Research article

Effects of a notational analysis-based intervention on coaches’ verbal behaviour according to physiological activation during competition

José F. Guzmán a, Joaquín Madera a, Diana Marín-Suelves b,*, Jesús Ramón-Llin c

a Department of Physical Education & Sport, University of Valencia, Valencia, Spain
b Didactics of School Organisation, University of Valencia, Valencia, Spain
c Didactics of Physical Education, Arts and Music, University of Valencia, Valencia, Spain

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ABSTRACT

The aim of this study was to examine the effects of a notational analysis-based intervention on coaches’ verbal behaviour considering their physiological activation during competition and game actions. Verbal behaviour, physiological activation (heart rate), and game actions of 4 handball coaches were recorded for a total of 28 matches. Each coach was recorded in 7 matches, three pre-interventions, two post-intervention, and two retention. Verbal behaviour was assessed using the Coach Analysis and Intervention System (CAIS: Cushion et al., 2012), and game actions were coded as positive or negative depending on their outcome. In total, 15223 verbal behaviours and 3780 game actions were recorded. The intervention programme sought to help coaches to provide constructive information (corrective feedback and instructions) after negative events or actions, encourage players (especially when the team is losing or playing badly), reduce the protests to the referee, and reduce or eliminate punishment to players. Chi-square analysis suggested that the intervention stimulated the intended changes in coaches’ behaviour, and that these changes were retained for subsequent games. Verbal behaviour changed depending on the physiological activation. This study suggests that a brief (two-session) notation-based intervention can elicit changes in coaches’ verbal behaviour during competition.

1. Introduction

Coaches are responsible for helping athletes to develop their skills, enjoy the experience, achieve performance goals, and maintain long-term participation (Fraser-Thomas and Coté, 2009; Smith and Smoll, 2007; Stebbings and Taylor, 2016). Verbal behaviour during training and competition has been linked to athletes’ anxiety, perceived competence, motivation, and performance (Allen and Howe, 1998; Amorose and Horn, 2001; Amorose and Smith, 2003; Amorose and Weiss, 1998; Black and Weiss, 1992; Duda, 2001; McArdle and Duda, 2002; Smoll et al., 2007; Stein et al., 2012). Some studies (Fletcher and Fletcher, 2005; Fletcher et al., 2008) reported a model of the relationship between what a coach does and the affective consequences and behaviours they cause in their athletes. Further, Smith and Smoll (1990) pointed out the fact that coaches are not always aware of their behaviour, or the way they influence the well-being and performance of their athletes. Thus, the analysis of coaches’ verbal behaviour and the use of this information to provide feedback to coaches appears to be a valid method to facilitate coaching effectiveness (Shannon et al., 2021).

The systematic study of coaches’ verbal behaviour through direct observation is a relevant research methodology in the field of sports performance, because it allows for the description of behaviour in training and competition (Abraham and Collins, 1998; Gilbert and Trudel, 2004; Shannon et al., 2021; Smith and Cushion, 2006). In fact, observational notational analysis with video recording increases objectivity when interpreting events that have happened during a competition (bib.odonoghue_2009O’donoghue, 2009). Research has analysed instruction in team and adversary sports, indicating that it constitutes the most frequent behaviour of the coach (Cruz et al., 1987; Cushion and Jones, 2001; Guzmán and Calpe-Gómez, 2012; Guzmán et al., 2014; Mouchet et al., 2013; Trudel et al., 1996; Smith and Cushion, 2006).

Several studies have analysed the positive or negative nature of the feedback provided by coaches during matches, verifying that they provide more positive than negative feedback, especially when they are winning (Calpe-Gomez et al., 2013; Halperin et al., 2016; Mouchet et al., 2013; Smith and Cushion, 2006) and that this correlates with an improvement in decision-making (Mann, 2012). Mason et al. (2020) recently verified a higher frequency of negative feedback than positive in...
high-level team sport, although the trend of providing more positive feedback during the time periods in which the team was winning compared to those it was losing remained. As for the overall amount of feedback, it has been shown that it is used very often and is not affected too much by the result (win/lose) (Halperin et al., 2016).

Research has shown that both instruction and positive feedback can boost effort and reduce athlete anxiety (Dwyer and Fischer, 1988). Additionally, affective communication has also proved to be important. Specifically, coach behaviour displaying negative emotion caused insecurity, concern, and a loss of concentration in players; and, in contrast, when they communicated positive with their players, they increased their feelings of self-worth and satisfaction towards the activity (Shigunov et al., 1993).

Several aspects of the competitive environment, such as the state of the game (positive or negative), the time remaining, or the positive or negative nature of the actions performed by players, may influence coach behaviour (Guzmán et al., 2014; Lorenzo et al., 2013; Mouchet et al., 2013). Mouchet et al. (2013) analysed the verbal behaviour of six rugby coaches depending on events of the game and observed communication peaks during important moments of the match, as well as after changes in the state of the game. Lorenzo et al. (2013) studied coaches’ verbal behaviour during the game and in time-outs, concluding that during the game, coaches used more brief exchanges of information, e.g., encouragement or positive feedback, whereas they turned to more elaborate information like corrective tactical feedback during time-outs or pauses.

Guzmán et al. (2014) examined the verbal behaviours in response to game actions of 21 handball coaches during 21 matches. After positive actions, coaches provided more positive and corrective feedback, instruction, hustle (encouragement), and praise; conversely, after negative actions, they provided more specific negative and corrective feedback, scolded players, gave information and direct management, and exhibited more non-specific verbalisations of their thoughts and feelings (not directed specifically to anyone). These results showed that sometimes coaches’ verbal behaviour is not always supportive of their players’ needs in specific game situations. For example, sometimes the instruction to hurry or the provision of corrective feedback (after mistakes) would be better to increase player confidence and motivation, instead of providing negative feedback, which often includes redundant information.

Another variable related to coaches’ verbal behaviour is their activation state. This variable refers to a psycho-physiological state ranging from deep sleep to nervous shock (Gould et al., 2002). The theory of the individual zone of optimal functioning (Hanin, 2000, 2007; Kamata et al., 2002) states that activation is related to sport performance because it affects muscular tension and attention. Imfeld (2015) measured activation via skin conductance and analysed the relationship between activation and coaches verbal behaviour during competition in basketball and handball. Using the modified categories of Coach Analysis and Intervention System (CAIS), proposed by Guzmán et al. (2014), Imfeld (2015) reported that high activation (in comparison to low activation) correlated with more encouragement and criticism of the organisation, less provision of information and corrective feedback, and less consultation with assistants.

Recently, the effect of emotional intelligence and the type of motivation the coach provides has been studied (Grijalbalto et al., 2022). Thus, Grijalbalto et al. (2022) grouped the CAIS verbal behaviours according to the type of coping that the coach was using in task-oriented, emotional positive and emotional negative. The results showed that coaches with greater self-determination motivation and emotional intelligence used more verbal behaviours showing positive emotional coping.

Researchers have proposed several intervention programmes to improve coach behaviour. The first training programmes for coaches were developed in the US: the American Coach/Sport Education Program (ACEP/ASEP: Martens, 1987), the National Youth Sports Coaches Association programme (NYSCA: Brown and Butterfield, 1992), the Athletic Coaches Education (PACE: Seefeldt et al., 2001), and the Coach Effectiveness Training (CET: Smith et al., 1979).

CET was an effective programme across several studies with soccer, baseball, and basketball coaches (Barnett et al., 1992; Boixados and Cruz, 1999; Conroy and Coatsworth, 2006; Cruz, 1994; Smith et al., 1995, 1979; Sousa et al., 2007). Results showed that after the intervention, players further appreciated coaching, provided higher evaluations of their coaches’ competence, and their dropout probability was reduced fivefold. CET was adapted to the motivational climate and achievement goals literature, leading to the Mastery Approach to Coaching (MAC: Smith et al., 2007).

The alternative Programme of Personal Advice to Coaches (PAPE) designed by Sousa et al. (2006), was an adaptation and individualisation of the CET guidelines. It was amended based on the idea that each coach had their own specific needs for improving, and as such, the intervention must satisfy the specific needs of each individual coach. This programme helped coaches to improve supportive behaviours and decrease punishment, and both changes were detected by their players (Cruz et al., 2011; Sousa et al., 2006, 2007).

The goal of many of these coach education interventions was to improve verbal behaviour especially in training; most of them did not use a reflective intervention based on the previous observation of coach verbal behaviour during competition. In addition, none of the interventions found in our review considered the verbal behaviour of the coaches based on their level of anxiety, nor the positive or negative actions of the team. Thus, the objective of this study was to analyse the effects of a two-session intervention programme on coaches’ verbal behaviour in the competitive environment considering their physiological activation and the game actions of the coached team. Specifically, coaches are provided with information about their general verbal behaviour during matches, associated game actions, and their levels of activation. Recommendations to improve their verbal behaviour patterns were justified by observational data and adjusted to respond to coach and player needs.

2. Method

The Ethical Commission of Experimental Research of the University of Valencia approved the study. The authors assured the participants that the study data would be presented anonymously, and they agreed in writing to participate.

2.1. Participants, matches, and behaviours

Four male handball coaches, aged 24, 31, 33 and 35, participated in the study. Each was observed during 7 matches (28 matches in total), from which 15,223 verbal behaviours were recorded, and 3,780 game actions coded. Their teams were junior (2) and senior (2) and competed in an intermediate category.

2.2. Measures

Verbal behaviours, game actions, and physiological activations were registered and synchronised using a Casio stopwatch (Casio Inc., Tokyo; Japan) that marked the beginning and end of the recording from each tool used to register these variables.

The coaches carried a pocket digital recorder that allowed us to register their verbal behaviours. Then, these were coded using a modified version of CAIS (Cushion et al., 2012) proposed by Guzmán et al. (2014). It comprised 25 primary verbal behaviours, two more than the original CAIS, with two extra categories: “alert” and “report”. See the description of the categories in Table 1.

2.2.1. Game actions and verbal behaviour after a positive or negative action

Two cameras, one pointed at the coaches on the opposite side, and the second placed on the field’s centreline. The second camera was elevated as high as possible to ensure the best possible view of the events during the game.
Based on Guzmán et al. (2014), nineteen game actions were coded, nine of which were registered as positive: score a goal, force a penalty throw, cause the expulsion of an opposing player, intercept or steal the ball, block or stop a shoot, force a bad pass, cause passive play, make a tactical foul that prevented a goal, and force an opponent’s offensive foul. The other 10 behaviours were negative: bad pass, bad reception, double dribble, steps, throw without scoring, passive play, make an offensive foul, cause the expulsion of an opposing player, intercept or steal the ball, and cause dangerous players or other team tactics.

The delay between a positive action and the next action was coded as “time after positive action”, and verbal behaviours performed during this phase were coded as behaviours after positive action. The same procedure was applied to negative actions.

2.2.2. Activation

Coach heart rate (HR) was recorded throughout the matches using a pulsedotter (polar 800). For each match, HR scores higher than the mean (M) plus half the standard deviation (SD) (M + 1/2 SD) were labelled as high coach activation. Verbal behaviours performed in this state were coded as made under high activation. On the other hand, HR scores lower than M – 1/2 SD were labelled as low activation, and verbal behaviours performed in this state were coded as being performed under low activation. This procedure allowed the authors to categorise behaviours in the analysis. The authors synchronised the encoding of game actions, coaches’ verbal behaviour, and HR.

2.3. Procedure (intervention)

There were three phases to the study: Pre-intervention, intervention, and post-intervention. In the pre-intervention phase, coaches’ verbal behaviour, activation, and game actions were recorded for three matches. In the intervention phase, the researchers provided the coaches with two sessions of information and reflection about their verbal behaviour in previous matches, as well as recommendations for improvement, based on results of Calpe-Gómez et al. (2013) and Grijalbo et al. (2022). Specifically, researchers delivered a presentation to coaches, where they received quantitative information of their verbal behaviour because in relation to game actions (positive or negative) and coaches’ activation level (high or low); they also had the opportunity to observe these. The researchers promoted the coaches’ reflection with open questions about how they thought their behaviour was affecting player motivation, satisfaction, and performance. From this reflection, the researchers justified and provided different recommendations, as can be seen in Table 2. Each recommendation was qualified according to the behaviours performed by each coach based on results of previous studies (Cruz et al., 2011; Guzmán et al., 2014; Grijalbo et al., 2022, Sousa et al., 2006, 2007).

The subsequent matches played after each intervention session were the intervention matches. Finally, two further matches played immediately afterwards comprised the post-intervention phase. Thus, in total the research team analysed the verbal behaviour of seven matches for each coach.

2.4. Variables analysed

There was one dependent variable:

• CAIS behaviours modified by Guzmán et al. (2014). This variable was grouped into four categories, as explained in the data analysis section.
To reduce or eliminate punishment or scolding to players
To try to control activation before performing any verbal behaviour

There were three independent variables:

- Moment of Intervention (3 intraclass categories): Pre-intervention, during the intervention, and post-intervention.
- Type of action (2 interclass categories): After a Positive Action (of the team coached) or After a Negative Action.
- Activation level (heart rate) of the coach (2 interclass categories): High Activation and Low Activation.

2.5. Data analysis

To facilitate the analysis and reflection, the researchers grouped coach behaviours into four higher-order categories of special relevance for feedback provision. These categories were proactive task behaviour, positive behaviour towards a player, negative behaviour towards a player, and criticism of the organisation. This categorisation is very similar to the one made by Grijalbo et al. (2022), who grouped according to the type of coping expressed by the coach (task-oriented, positive emotional, and negative emotional). Thus, there is a coincidence between proactive behaviours and those oriented to the task, between positive behaviours and positive emotional coping, but we have separated negative emotional coping into negative behaviours and criticism of the organisation. To describe our 4 categories, Crant (2000) defined proactive behaviour as taking the initiative to improve current circumstances or create new ones. In this study, proactive task behaviour comprised those behaviours where the coach intended to improve athlete performance, i.e., corrective feedback, instruction, alert, inform, direct organisation, and indirect organisation. Positive behaviour towards players intended to promote their well-being, providing them with positive affective information, and included humour, encouragement, and praise. Negative behaviour towards players tried to eliminate behaviours in a negative affective way, and included punishment and scolding. Finally, criticism to organisation corresponded to category 23 (“management criticism”) in CAIS (Table 1).

2.5.1. Reliability

Three analysts coded the verbal behaviours, with adequate inter-observer reliability (inter-observer kappa = .81; M of intra-observer kappa = .84). The reliability of the categories added to CAIS was adequate for “alert” (inter-observer kappa = .86; M of intra-observer kappa = .89) and “inform” (inter-observer kappa = .83; M of intra-observer Kappa = .87).

Two analysts coded the game actions, with adequate inter and intra-observer reliability (kappa coefficients .95 and .99 respectively).

2.5.2. Statistical analysis

Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences, Chicago, Illinois, United States) version 26.0. Frequencies and percentages of “primary verbal behaviours” in CAIS and their frequencies and percentages depending on the type of previous action (positive or negative) and activation (high or low) were calculated. Five chi-square tests (for general data, high activation, low activation, after a positive action, and after a negative action) were conducted to assess differences in verbal behaviour in pre-intervention (three), intervention (two), and post-intervention (two) matches with post hoc Z test adjusting the significance according to Bonferroni. The effect size on these variables was calculated using Crammer’s V and phi where 0.1 represented a small effect, 0.3 medium and 0.5 large (Crammer, 1999). The value of significance was adjusted for values of p < 0.05.

3. Results

3.1. Overview of verbal behaviours

In general terms, “proactive task behaviours” (corrective feedback, instruction, alert, inform, direct and indirect management) were performed most frequently. Instruction was the most common (30.4–33.7%), followed by direct management (7.1–8.5%). The next most performed category was positive behaviour towards a player (humour, hurry, and praise); of these, hurry was by far the most frequent (7–13.2%), followed by humour (0.2–0.5%), and praise (0–0.2%). The third general category in terms of frequency of use was criticism to the organisation (0.4–4.1%), and finally the least frequent category was negative behaviour towards a player (punishment and scolding), with scolding being the most common aspect (0.6–1.7%) followed by punishment, which was very infrequent (0.6–1.7%) (Table 3).

3.2. Effects of the intervention on coaches’ verbal behaviour

In general, the intervention had a significant effect ($\chi^2 = 102.1; p < 0.001; \phi = 0.110.$) on the different verbal behaviours (Table 3). As for proactive behaviours, they were maintained during the intervention but decreased significantly after the intervention ($\chi^2 = 25.7; p < 0.001; V = 0.048.$). Thus, significantly, instructions decreased in the intervention phase but then returned to the previous level, and corrective feedback increased initially, and although it decreased afterwards, it was still higher than the initial levels. No significant differences were found during the intervention in direct or indirect management. While the “alert” behaviour increased significantly during the intervention and decreased (significantly) to values similar to the initial ones, the “inform” behaviour decreased during the intervention, and then significantly after it.

Positive behaviour towards players increased significantly and progressively ($\chi^2 = 115.1; p < 0.001; V = 0.101$). These changes occurred due to the significant increase in “hurry” behaviours, while “humour” and “praise” remained between final and initial values.

Finally, criticism to the organisation ($\chi^2 = 47.4; p < 0.001; V = 0.065$) and negative behaviour towards players ($\chi^2 = 46.3; p < 0.001; V = 0.064$), based on scolding, decreased significantly; these changes remained in the post-intervention phase (Table 3).

3.3. Effects of the intervention on coach verbal behaviour under high or low activation

The effects of intervention differed depending on their activation levels (Table 3). The intervention had a significant effect on the verbal
The effects of the intervention on coaches' verbal behaviour differed according to game actions. Thus, the intervention had a significant effect on coach verbal behaviour after positive team actions ($X^2 = 64.2; p < 0.001; \phi = 0.125$). After a negative action, negative behaviours towards players (scolding) ($X^2 = 32.9; p < 0.001; V = 0.079$) decreased significantly, as did some proactive tasks ($X^2 = 8.6; p = 0.014; V = 0.04$) like information (inform) to players, while positive behaviour towards players (hurrying) ($X^2 = 39; p < 0.001; V = 0.086$) increased significantly. Criticism to the organisation ($X^2 = 43.7; p < 0.001; V = 0.091$) decreased and then increased significantly, but to a significantly lower level than before. The opposite was found with proactive tasks (corrective feedback and direct management), increasing during the intervention, and decreasing afterwards but not to the same level as before (Table 3).

### 3.4. Effects of the intervention on coach verbal behaviour after a positive or negative action

The effects of the intervention on coaches' verbal behaviour differed according to game actions. Thus, the intervention had a significant effect on coach verbal behaviour after positive team actions ($X^2 = 64.2; p < 0.001; \phi = 0.125$). After a negative action, negative behaviours towards players (scolding) ($X^2 = 32.9; p < 0.001; V = 0.079$) decreased significantly, as did some proactive tasks ($X^2 = 8.6; p = 0.014; V = 0.04$) like information (inform) to players, while positive behaviour towards players (hurrying) ($X^2 = 39; p < 0.001; V = 0.086$) increased significantly. Criticism to the organisation ($X^2 = 43.7; p < 0.001; V = 0.091$) decreased and then increased significantly, but to a significantly lower level than before. The opposite was found with proactive tasks (corrective feedback and direct management), increasing during the intervention, and decreasing afterwards but not to the same level as before (Table 3).

### 4. Discussion

The results of this study suggest that a performance analysis-based intervention was a useful tool to improve coach communication during competition. The key points of the methodology were based on the results of Calpe-Gómez et al. (2013) and Grijalbo et al. (2022): (1) coaches had quantitatively knowledge about the verbal behaviours they had performed during the game. (2) coaches knew how their verbal behaviour changed depending on game actions and results – this allowed them to reflect on how it was connected to player needs during the game, and researchers provided recommendations to improve communication. (3) Coaches knew how their verbal behaviour changed depending on their arousal – this allowed them to reflect on how their pattern of communication changed based on internal processes and enabled the researchers to provide recommendations. (4) Coaches could observe their verbal behaviour if they asked for it; observation was as a strong stimulus to reflect on their behaviour.

Verbal behaviours performed by coaches in this study showed similar results to those obtained in other studies (Cruz et al., 1987; Trudel et al., 1996; Partington, 2013; Lorenzo et al., 2013; Guzmán et al., 2014), with task behaviours being the most common, especially instruction. Cruz et al. (1987) reported that over 50% of verbal behaviour in a sample of basketball coaches involved technical or tactical information. In a junior football context, some studies (Cushion and Jones, 2001; Smith and Cushion, 2005), reported that professional coaches predominantly used instruction (34.79% of verbal behaviours) while lower proportions were devoted to other behaviours, such as compliments (25.33%), encouragement (6.61%), and scolding (1.64%). Conversely, the work of Trudel et al. (1996) suggests lower levels of instruction in junior ice hockey coaches during games, who rather focused on organising (15%), and directing the game (8.1%).
Several potential recommendations may be useful in promoting effective coach behaviour. First, coaches should ensure they provide useful information after negative events or actions, especially corrective feedback and instructions. Grijalbo et al. (2022) pointed out that coaches with higher self-determination and motivation used coping strategies such as corrective feedback and instructions. In this way, the intervention resulted in an increase in corrective feedback, though levels of instruction remained stable. Corrective feedback, on the other hand, increased in conditions of high activation, and after positive and negative action; unfortunately, these positive effects tended to decrease after the intervention phase. It seems logical that eliciting robust change in coach behaviour may require a more prolonged intervention phase, and most certainly continued training and support in realising such change (Singer and Anshel, 2006).

The second recommendation arising from this study is that players need to be actively encouraged by coaches. Guzman et al. (2014) pointed out the importance of hurrying behaviours and positive feedback especially if the team is losing, playing badly, or after an individual mistake. Hurrying messages provided by the coach have great motivational importance because they transmit confidence to the player and increase their possibilities of playing well and downplay errors, which would be related to an improvement in decision-making performance, as indicated by Mann (2012). It also shows affection for the players, who are more likely to feel accepted and socially valued. Thus, hurry and encouragement may reinforce two basic needs of the athletes, affiliation and perceived competence. Results suggested that coaches followed the recommendation of increasing hurry up behaviours (in general, in high and low activation, and after positive and negative action). These recommendations were pointed out by Grijalbo et al. (2022) who indicated that coaches with higher emotional intelligence, self-determination, and motivation used more positive coping verbal behaviours.

Thirdly, it is important that coaches reduce the level of criticism to the referee. Criticism limits the opportunities for the coach to direct his verbal behaviour to more productive aspects for performance improvement and represents a distraction for both the coach and players, with the focus shifting from the game to the referee (Grijalbo et al., 2022). Moreover, this also anticipates the attraction of failure to an external cause; it is natural for the players to consider whether the coach is starting to lose hope of winning the game (Allen et al., 2020). The intervention reduced this behaviour (in general, in high activation, and after positive and negative actions). This behaviour did not change in low activation, probably because it was already very low in the pre-intervention phase. Nevertheless, after a negative action, there was a tendency to return to pre-intervention rates. On the other hand, criticism to the organisation is a potentially distracting variable, because coaches lose the focus on the task in favour of other aspects of the environment, such as the referee. According to Grijalbo et al. (2022), coaches with higher self-determination, motivation, and emotional intelligence made significantly less criticism of the referee and the organisation. In our case, coaches significantly decreased this behaviour in a high activation state, suggesting that the coach was less concerned with things out of his control, such as the referees’ behaviour.

The fourth general guideline for coaches is to reduce or eliminate punishment and scolding (Cruz et al., 2011; Grijalbo et al., 2022; Sousa et al., 2006, 2007). Incidents of punishment were low throughout the intervention phase. Nevertheless, after a negative action, there was a tendency to return to pre-intervention rates. On the other hand, criticism to the organisation is a potentially distracting variable, because coaches lose the focus on the task in favour of other aspects of the environment, such as the referee. According to Grijalbo et al. (2022), coaches with higher self-determination, motivation, and emotional intelligence made significantly less criticism of the referee and the organisation. In our case, coaches significantly decreased this behaviour in a high activation state, suggesting that the coach was less concerned with things out of his control, such as the referees’ behaviour.

The next recommendation for coaches is that, independently of activation, behaviours need to remain task-focused to improve performance. The percentage of proactive task behaviours in high activation was very stable across the study, with a very small non-significant variation between phases. Thus, the stability of proactive task behaviour indicated that coaches remained focused on improving performance. Smith et al. (2015) previously reported that an excessive amount of proactive behaviours can lead to an overload of cognitive processing and a decrease in physical performance, as well as worse decision-making (Smith et al., 2016), so several authors have concluded that it is desirable to limit them to truly key aspects related to performance improvement (Mouchet et al., 2013; Smith and Cushion, 2006).

Overall, the results supported the effectiveness of the intervention based on the recommendations of previous studies (Cruz et al., 2011; Grijalbo et al., 2022; Sousa et al., 2006, 2007). In general, coaches increased positive behaviour (hurrying up and encouragement), decreased negative behaviour (scolding), and decreased criticism towards the organisation. These changes were maintained even when coaches were highly activated or the team was playing badly/making mistakes (after a negative action).

Because some changes were lost post-intervention, it would be appropriate to repeat the intervention periodically (Singer and Anshel, 2006), emphasising differential player needs after a positive and negative action and accompanying it with other procedures, such as training to manage activation states, so that effects might be more robust over time. Finally, it should be noted that the present study has some limitations, such as not having qualitatively analysed the performance of the coaches with potential interviews or quantitatively through questionnaires with them and their players, which is why this is proposed as a future line of research. Although we think that the coaches of high-performance teams will present the same behaviours in junior and senior categories, it is a variable that could be analysed in the future. Another proposal for the future would be to carry out interventions based on analysing a coach’s verbal behaviours based on the interaction of the type of action previously performed by the team (positive or negative) and the level of physiological activation (high or low activation).

5. Conclusion

An intervention where coaches received quantitative information about their verbal behaviour during competition as a function of game action results (positive or negative) and their activation state (high and low), along with recommendations based on motivational theories was useful for improving coach verbal behaviour during competition.

Declarations

Author contribution statement

José F. Guzmán; Joaquín Madera; Diana Marín Suelves; Jesús Ramón-Llin: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interest’s statement

The authors declare no conflict of interest.

Additional information

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