Journal of Human Kinetics volume 59/2017, 55-65 DOI: 10.1515/hukin-2017-0147
Motivation in Physical Education, Sport and Physical Activity and Health

DE GRUYTER OPEN

The Cognitive and Motivation Intervention Program in Youth Female Volleyball Players

by
Fernando Claver[1], Ruth Jiménez[1], Alexander Gil-Arias[2], Alberto Moreno[1], M. Perla Moreno[1]

This study, grounded in Self-Determination Theory (Deci and Ryan, 1985, 2002) was aimed to determine the influence of a cognitive-motivational intervention program, to improve the basic psychological need satisfaction of autonomy and competence, autonomous motivation, procedural knowledge, perceived performance and sport commitment, in youth volleyball players. Participants included 34 Under-19 female volleyball players. A quasi-experimental design was carried out with an experimental group (n = 16; M = 17.45; SD = .45) and a control group (n = 18; M = 16.64; SD = .70). The experimental group followed a multidimensional intervention program comprised of 24 sessions held over three months (two training sessions per week). It was based on two strategies: giving athletes the possibility of choice in specific training tasks (proposing training situations with several action alternatives) and questioning (cognitively involving players through tactical questions). A repeated-measures MANOVA 2 (group: experimental and control) x 2 (time: pre-test and post-test) was used to analyse the effect of Group x Time interaction. The results of the inter-group analysis showed significant differences in the post-test measurement between the experimental group and the control group (in favour of the experimental group) in the variables: basic psychological need satisfaction of autonomy and competence, autonomous motivation, procedural knowledge, perceived performance and sport commitment. Given the relevance of the cognitive-motivational processes, not only for performance but also for sport commitment, this intervention has important implications for sport coaching.

Key words: *intervention program, self-determination, cognition, youth sport, volleyball.*

Introduction

Recent research findings demonstrate that the sport context provides a setting where physical activity participation and its positive consequences can be enhanced (Jõesaar and Hein, 2011). Positive motivational aspects decrease during adolescence and sedentary lifestyles are increasingly prevalent amongst adolescents, mainly in females (Hagger et al., 2003). Thus, it is necessary to improve the youth sport context as a way to promote active lifestyles and to avoid drop out (Jõesaar and Hein, 2011).

A considerable amount of research in the last two decades examined the implications of motivational processes in the sport context (Deci and Ryan, 2002). The Self-Determination Theory (SDT: Deci and Ryan, 1985, 2002) is a theoretical framework that explains how the social context can support or frustrate natural tendencies for optimal psychological growth, and to achieve adaptive consequences (Deci and Ryan, 2002). The SDT establishes a continuum from the most autonomous behaviours (experiences of volition, psychological freedom and reflective self-endorsement) to less self-determined behaviours

[1] - *Didactic and Behavioural Analysis in Sport Research Group. Faculty of Sport Sciences. University of Extremadura (Spain).*
[2] – *Area of Physical Education and Sport. Rey Juan Carlos University (Madrid, Spain).*

Authors submitted their contribution to the article to the editorial board.
Accepted for printing in the Journal of Human Kinetics vol. 59/2017 in November2017.

(lack of reasons for participating), as well as controlled motivation as experiences of pressure and coercion to think, feel, or behave in particular ways (Vansteenkiste et al., 2010). Likewise, it establishes three basic psychological needs: autonomy, the desire to commit to an activity due to one's own choice; competence, the desire to interact efficiently with the medium to feel competent; and relatedness, the desire to feel part of a group (Vansteenkiste et al., 2010). A theoretical proposition of SDT (Deci and Ryan, 2002) is that social factors, such as coaches' behaviour, can influence athletes' motivation and its positive consequences by nurturing versus thwarting the basic psychological needs (Vansteenkiste et al., 2010). Thus, deeper knowledge of the athletes' motivational process, mediated by the satisfaction of the basic psychological needs (BPNS), would help understand the possible consequences; these may be cognitive, affective and/or behavioural, such as perceived performance, enjoyment or sport commitment (Vallerand, 2015).

Later, the Hierarchical Model of Motivation (Vallerand, 1997) was constructed in order to improve and associate the SDT constructs (Deci and Ryan, 1985, 2002), becoming the main model for explaining motivation in the field of physical activity and sport, and being one of the first to propose an integral analysis of motivational and cognitive processes (McCarthy, 2011). According to this model, specific types of motivation exist at different levels of analysis (i.e., the global, contextual and situational levels), are shaped by social and personal determinants and generate predictable cognitive, affective and/or behavioural outcomes (Vallerand, 1997). The current research was carried out at a contextual level following the Hierarchical Model of Motivation, the three basic psychological needs were included as well as the three main types of motivation of the self-determination continuum: autonomous motivation, controlled motivation and amotivation (Vansteenkiste et al., 2010). Finally, procedural knowledge, perceived performance and sport commitment were included because of their relevance for the cognitive-motivational processes in youth sport, and also considering their importance due to the changes produced during the adolescence (Vallerand, 2015). Procedural knowledge refers to the knowledge structures stored in the memory and involves the selection of an appropriate action within the context of the game (McPherson, 1994). Perceived performance is the athletes' perception of their own performance (Nikbin et al., 2014). Sport commitment refers to the desire to continue practicing a sport (Belando et al., 2012). The intervention programs based on strategies for basic psychological needs fulfilment were associated with enjoyment, performance and sport commitment in different sports (Occhino et al., 2014). On the other hand, questioning has been an effective training strategy to improve cognitive expertise in tennis and volleyball in youth athletes (García-González et al., 2013; Gil-Arias et al., 2015).

For sports coaching researchers looking to position their work within the findings of previous research, there is an obvious lack of intervention studies where sport coaching is a pedagogical setting. The majority of studies on youth athletes have focused on educational and high-performance contexts, analysing the effects of different programs on a serie of positive consequences, including both academic or sport performance (García-Calvo et al., 2015; Mageau and Vallerand, 2003). However, research conducted in the educational context may be generative in informing future research in coaching formative stages settings (Occhino et al., 2014). In this sense, Teaching Games for Understanding (TGFU) is a pedagogical model aimed at generating greater understanding of teaching in sport education, to obtain better results in students/athletes self-determination, while increasing physical activity levels, cognitive processes and enjoyment (Memmert et al., 2015). For example, Báguena-Mainar et al. (2014), developed an intervention program during a physical education volleyball didactic unit, giving students some freedom to choose, improving their tactical ability but not their intrinsic motivation.

However, to the best of our knowledge, there is no evidence of intervention programs based on both cognitive and motivational strategies. This work explains how a multifactorial intervention program can contribute to developing cognitive and motivational processes. The aim of the study was to determine the influence of a cognitive-motivational intervention program, to improve

the satisfaction of the basic psychological needs of autonomy and competence, autonomous motivation, procedural knowledge, perceived performance and sport commitment in youth female volleyball players.

We hypothesized that the cognitive-motivational training program would significantly increase players' BPNS of autonomy and competence, autonomous motivation, procedural knowledge, perceived performance and sport commitment.

Methods

Participants

The study sample consisted of 34 Under-19 category female volleyball players (*M* = 17.14; *SD* = .67), divided into two groups: an experimental group (n = 16) and a control group (n = 18). The participants in the experimental group had a mean age of 17.47 ± .45 years, and their average experience of federated practice was 6.25 ± 1.04 years. The participants in the control group had a mean age of 17.64 ± .70 years, and average experience of federated practice of 6.80 ± .84 years.

The sampling technique was intentional, both teams' requirements to participate in the study were: playing in the same league (a Spanish regional one), category (U-19), season (2014/2015) and practicing the same number of hours per week during the season (two sessions of two hours each). Coaches of both teams had similar characteristics: males, 28 years of age, a minimum of three years' experience in coaching formative stages, degrees in Sport Sciences and the highest national coaching qualification.

Measures

The dependent variables of the study were as follows:

Basic psychological needs, which were measured through the Scale of Motivational Mediators in Sport (González-Cutre et al., 2007). It begins with the sentence: "Your impression about training sessions is that…", and has 23 items into three dimensions. Eight items measure autonomy (e.g. "My coach lets me make decisions"), seven items measure competence (e.g. "I feel competent when I execute the activities"), and the other eight items measure relatedness (e.g. "I really like my teammates").

Motivation, that was measured through the Spanish version of the Behavioural Regulation in Sport Questionnaire (Moreno-Murcia et al., 2011). It begins with the sentence: "I participate in this sport…" and has 36 items to complete it. Twenty-four items measure autonomous motivation, including identified and integrated regulations in addition to intrinsic motivation (e.g. "Because I like to learn new techniques"), eight measure controlled motivation, including external and introjected regulations (e.g. "Because if I don't play, others won't be pleased"), and four measure amotivation (e.g. "I don't know why I continue playing") as in previous studies (Vansteenkiste et al., 2010).

Procedural knowledge was measured through the Procedural Knowledge Questionnaire in Volleyball (Moreno et al., 2013); it is comprised of 24 questions that include different tactical situations in volleyball. Each question has four possible answers, only one of which is correct (e.g. "When you attack, what aspect of the opposing team should you pay attention to? a) The block; b) The second-line defence; c) Both the block and the second-line defence; d) None of them, the most important is to attack with the maximum power").

Perceived performance was measured through the item "Your performance in the today's match has been…" as in previous research (Nikbin et al., 2014).

Sport commitment was evaluated through the Spanish version of the Sport Commitment Questionnaire (Belando et al., 2012). It begins with the sentence "Your commitment to volleyball…" and it is composed of 8 items of which four measure future commitment (e.g. "I really want to continue playing in the future").

Likert scale ranging and the reliability values of the questionnaires are showed in Table 1.

Design and procedures

A quasi-experimental design (2x2) was proposed, with two groups: experimental and control, establishing an initial measurement prior to the intervention (pre-test) and a measurement after the intervention (post-test).

Intervention program

The independent variable of the study was a multidimensional (cognitive-motivational) intervention program. It was based on the postulates of SDT and questioning, following the same experimental study guidelines developed

previously (García-Calvo et al., 2015; Gil-Arias et al., 2015). Two main strategies were applied to the experimental group:

1) Possibility of choice in specific training tasks. In order to increase players' autonomy, the coach facilitated activities where players had some freedom of decision. Specific training situations were proposed where the player had to choose between several action alternatives (e.g., decide to hit down the line or diagonally in an attack situation). To this end, the protocol was as follows: 1) Initial information about the task. 2) Proposal of the need to choose between at least two options within the specific training task. 3) Launching the task, reinforcing the possibility of choice.

2) Questioning. In order to improve players' competence, they were cognitively involved through tactical questions during training (e.g. in an attack situation, "What were you thinking when attacking?"). To this end, the questioning protocol was the following: 1) Proposal of the tactical objective to be worked within the task. 2) First moment of execution. 3) Questioning, a question that represents a problem was asked and the verbalization of different action alternatives took place. 4) Second moment of execution after verbalization. 5) Group reflection to arrive at a synthesis of best solutions, guaranteeing participation of all players in the reflection.

The intervention program was comprised of 24 sessions held over a three-month period, as recommended for intervention research in youth athletes (García-Calvo et al., 2015; García-González et al., 2013; Gil-Arias et al., 2015; Tomporowski et al., 2015). Two weekly sessions were held, each of them lasting for two hours. During the program application, the development of the training sessions was monitored in detail (using a checklist to control it) in order to guarantee that the cognitive-motivational strategies of the intervention program were implemented correctly.

Procedures

The teams were initially contacted to give their authorization to participate in the research. Likewise, both parents and participants were informed and signed a participation consent form. An experienced researcher was present while the questionnaires were completed, guaranteeing an adequate climate of concentration and avoiding the presence of the coach. The research was developed with the authorization of the Ethics Committee of the University of Extremadura and following the guidelines of the Helsinki Declaration.

A data collection protocol was designed to ensure that the data were obtained from all participants in a similar manner in each group. Initially, pre-test data collection was conducted in October. During November, December and January, the experimental group followed an intervention program (24 training sessions), while the control group did not. In February, the same data collection (post-test) as in the pre-test was carried out.

Statistical Analysis

The statistical program SPSS 24.0 (Chicago, IL) was used for the data analysis and processing. A repeated-measures analysis of variance, MANOVA 2x2 (Test-time x Group) was performed to determine the effect of the intervention program on the interaction between the two test-times (pre-test and post-test) and between the two groups (experimental and control). Nine dependent variables were included: BPNS (autonomy, competence and relatedness), motivation (autonomous, controlled and amotivation), procedural knowledge, perceived performance and sport commitment. The independent variable was the multidimensional intervention program.

Preliminary assumption testing was conducted to check for normality, outliers, homogeneity of variances and multicollinearity, with no violations noted. Initially, data normality was examined through the Shapiro-Wilks test, which led to the use of parametric statistics. Outliers were evaluated through Mahalanobis distances, and in both the pre-test (21.97) and the post-test (21.18) the values did not overcome the critical value for a model with nine variables (27.88). Homogeneity of variance was evaluated through the Levene's test, as a prior step to the application of the intervention program (Table 1). Absence of multicollinearity was noted by the correlations between dependent variables both in the pre-test and post-test measures, with no Spearman values up to .70 (Tabachnick and Fidell, 2013).

The two phases of the study (pre-test and post-test) were considered in the repeated

measures factor, while both the experimental group (n = 16) and the control group (n = 18) were included in the group factor. The Pillai-Barlett trace, V (which is considered to be robust in small sample sizes and in unequal N values), was used to evaluate the existence of statistically significant differences, using a Bonferroni correction to control for Type 1 errors when using multivariate comparisons (Tabachnick and Fidell, 2013). The significance criterion was $p < .05$. A 95% confidence interval (CI) was calculated. Effect sizes are reported as $\eta_p 2$. Post-hoc power analyses ($\pi = 1-\beta$) were performed using GPOWER 3.1.7 software (Faul et al., 2013).

Results

Preliminary analysis

The descriptive statistics and the internal consistency coefficient (Cronbach's Alpha) are shown in Table 2. All these subscales showed acceptable reliability levels, both in the pre-test and post-test measurements, exceeding the criterion of .70 (Hair et al., 2013). The pre-test measure mean scores were similar in both the control and experimental group. Regarding each variable, youth female players reported low levels of amotivation, moderate levels of autonomy, competence, controlled motivation autonomous motivation, procedural knowledge, future commitment and high levels of relatedness.

Analysis of the intervention effect

Table 2 presents the scores obtained in the analysis of variance that included the multidimensional intervention program as the independent variable and eight dependent variables. In the multivariate statistics, the results showed significant effects on the interaction between the test-time (pre-test and post-test) and the group (experimental and control), where the effect size had moderate magnitude (Pillai's Trace $V = .67$; $F_{(1, 32)} = 3.63$; $p = .005$; $\eta_p^2 = .67$; $\pi = .83$).

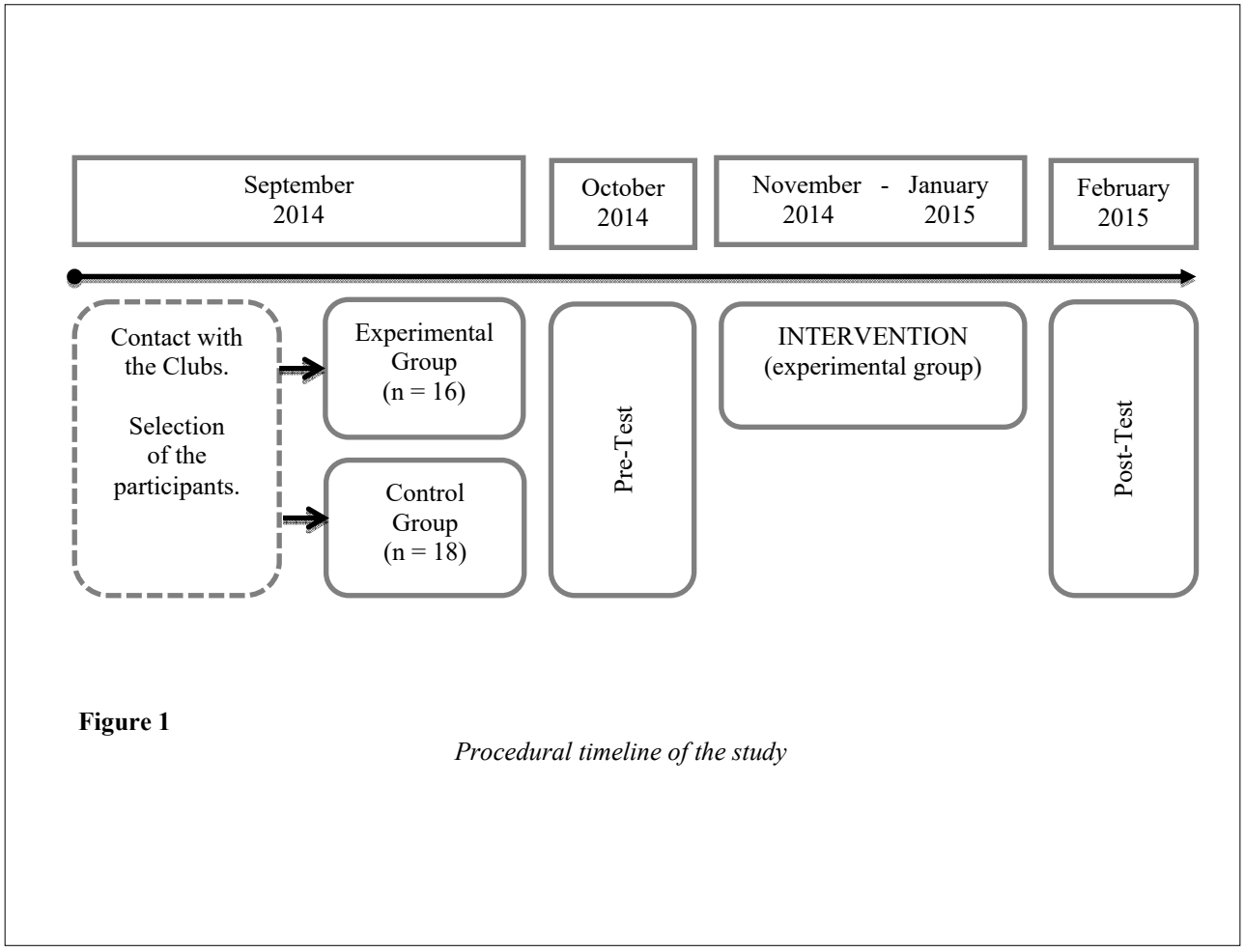

Figure 1

Procedural timeline of the study

Table 1

Levene's Test Results

Variables	Levene's test	*p*
Autonomy	.21	.65
Competence	.61	.44
Relatedness	1.59	.27
Autonomous motivation	.03	.87
Controlled motivation	.69	.413
Amotivation	.18	.68
Procedural knowledge	1.64	.21
Perceived performance	.29	.60
Future commitment	1.85	.18

p = significance level, established at .05

Table 2

Descriptive statistics, internal consistence and pairwise comparison of all variables for inter-group analysis

Variables	Scale	Test-time	α	Exp. group (n = 16)		Cont. group (n = 18)		T. error	*p*	Diff. 95% CI		F(1, 32)	ηp^2	π
				M	*SD*	*M*	*SD*			*[L.L.*	*U.L.]*			
Autonomy	1-5	Pre	.70	2.16	.66	2.33	.80	.25	.489	[-.34	.69]	.49	.02	.13
		Post	.76	3.33	.75	2.44	.83	.27	.003	[-1.44	-.33]	10.50	.25	.98
Competence	1-5	Pre	.85	2.86	1.04	3.17	.95	.34	.362	[-.38	1.01]	.86	.03	.20
		Post	.88	3.84	.60	3.29	.58	.20	.010	[-.97	-.14]	7.46	.19	.99
Relatedness	1-5	Pre	.94	3.91	.54	3.93	1.00	.28	.932	[-.55	.60]	.01	.00	.95
		Post	.93	4.11	.66	4.19	.98	.29	.772	[-.51	.68]	.09	.00	.06
Autonomous motivation	1-7	Pre	.97	5.01	.92	5.31	1.34	.40	.457	[-.51	1.12]	.568	.02	.21
		Post	.94	6.29	.65	5.58	.71	.24	.005	[-1.19	-.23]	9.15	.22	.95
Controlled motivation	1-7	Pre	.73	1.73	.75	2.12	1.18	.33	.239	[-.28	1.07]	1.44	.04	.68
		Post	.81	3.51	.61	3.54	.75	.24	.899	[-.45	.51]	.02	.00	.06
Amotivation	1-7	Pre	.71	1.98	.68	2.01	1.18	.34	.931	[-.66	.71]	.01	.00	.06
		Post	.81	1.41	.91	1.75	.87	.31	.269	[-.28	.97]	1.26	.04	.39
Procedural knowledge	0-100	Pre	.71	54.68	11.37	50.46	7.55	3.28	.206	[-10.90	.2.45]	1.66	.05	1.00
		Post	.70	68.49	6.80	52.77	15.66	4.23	.001	[-24.34	-.7.11]	13.77	.30	1.00
Perceived performance	1-10	Pre	-	4.90	1.14	4.96	1.57	.48	.896	[-.91	1.03]	.02	.00	.06
		Post	-	6.03	1.36	5.2	.76	.37	.019	[-1.67	-.16]	6.06	.16	.99
Future commitment	1-5	Pre	.71	3.72	.82	4.14	.59	0.24	.092	[-.07	.91]	3.01	.09	.43
		Post	.71	4.31	.44	3.53	.85	0.24	.002	[-1.27	-.30]	11.00	.26	.99

M = mean; SD = standard deviation; α = Cronbach's alpha;
"-" = reliability values of the players' perceived performance are not presented as this was obtained through one single item.
Significance level established at .05

Intergroup analysis

The multivariate contrasts in the pre-test measurement did not show significant effects between the experimental group and the control group in all study variables, where the effect size had low magnitude (Pillai's Trace $V = .33$; $F_{(1, 32)} = .87$; $p = .591$; $\eta_p^2 = .33$; $\pi = .99$).

The multivariate contrasts in the post-test measurement showed significant effects between the experimental group and the control group in the study variables, where the effect size had high magnitude (Pillai's Trace $V = .86$; $F_{(1, 32)} = 11.15$; $p \leq .001$; $\eta_p^2 = .86$; $\pi = 1.00$). Specifically, significant differences were found between the experimental group and the control group (in favour of the experimental group) in the following variables: BPN of autonomy ($p = .003$), BPN of competence ($p = .010$), autonomous motivation ($p = .005$), procedural knowledge ($p = .001$), perceived performance ($p = .019$) and sport commitment ($p = .002$). No significant differences were found between the two groups in such variables as relatedness ($p = .772$), controlled motivation ($p = .889$) and amotivation ($p = .269$) (Table 2).

Discussion

The aim of this work was to determine the influence of a cognitive-motivational intervention program to improve the BPNS of autonomy and competence, autonomous motivation, procedural knowledge, perceived performance and sport commitment, in youth female volleyball players.

The study hypothesis stated that the cognitive-motivational training program would increase players' BPNS of autonomy and competence, autonomous motivation, procedural knowledge, perceived performance and sport commitment in the experimental group compared to the control group. This hypothesis can be confirmed with the results obtained. After applying the intervention program, significant differences were found between the experimental group and the control group (in favour of the experimental group) in the variables: BPNS (autonomy and competence), autonomous motivation, procedural knowledge, perceived performance and sport commitment.

Regarding the BPNS, the obtained results are supported with previous research that highlighted some pedagogical behaviours as key in assisting the coach in creating autonomy and competence-supportive environments, i.e. providing choice (allowing athletes to choose between two or more options) or facilitating improvement in the athletes' decision-making (Occhino et al., 2014). Some intervention programs demonstrated that giving athletes the desired amount of choice and allowing opportunities for initiative-taking facilitated their autonomy (Jõesaar et al., 2012). Recently, Báguena-Mainar et al. (2014) developed an intervention program during a physical education didactic unit, giving students some freedom to choose and improve their tactical ability. They also found significant differences in the BPN of autonomy. On the other hand, questioning is a training strategy that could improve player's competence, guiding them, by asking open-ended questions, towards self-reflection, self-adaptation and problem solving (Gil-Arias et al., 2015). The use of questioning programs has been an effective tool for the cognitive development of athletes at lower performance levels (García-González et al., 2013). Recently, Gil-Arias et al. (2015) developed an intervention program based on questioning in youth female volleyball players. After the intervention, the experimental group showed more complex, sophisticated and structured tactical knowledge, compared to the control group. These results highlight the need to complement the training process with cognitive tools in order to favour athletes' competence. Thus, it is suggested that the intervention may have had positive effects on competence through tactical improvement. No differences were found in the BPN of relatedness due to the strategies used and both groups presented a high level of this variable in the pre-test, yet this BPNS should not be forgotten because of its relevance for performance and sport commitment (Vallerand, 2015; Vansteenkiste et al., 2010). One of the main strengths of the study is that the multidimensional intervention based on cognitive-motivational tools could help coaches to increase players' BPN of autonomy and competence.

With respect to the motivational process, using different strategies such as giving athletes responsibility for different tasks related to the training process would help both to stimulate and intrinsically motivate them (Ahlberg et al., 2008). SDT advocates that it is vital to provide youth

athletes with appropriate motivational environments to keep them intrinsically motivated (Vallerand, 2015). Youth sport studies utilizing SDT have shown that using tools to improve the BPNS contributes to sport participants being more likely to remain intrinsically motivated (Deci and Ryan, 1985, 2002). Intervention programs based on strategies to improve the BPN of autonomy could be essential to increase the levels of self-determined motivation towards physical exercise (Ahlberg et al., 2008; Vallerand, 2015). The strategies used to improve the autonomy support from the coach predicted athletes' intrinsic motivation (Jõesaar et al., 2012). Ahlberg et al. (2008) applied an action research methodology to assist a rugby coach in creating an environment that sought to promote players' self-determined motivation allowing athletes some choice in training. Similar findings were found in studies that used tools to improve the BPNS of competence. Specifically, research in youth sport settings has consistently shown that using tools to increase the BNPS of competence results in intrinsic motivation (McCarthy, 2011). Nevertheless, our results are not in line with those obtained by Báguena-Mainar et al. (2014) in a volleyball physical education intervention because they found that the intervention program did not increase students' intrinsic motivation and decreased their amotivation. We could interpret that motivation increases when the individual perceives that his/her learning experiences are significant, as they occur in a real game situation or in the intervention program, when we let him/her choose or solve tactical problems.

Intervention programs highlighted questioning as an appropriate tool to increase procedural knowledge (García-González et al., 2013; Gil-Arias et al., 2015). In addition, TGFU demonstrated that if students are able to solve particular task problems it may influence their motivation (Memmert et al., 2015). Self-regulated profiles are characterized as metacognitively, motivationally, and behaviourally active participants in their own learning (Kitsantas and Zimmerman, 2002). Thus, this study could be helpful for coaches to enhance athletes' metacognitive skills using appropriate tools.

In terms of perceived performance, different authors indicate that this is a decisive variable of many of the behaviours, cognitions and affective feelings that individuals develop in the sporting environment (Cervelló et al., 2007; Nikbin et al., 2014). No intervention studies using cognitive-motivational strategies have been found with perceived performance as a dependent variable. Previous research suggests that perceived performance is associated with real performance (Cervelló et al., 2007; Nikbin et al., 2014). If athletes believe that their ability can improve, they will probably enjoy physical activity more, since they know that if they make an effort, they will manage to improve and this leads to satisfaction. Therefore, they could participate motivated by the fact that acquiring knowledge and improving performance is fun. Following this research, it is proposed for coaches to tactically question their athletes, giving them the option to choose among several action alternatives, as such conduct improves athletes' perceived performance.

Regarding sport commitment, SDT has been applied in youth sports, but only a limited amount of research has used SDT to help examine the commitment level in female youth athletes. An intervention study carried out by Player (2010) on young volleyball players, found that commitment was associated to their intention to play the next season. The importance of the coach intervention in developing positive consequences of perceived performance or commitment, is thus highlighted. Recent studies in young soccer players suggest that coach behaviour is related to daily physical activity patterns (Fenton et al., 2014). Thus, as in the present research, it is necessary to improve the youth sport context using adequate tools as a way to promote active lifestyles and to avoid drop out, especially considering that positive motivational aspects decrease during adolescence and sedentary lifestyles are increasingly prevalent amongst adolescents, mainly in female athletes (Hagger et al., 2003).

In summary, the cognitive-motivational intervention program improved the BPNS of autonomy and competence, as well as autonomous motivation, procedural knowledge, perceived performance and sport commitment. The more autonomy supportive the social agents' behaviours are (by questioning and giving athletes' some freedom to choose), the more positive the athletes' perceptions of autonomy and

competence, and the higher their levels of self-determined motivation could be. As previous studies stated, intrinsic motivation is the most self-determined type of motivation and leads to more effort exerted during practices and games. As the SDT (Deci and Ryan, 1985, 2002) stated, and the Hierarchical Model of Motivation (Vallerand, 1997) reaffirmed, self-determined contexts could result in higher consequences of learning, enjoyment, performance, commitment and less drop-out from sport. Youth sport offers an opportunity to be self-determining, to feel more competence and to experience social involvements (Deci and Ryan, 1985).

Conclusions

On the one hand, the study showed how a multidimensional intervention program improved youth female volleyball players' BPNS of autonomy and competence, self-determined motivation, procedural knowledge, perceived performance and sport commitment. Thus, this research may help practitioners foster self-determined participation, achieve their performance goals and retain female youth athletes in recreational sports.

On the other hand, the study demonstrates that giving some freedom of choice and questioning has been shown as appropriate tools to improve the youth female volleyball players' cognitive level (procedural knowledge) as well as their motivational processes (BPNS of autonomy and competence, autonomous motivation, perceived performance and sport commitment). The coach's intervention influenced the athletes' behaviour and this research provides them with some keys and tools to understand and improve the cognitive-motivational processes.

The most significant limitation of the study includes the participants, from two female U-19 regional teams, with average values in the measured variables. This could be solved in future research involving male players, taking into account a higher sample size from different sports (individual and team), competitive level, and/or making comparisons between them. Another future line of the research that could be carried out is to analyse the mediator effect of the motivational process (BPNS and/or motivation) between the intervention program and the measured consequences.

Acknowledgements

The study was supported by the FPU program of the Spanish Ministry of Education, Culture and Sport. Reference FPU2013/03922.

This article falls within the work of the Research Group on Didactic and Behavioral Analysis in Sport [SEJ006], which receives support from the Government of Extremadura (Regional Ministry of Employment, Enterprise and Innovation).

References

Ahlberg M, Mallett CJ, Tinning R. Developing autonomy supportive coaching behaviors: An action research approach to coach development. *Int J Coach Sci*, 2008; 2(2): 3–22

Báguena-Mainar JI, Sevil-Serrano J, Julián-Clemente JA, Murillo-Pardo B, García-González L. The game-centered learning of volleyball in Physical Education and its effect on situational motivational variables. *Agora Educ Física Deport*, 2014; 16(3): 255–70

Belando N, Ferriz-Morell R, Moreno-Murcia JA. Validation of the Scale of Degree of Sport Commitment to the Spanish context. *Eur J Hum Mov*, 2012; 28: 111–24

Cervelló E, Santos Rosa FJ, García-Calvo T, Jiménez R, Iglesias D. Young tennis players' competitive task involvement and performance: the role of goal orientations, contextual motivational climate, and coach-initiated motivational climate. *J Appl Sport Psychol*, 2007; 19(3): 304–21

Deci EL, Ryan RM. *Intrinsic Motivation and Self-Determination in Human Behavior*. New York: Plenum; 1985

Deci EL, Ryan RM. *Self-determination research: Reflections and future directions.* In ELD y RM Ryan, (Ed.),

Handbook of self-determination research, Rochester, NY: University of Rochester Press; 2002

Faul F, Erdfelder E, Lang A-G, Buchner A. G*Power 3.1.7 Software. *Heinrich-Heine Univ - Inst Exp Psychol*, 2013

Fenton SA, Duda JL, Quested E, Barrett T. Coach autonomy support predicts autonomous motivation and daily moderate-to-vigorous physical activity and sedentary time in youth sport participants. *Psychol Sport Exerc*, 2014; 15(5): 453–63

García-Calvo T, Sánchez-Oliva D, Leo FM, Amado D, Pulido JJ. Effects of an intervention programme with teachers on the development of positive behaviours in Spanish physical education classes. *Phys Educ Sport Pedagog*, 2015; 1–17

García-González L, Moreno MP, Moreno A, Gil-Arias A, Del Villar F. Effectiveness of a video-feedback and questioning programme to develop cognitive expertise in sport. *PLoS One*, 2013; 8(12): e82270

Gil-Arias A, Del Villar F, García-González L, Moreno A, Moreno MP. Effectiveness of video feedback and interactive questioning in improving tactical knowledge in volleyball. *Percept Motor Skill*, 2015; 121(3): 1–19

González-Cutre D, Martínez-Galindo C, Alonso N, Cervelló E, Conte L, Moreno-Murcia JA. *Ability beliefs and psichological mediators as predictors of self-determined motivation in youth athletes.* In J Castellano & O Usabiaga, (Eds.), Investigación en la Actividad Física y el Deporte II, Universidad del País Vasco, 2007 407–17

Hagger MS, Chatzisarantis N, Culverhouse T, Biddle SJ. The Processes by Which Perceived Autonomy Support in Physical Education Promotes Leisure-Time Physical Activity Intentions and Behavior: A Trans-Contextual Model. *J Educ Psychol*, 2003; 95(4): 784–95

Hair JF, Black WC, Babin BJ, Anderson RE. *Multivariate data analysis*. Harlow: Prentice Hall; 2013

Jõesaar H, Hein V. Psychosocial determinants of young athletes' continued participation over time. *Percept Motor Skill*, 2011; 113(1): 51–66

Jõesaar H, Hein V, Hagger MS. Youth athletes' perception of autonomy support from the coach, peer motivational climate and intrinsic motivation in sport setting: One-year effects. *Psychol Sport Exerc*, 2012; 13(3): 257–62

Kitsantas A, Zimmerman BJ. Comparing Self-Regulatory Processes Among Novice, Non-Expert, and Expert Volleyball Players: A Microanalytic Study. *J Appl Sport Psychol*, 2002; 14(2): 91–105

Mageau GA, Vallerand RJ. The coach–athlete relationship: a motivational model. *J Sports Sci*, 2003; 21(11): 883–904

McCarthy PJ. Positive emotion in sport performance: current status and future directions. *Int Rev Sport Exerc Psychol*, 2011; 4(1): 50–69

McPherson SL. The Development of Sport Expertise: Mapping the Tactical Domain. *Quest*, 1994; 46(2): 223–40

Memmert D, Almond L, Bunker D, Butler J, Fasold F, Griffin L, et al. Top 10 Research Questions Related to Teaching Games for Understanding. *Res Q Exerc Sport*, 2015; 86(4): 347–59

Moreno A, Del Villar F, García-González L, García-Calvo T, Moreno MP. Psychometric properties of Procedural Knowledge Questionnaire in Volleyball (PKQV). *RICYDE Rev Int Ciencias del Deport*, 2013; 9(31): 28–47

Moreno-Murcia JA, Marzo JC, Martínez-Galindo C, Conte L. Validation of Psychological Need Satisfaction in Exercise Scale and the Behavioural Regulation in Sport Questionnaire to the Spanish context. *RICYDE Rev Int Ciencias del Deport*, 2011; 7(26): 355–69

Nikbin D, Hyun SS, Iranmanesh M, Foroughi B. Effects of Perceived Justice for Coaches on Athletes' Trust, Commitment, and Perceived Performance: A Study of Futsal and Volleyball Players. *Int J Sports Sci Coach*, 2014; 9(4): 561–78

Occhino JL, Mallett CJ, Rynne SB, Carlisle KN. Autonomy-supportive pedagogical approach to sports

coaching: Research, challenges and opportunities. *Int J Sports Sci Coach*, 2014; 9(2): 401–16

Tabachnick BG, Fidell LS. *Using Multivariate Statistics*. Boston: Pearson; 2013

Tomporowski PD, McCullick B, Pendleton DM, Pesce C. Exercise and children's cognition: The role of exercise characteristics and a place for metacognition. *J Sport Heal Sci*, 2015; 4(1): 47–55

Vallerand RJ. Toward a Hierarchical Model of Intrinsic and Extrinsic Motivation. *Adv Exp Soc Psychol*, 1997; 29: 271–360

Vallerand RJ. *The psychology of passion: A dualistic model.* New York: Oxford University Press; 2015

Vansteenkiste M, Niemiec CP, Soenens B. The development of the five mini-theories of self-determination theory: an historical overview, emerging trends, and future directions. *Adv Motiv Achiev*, 2010; 16(1): 105–66

Corresponding author:

Fernando Claver Rabaz.
Faculty of Sport Sciences. University of Extremadura (Cáceres, Spain)
Avda/ de la Universidad s/n, 10005, Cáceres (Cáceres/Spain).
Phone number: (+34) 666066983
E-mail: fclaver@unex.es