to coaches, while also presenting findings during coaching workshops and seminars using less technical language that could be easily understood by coaches.

The current study provides baseline information on knowledge transfer from sport science to coaching in South Africa, but it has some limitations. The fact that the participants were unevenly distributed in terms of gender and drawn from five sports emphasises the need for future studies to include a variety of sports and adopt a qualitative research approach. This will be helpful to obtain in-depth data regarding the transfer of sport science knowledge to coaching.

PRACTICAL IMPLICATIONS

The results of this study highlight practical implications of sport science knowledge transfer for sport coaches. Firstly, sport federations should establish formal and informal mentorship programmes so that coaches could have the opportunity to acquire sport information from more experienced colleagues. Secondly, sport scientists should present their research findings in an understandable form to the coaches and/or athletes and assist them to address coaching problems and improve athletic performance. Thirdly, partnerships should be established between sport federations and universities in order to facilitate access to sport science research information in their libraries for coaches.

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