Effects of a nonlinear pedagogy intervention programme on the emergent tactical behaviours of youth footballers

PRÁXEDES, Alba <http://orcid.org/0000-0001-8959-480X>, DEL VILLAR ÁLVAREZ, Fernando, MORENO, Alberto, GIL-ARIAS, Alexander and DAVIDS, Keith <http://orcid.org/0000-0003-1398-6123>

Published version

PRÁXEDES, Alba, DEL VILLAR ÁLVAREZ, Fernando, MORENO, Alberto, GIL-ARIAS, Alexander and DAVIDS, Keith (2019). Effects of a nonlinear pedagogy intervention programme on the emergent tactical behaviours of youth footballers. Physical education and sport pedagogy.

Copyright and re-use policy

Effects of a Nonlinear Pedagogy intervention program on the emergent tactical behaviors of youth footballers.

Abstract

This study analysed effects of a training intervention program using principles of Non-Linear Pedagogy (NLP) on the decision making (DM) and performance behaviours (P) of youth footballers. For this purpose, 19 footballers (U12 yrs) participated in 14 training sessions, spread over three phases: Pre-intervention, Intervention, Retention. The intervention was based on use of Small-Sided and Conditioned Games in practice. We assessed participant progress during the intervention phase at two different points: intermediate and final. The GPET instrument was used to analyze the DM and P during completion of 3208 passes in the intervention. Results showed significant improvements in the DM and P after the intermediate and final points of the acquisition phase. Moreover, significantly higher values were also obtained in both variables in the retention, compared to the pre-intervention phase. Results indicated that the NLP intervention program was effective in improving both aspects of team games performance in youth players, with effects consolidated over time.

Key Words: Nonlinear Pedagogy, Small-Sided and Conditioned Games, learning design, intervention, decision-making performance, youth football.

Introduction

Team sports, such as football, require players to use information to continuously co-adapt their performance behaviours (actions, intentions and perceptions) to movements of opponents and teammates in achieving task goals (Chow, Davids, Button, & Renshaw, 2016).). Thus, players have to be skilled in adaptive decision-making (Araújo & Davids, 2015) and act autonomously in their competitive performance environment (Withagen, Araújo, & de Poel, 2017).

Within an ecological dynamics framework, players are trained to select from a rich and diverse range of *affordances* (possibilities for action offered by their environment, Gibson, 1979; Rietveld, & Kiverstein, 2014) available in a landscape in a competitive performance environment. Thus, they are better equipped to perceive information, adapt their actions, make decisions and interact skilfully with ecological constraints of competition (Davids, Güllich, Shuttleworth, & Araújo, 2017). In this regard, coaches have to develop the on-field autonomy of players by facilitating their active exploration of a landscape of available affordances during practice, which helps them to perceive and pick up action opportunities which exist in a performance environment (Araújo, Davids, & Hristovski, 2006). Despite this aim, coaching practice has been criticised for over-emphasising traditional teaching and training methods, with an over-reliance on direct instruction of athletes, prescribed through a technique-focused, linear coaching style (tasks decomposed in drill-based practices) (Chow et al., 2016).

Small-Sided and Conditioned Games (SSCGs; commonly used modified games that take place in tight spaces, involving small numbers of players and with modified rules) have been proposed to be an effective methodological tool to improve skills and enhance acquisition of expertise in team sports (Davids, Araújo, Correia, & Vilar, 2013; Renshaw, Chow, Davids, & Hammond, 2010). These practice methods ensure that task constraints during learning demand similar perceptual-action relationships as those needed in competitive performance (Renshaw, Davids, Shuttleworth, & Chow, 2009). Therefore, since the sport of football is a dynamic system in which athletes must continually interact with teammates and opponents, performance analysis must not only focus on technical variables, but also on tactical decision-making behaviours (Davids et al., 2013a).

The methodology of SSCGs is closely aligned with the framework of Nonlinear Pedagogy (NLP) a new teaching-learning perspective that it is characterized by an integrated consideration of technical and tactical skills, psychological regulation and player conditioning (Chow, Davids, Button, Shuttleworth, Renshaw, & Araújo, 2006; Headrick, Davids, Pinder & Araújo, 2015; Davids, Araújo, Vilar, Renshaw, & Pinder, 2013; Tan, Chow, & Davids, 2012). As part of the ecological dynamics approach, NLP considers that, in team games, performance behaviors emerge from the continuous interactions between each learner and the task constraints of practice. In learning design, NLP involves manipulating interacting constraints between the learner, task and environment, with particular emphasis on the information that is designed into practice tasks for learners to use in regulating their actions. Actions emerge under interacting constraints, based on information for affordances which are invitations or opportunities for achieving task goals. In SSCGs, NLP offers learners a great variety of experiences which simulate the performance conditions of competitive games. Using SSCGs, learning designs need to consider the level of expertise of learners in seeking them to adapt to task complexity. The methodology of NLP, involving the manipulation of constraints, situates learning in a real context in the learning environment. For example, NLP provides opportunities for learners to perceive information and act in using a tactical concept through the manipulation of task constraints, but maintaining the primary rules of the full game. In this regard, NLP methodologies strategically support learners in adapt their behaviors which emerge under the design of task constraints, without coaches providing them with explicit verbal instructions all the time (Tan et al., 2012).

In team sports such as football, task constraints during practice (e.g. task goals, number of players involved, level of opposition, playing area dimensions, duration, and rules of the conditioned game) are particularly relevant since they force players to adapt actions to a changing performance environment, similar to competitive performance conditions (Passos, Araújo, Davids, & Shuttleworth, 2008). Despite the importance of acquiring tactical performance behaviors in the learning process in youth football players and for the acquisition of skill and expertise, most previous research on effects of SSCGs has tended to focus on physical and physiological parameters (Gabbett, Jenkins, & Abernethy, 2009; Hill-Haas, Dowson, Couts, & Rowsell, 2010). Tactical performance behaviors are not typically analysed over extended periods of time using

data from game play (for limited exceptions see, Folgado, Lemmink, Frencken, & Sampaio, 2012; Travassos, Gonçalves, Marcelino, Monteiro, & Sampaio, 2014; Travassos, Vilar, Araújo, & McGarry, 2014; Vilar, Duarte, Silva, Chow, & Davids, 2014). Moreover, in the extant research literature, little or no work has explored whether player performance is enhanced through learning after the application of a SSCG practice program, using principles of NLP within the ecological dynamics perspective.

The present study sought to apply key principles of NLP in an ecological dynamics framework in order to examine the effects of their application on team games performance (Tan et al., 2012). The primary objective of this study was to analyze the effect of an intervention program based on principles of NLP, on emergence of tactical behaviors and decision making in young football players. The second objective was to analyze whether any identified effects were consolidated over time in a retention phase

METHOD

Design

An intra-group, quasi-experimental design was used to obtain information relevant to our research aims. Three research phases were considered in this study. The first, pre-intervention, phase was comprised of six sessions during which a direct instruction model was used (an approach characterized by a decontextualization of the usual practical methodology, that moved away from the perspective of the NLP). In the second phase we applied the intervention based on key principles of NLP. In the third phase we analysed effects of the NLP methodologies applied over time in a retention phase. In the intervention phase, two points of measurements were located to assess the decision-making and performance behaviors of the youth footballers. An intermediate measure was carried out based on the observation of the first three matches played by participants, during the first 6 intervention sessions (half the process). A final measure was carried out, based on observation of the last four matches, during the last 8 intervention sessions.

Participants and context

Participants were 19 football players from the under-12 yrs category (age, M = 10.63 yrs and SD = 0.49; experience of playing football, M = 3.52 yrs, SD = 1.34) of two teams from the same Spanish club (natural groups not modified for research). Both teams consisted of 10 and 9 players respectively and had an average-low skill level of expertise. Thus, these players had not been selected as the best of their category. Their participation in the club was recreation and education-oriented. Both teams had the same coach and received the same amount of training: two weekly sessions of one hour each .

The teams in which the intervention was applied are part of a Spanish club of which the main team was in the 3rd division of La Liga.

The research has been developed under the ethical guidelines of the Declaration of Helsinki. The participants and their parents were informed of the study. As the participants' were under age, the parents signed an informed consent if they agreed to participate in the study. The research project was fully approved by the Ethics Research Committee of the University of Extremadura (Spain).

Intervention procedure

In preparation for the intervention, several meetings were conducted between the coach and the main researcher (professor in Sport Sciences and with 12 yearsexperience in football at youth level). As in the studies by (Harvey, Cushion, Wegis, et al., 2010; Práxedes, García-González, Moreno, Moreno, & Moreno, 2016; Práxedes, Moreno, Sevil, García-González, & Del Villar, 2016), the training program to guide the coaching staff was developed over three weeks. In the first week, the coach was required to read three NLP-related articles (Chow et al., 2006; Davids et al., 2013a; Passos et al., 2008). For each article, the coach met with the first author (of this submission) to discuss the contents. In the second week, the coach designed a series of tasks based on the principles of NLP. Finally, in the third week, a practical application of the tasks was piloted with football team of the same age category as the participants of the present study. The pilot sample was not included in the current study.

In parallel, the coaches developed their six training sessions (over 3 weeks) following the direct instruction model, a traditional approach characterized by a decontextualization of the practice methodology, prioritizing the reproduction of the technical component of execution without manipulating the conditions of the task. That methodology was not aligned with the principles of NLP. Furthermore, in order to establish a baseline performance level, prior to the intervention, performance behaviours (decision making and actions) were recorded for the sample of players in the initial three matches of the season.

As a result of the work conducted during the initial preparation and training phase, the coach planned objectives for 14 training sessions (two weekly sessions of one hour each) for the intervention phase (see Table 1).

Table 1: Schedule of sessions for the sample of participants involved in the study.

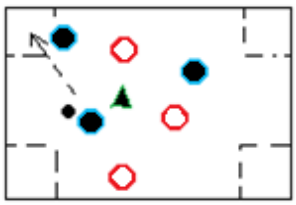
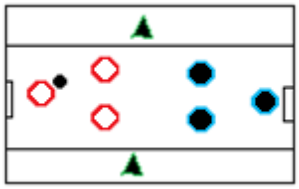
Week number (Sessions)	Sessions objectives	
	Attack	Defense
1 (1-2)	Space (width and depth in attack) Penetration (attacking the goal area)	Preventing passing lines and anticipation Covering teammates
2 (3-4)	Mobility to interchange positions Dealing with crosses	Pressing Closing down opponents with the ball
3 (5-6)	Mobility to create passing lines Creation and occupation free spaces	Balance (restricting passing lines) Marking opponents
4 (7-8)	Penetration (creating an overload) Space (width and depth in attack) II	Occupy spaces Prevent passing lines and anticipation II
5 (9-10)	Penetration (attacking the goal area) II Mobility and interchange of positions II	Covering II Pressing II
6 (11-12)	Dealing with crosses II Mobility to create passing lines II	Closing down opponents with the ball II Balance (restricting passing lines) II
7 (13-14)	Creation and occupation free space onfield II Penetration (creation of an overload) II	Marking II Occupy spaces II

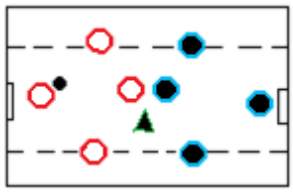
Given the characteristics of the participants (young footballers with an average-low skill level) the coaching staff needed to start with games of less complexity. To make it easier for learners, the coaching program was initiated with use of SSCGs with

clear numerical superiority on one side. This task constraint afforded a greater amount of time for participants to make decisions about what to do and how to do it.

In each 1-hr training session, four tasks of 15 minutes each were designed. These task constraints were designed to simulate competitive contexts of play and each task referred to a tactical principle of play (e.g., to maintain ball possession, to advance towards the goal, and to shoot at goal when there was an affordance to do so i.e. a gap in the defence). In all practice tasks, field dimensions were reduced to between ¼ (15x10m) and ½ of a regulation size football field (30x20m) according to the number of players, which was also reduced to 2-5 players per team in order to increase involvement. The practice task constraints did not limit the number of touches of the ball allowed by each player. The ball used was always the standard size for this age group. Table 2 presents a practice session example, specifically session 1.

Table 2: Training session 1 of the intervention phase.

OBJECTIVE	EXPLANATION	GRAPHIC
1st tactical principle: possession of the ball	5 vs. 5 + 1 wild card in ¼ of the F8 field. - *Offensive objective*: keep possession of the ball (rewarded with 1 point). Receive a pass in one of the squares of the corners (rewarded with 2 points). - *Defensive objective*: Anticipate and intercept a pass and steal the ball (rewarded with 1 point).	
2nd tactical principle: progression towards the goal	3 vs. 3 + 2 wild cards in ¼ of the F8 field. - *Offensive objective*: to score a goal in the opposition goal with the following premise: before throwing the ball into the goal, the wildcard players have to touch the ball (rewarded with 1 point). - *Defensive objective*: Anticipate and, intercept a pass and steal the ball (rewarded with 1 point).	
2nd and 3rd tactical principle: progression and shoot at goal with the lowest level of opposition	4 vs. 3 in the middle of the F8 field. - *Offensive objective*: to score a goal in the opposite goal with the following premise: before throwing the ball into the goal, players must progress towards this aim by giving a pass to a teammate who is located in one of the bands. If a player who is in the left band receives the ball, the another is not necessary to be in the right band. - *Defensive objective*: Anticipate and steal the ball (rewarded with a change of roles).	

Small-sided game similar to real context.	4 vs. 4 + the 2 goalkeepers + 1 wild card in the middle of the F8 field. - *Offensive objective*: to score a goal in the opposition goal with the following premise: players who are in the bands have to receive the ball in this delimited area. If a player who is in the left band receive the ball, the another is not necessary to be in the right band. - *Defensive objective*: Anticipate and steal the ball (rewarded with 1 point)	

To ensure that the model was correctly applied, the training sessions were supervised by a researcher with 15 years' experience supervising teaching methodologies and he also attended the training sessions of the intervention phase. A 9-item checklist (see Table 3) was adapted to test the behavioural fidelity of the coach according to the principles of NLP. This researcher and the first author randomly selected sessions for the assessment of the presence or absence of the items included in Table 3. A sample of 5 sessions for each intervention was observed, more than 10% the total sample (Tabachnick & Fidell, 2007). A 100% agreement was reached between the two observers, who confirmed that all key aspects in the checklist on features of the NLP were used in each observed session.

Table 3. Instructional Checklist.

Date:	Present	Absent
1. All the tasks are related to Small-Sided and Conditioned Games.		
2. Manipulation of constraints of the full-game were performed.		
3. All the tasks required different performance solutions by the players.		
4. The coach simply explains the task without prescribing performance solutions to the learners.		
5. The number of players involved in each team was between two and five.		
6. The pitch dimensions were reduced proportionally to the number of players.		
7. The defense always played an active role.		
8. The numbers of touches of the ball for each player were not limited in any task.		
9. There was a numerical superiority of players in attack for all tasks.		

Simultaneously, the seven matches played as part of the regular league competition (corresponding to the seven weeks of the intervention), were recorded so that decision making and actions could be analysed to assess effects of the intervention on participants' performance.

Finally, in the retention phase, the coach designed the sessions following the same procedure as the pre-intervention phase. Performance in competitive matches was also recorded, but with the purpose of analyzing whether any effects observed in the intervention had remained in the retention phase. This phase was composed of six training sessions (direct instructional model). The values of the game behaviours (decision making and actions) were obtained by observing the players in three of the competitive matches in this phase.

Data collection

All the matches corresponding to the 13 weeks of the intervention, being a total of 13 matches of the league of the season 2015/2016, were recorded, using a Sony HDRXR155 camera, from a fixed position. The camera was always placed in the background of the playing field, at a height of 4 m, guaranteeing an optimal view of all the game actions performed by the participants.

Decision making and actions were analysed for a total of 3207 completed passes. Decision-making was defined as the process whereby athletes selected one type of attacking behaviour from a series of alternatives which was observed in an emergent action at a specific moment in the competitive game situation (Bar-Eli, Plessner, & Raab, 2011). The percentage of successful decisions made, from the total number of decisions observed for each participant was recorded. Football actions were defined as a performance outcome that emerged onfield from the decision-making process (Bar-Eli et al., 2011). In this study, successful actions were defined by the percentage of successfully completed passes to a teammate from the total number of passes attempted by a participant.

Assessment of decision-making and passing actions was based on use of indirect and external systematic observation, a methodology used in previous studies to measure athlete decision-making and the performance in competitive games (Nielsen & McPherson, 2001). In the current study, the GPET observation instrument was used (García-López, González-Víllora, Gutiérrez, & Serra, 2013). This instrument, has already used in other studies of youth football (e.g. Gutiérrez, Fisette, García-López, & Contreras, 2014; Práxedes, Moreno, Sevil, García-González, & Del Villar, 2016). It is an adaptation to football of the original "Game Performance Assessment Instrument

(GPAI)" (Oslin, Mitchell, & Griffin, 1998) which was created to assess performance in competitive games, from the perspective of analysing tactical behaviors. This instrument permitted us to evaluate each player's tactical problem-solving skills, by means of selecting and applying an appropriate football action, in competitive football performance, as recommended by Travassos et al. (2013).

To evaluate decision-making, the *decision-making* component of this instrument assigned a value of 1 to appropriate decisions and 0 to inappropriate decisions. Likewise, to evaluate actions, the *execution* component of the same instrument was used, assigning value 1 to successful actions and 0 to unsuccessful actions (see Table 4). To calculate the percentage of successful decisions, the total number of these decisions was divided by the sum of the number of successful and unsuccessful decisions and multiplied by 100 (Mitchell, Oslin, & Griffin, 2006). Analysis of the action variables was developed with the same procedure. It should be noted that all the criteria were considered equally important with no type of hierarchy implemented between the dependent variables.

Table 4. GPET coding procedures for decision making and passing actions in football (García-López et al., 2013).

PASSING ACTION		
Decision-making	1	- Passing to a teammate who is unmarked.
	0	- Passing to a player who is marked closely or there is a defensive player in a position to cut off the pass. - Passing to an area of the pitch where no team-mate is positioned.
Execution	1	- Successful pass to a teammate: to his/her body if he/she is stationary, passing into space ahead if he/she is running. - Appropriate length and speed.
	0	- Interception. - Pass is too hard. - Out of play. - Pass is too far behind or in front of a teammate.

GPET inter-observer reliability

Two research observers were trained to analyze decision-making and the execution of passing actions. These observers were trained by an expert in football (Level 1 in Coaching Football by the Spanish Football Federation), who has also 4 years' experience in use of observational methodology in research.

As a preliminary step, the expert met with the observers to discuss any questions about the observation instrument and the coding criteria used for each dependent variable (decision making and passing actions). Next, the observations of passing actions were carried out (510 passing actions were analysed) with a sub-sample of more than 10% of the total observations (Tabachnick & Fidell, 2007). Inter-observer reliability was calculated using the agreements/(agreements and disagreements) x 100 measure. Once this value was calculated, the Cohen kappa index was used. All training values were observed to be above 0.90, surpassing the value of 0.81 from which an adequate agreement is considered (Fleiss, Levi, & Cho Paik, 2003). These findings support the reliability for the subsequent coding procedures for both dependent variables in this study.

Finally, to guarantee reliability of the measurements over time, the same sample of matches was analysed after an interval of ten days, obtaining intraobserver reliability results of 0.92.

Data analysis

The statistical program SPSS v24.0 (Chicago, IL) was used for data analysis and processing. The asymmetry measures, Kurtosis, Shapiro-Wilk (for samples of 30 or less) with the Lilliefors correction, verified that the sample distribution did not follow a normal distribution ($p<.005$), establishing the need to use non-parametric statistical methods. The Friedman test was selected to analyze effects of the pedagogical methods on the different performance measures (decision-making and passing actions). Finally, in order to verify any existing differences between the different measures, an inferential analysis was performed using the Wilcoxon test for measures related to a Bonferroni correction (significance level of .05/4=.0125).

RESULTS

In the within-group analysis performed using the Friedman test, the contrast statistics revealed significant differences between the three intervention time points in this study (pre-intervention, intermediate, final and retention points), on decision-

making (Chi-square=9.379, gl=3, *p*=.025) and passing actions (Chi-square=16.263, gl=3, *p*=.001).

Decision-making: In Table 5 it can be seen that significantly higher values were observed at the intermediate point of the intervention phase, in comparison to the pre-intervention point. Furthermore, significantly higher values were also observed at the final point of the intervention, compared to the pre-intervention point. Finally, results also showed higher values of decision-making in participants at the retention point, compared to the pre-intervention phase. There were no statistically significant differences in the pairwise comparisons for decision-making between the retention and the final point of the intervention phase.

Table 5. Descriptive statistics and pairwise comparisons in analyses of decision-making behaviours as a function of the NLP pedagogical intervention.

Time (I)			Time (J)			*Wilcoxon Z*	*p*[a]
T´	M	SD	T´	M	SD		
Pre	.649	.169	Int	.732	.135	-2.575	.010
Pre	.649	.169	Fin	.768	.160	-2.897	.004
Pre	.649	.169	Ret	.772	.175	-2.978	.003
Fin	.732	.135	Ret	.772	.175	-.121	.904

N.B. Pre: Pre-intervention measure; Int: Intermediate measure; Fin: Final measure: Ret: Retention measure. [a]Bonferroni adjust for multiple comparisons.

Passing actions: In Table 6 it can be seen that significantly higher values were observed at the intermediate point of the intervention phase, in comparison to the pre-intervention point. Furthermore, significantly higher values were also observed at the final point of the intervention, compared to the pre-intervention point. Finally, results also showed higher values of passing actions in participants at the retention point, compared to the pre-intervention phase. There were no statistically significant differences in the pairwise comparisons for passing actions between the retention and the final point of the intervention phase.

Table 6. Descriptive statistics and pairwise comparisons in analyses of passing actions as a function of the NLP pedagogical intervention.

Time (I)			Time (J)			*Wilcoxon Z*	*p*[a]
T´	M	SD	T´	M	SD		
Pre	.551	.152	Int	.635	.135	-2.696	.007
Pre	.541	.152	Fin	.640	.169	-2.575	.010
Pre	.541	.152	Ret	.654	.153	-2.777	.005
Fin	.635	.135	Ret	.654	.153	-.362	.717

N.B. Pre: Pre-intervention measure; Int: Intermediate measure; Fin: Final measure: Ret: Retention measure. [a]Bonferroni adjust for multiple comparisons.

DISCUSSION

The main objective of this study was to analyze effects of a learning intervention program on the decision making and the actions of young low-skilled footballers, designed with principles of Nonlinear Pedagogy. Results showed, in both dependent measures, significantly higher values at the intermediate point of the intervention program, in comparison to the pre-intervention phase. Moreover, these significantly higher values in decision making and actions in football were also observed at the final point of measurement, compared to the values at the pre-intervention phase. These findings suggest that the teaching program based on principles of NLP was effective in improving decision-making and the execution of passing actions in youth footballers.

There are a number of possible reasons for these outcomes. First, the representativeness of the practice task designs could have led to enhanced adaptive behaviours of participants in the competitive matches, facilitating their capacity to resolve different challenges of the performance environment. Moreover, the great variety of training tasks may have provided players with opportunities to experience a great diversity of performance situations and perception-action patterns (Tan et al., 2012). In that way, once players are exposed to the experience of competitive matches, they are better equipped to perceive information, adapt their actions, make decisions, and interact skilfully with the ecological constraints of competition (Davids et al., 2017). The findings imply the need to design dynamic training task simulations that capture the inherent variability of the competitive performance environment, leading players to use information that is specifying (Pinder, Davids, Renshaw, & Araújo, 2011). On the contrary, in the traditional model, the use of task decomposition may inhibit the formation of perception-action couplings that underpin performance in competition matches. This is because traditional practice task designs may inhibit the perception of relevant information sources in such learning environments (Pinder, Renshaw, & Davids, 2009).

On the other hand, it is possible that the use of NLP pedagogical principles, through the manipulation of task constraints, may have promoted a constant exploration

and creativity on the part of the participants (see also Ric, Hristovski, & Torrents, 2015). In this regard, through the principle of exaggeration, coaches can modify the rules of the game to stimulate exploratory activity in the participants.

With respect to decision-making, findings of some previous research are aligned with the results obtained in our study. These studies reported improvements in decision making after intervention programs based on tactical models or decisional training models (e.g., García-González, Moreno, Gil, Moreno, & Villar, 2014; Práxedes et al., 2016b). More specifically, these previous findings seemed to indicate that the use of training tasks with a lower level of complexity for learners, represented by the greater number of players involved on the attacking side, may have led to less defensive pressure. This asymmetry in the players involved in the SSCGs may have allowed the player in possession of the ball to have more time make decisions and organise passing actions (Práxedes et al., 2016c), thus improving their decision-making after the intervention. In this regard, coaches, through the use of task simplification, rather than task decomposition, can reduce the complexity level of a task in low skill athletes, while maintaining the critical temporal-spatial information-movement relations (Renshaw et al., 2010).

With respect to the performance behaviors, the improvements obtained in our study indicate that the participation of a few players in the Small-Sided and Conditioned Games (from 2 to 5 per team) has allowed a greater number of contacts with ball, and ultimately, a greater participation in the game (Koklu, Asci, Kocak, Alemdaroglu, & Dundar, 2011). Finally, this led to a greater number of passing actions (Martins, Gonçalves, Varanda, Margarida, da Eira, & Correia, 2016). In this line, there are studies that have confirmed how, in situations of numerical superiority, there is greater continuity in the game, inducing greater participation of learners with respect to the frequency of contact with the ball (Práxedes, Pizarro, Conejero, González-Silva, & Moreno, 2016).

Finally, and with regard to this first objective, it is necessary to point out that the improvements obtained in the participants of this study may be due to the fact that the tasks (Small-Sided and Conditioned Games with numerical superiority in attack) were appropriately adapted to their level (average-low skill level of expertise), thus assessing the need to design in terms of experience (Mañero, & Rodríguez, 2011) and the level of

sporting skill, since the learning will be different depending on it (Araújo, Mesquita, & Hastie, 2014). To do that, it is important to keep in mind, in the task design, the NLP principles that have been discussed in this paper.

The second objective was to analyze the consolidation of these effects over time in a retention phase. Results showed in both variables, decision-making and execution, significantly higher values in the retention measure with respect to the pre-intervention phase. Moreover, they were not found significant differences between final and retention measures. These results show that the levels reached after applying the intervention program were maintained in time, even though with the absence of the intervention program. These findings suggest that after exposing players to select decisions from a rich and diverse range of affordances, they have assimilated and consolidated new learnings such as make decisions and adapt their actions to opponent´s actions (Verburgh, Scherder, van Lange, & Oosterlaan, 2016), thus demonstrating that the perspective of NLP facilitates the conservation of these learnings. Moreover, one of the aspects to be considered in order to justify these results is the length of the intervention program, which was applied in a total of 14 training sessions, as it is determined by previous studies that indicated the need to include more than 12 sessions (Harvey et al., 2010; Práxedes, Moreno, Sevil, García-González, & del Villar, 2017).

On the other hand, Thorpe Bunker, and Almond (1984) points out that learning is transferred between sport with the same internal dynamics (e.g. team sports with open motor skills such as football, basketball, hockey...). Thus, it may be that the learning in the intervention program, results from offering the player a great variety of tactical experiences, has been effective in its conservation even though it does not apply this methodology in the retention phase.

In the scientific literature, we find similar studies that analyze if the effect of the intervention program applied for the improvement of the decision making, is maintained in the time. Thus, García-González et al. (2014) and Hohmann, Obeloer, Schlapkohl, and Raab (2016) in their studies with young tennis and handball players respectively, obtained identical results as in the present study. However, there are also other investigations in which these same findings have not been found (Gil-Arias, Moreno, García-Mas, Moreno, García-González, & del Villar, 2016). In its case, the retention

phase was developed after 3 months and in a new competition league, being this issue the difference. It is important to point out that all these studies were framed within the cognitive perspective, being the methodological tool used for the improvement of the decision making, the joint application of video-feedback and questioning. That is why, in order to further deepen this field of knowledge, similar research is being developed but under the NLP approach.

REFERENCES

Araújo, D., & Davids, K. (2015). Towards a theoretically–driven model of correspondence between behaviours in one context to another: Implications for studying sport performance. *International Journal of Sport Psychology, 46,* 268–280.

Araújo, D., Davids, K., & Hristovski, R. (2006). The ecological dynamics of decision making in sport. *Psychology of Sport and Exercise, 7*(6), 653-676.

Araújo, R., & Mesquita, I., & Hastie, P. (2014) A. Review of the Status of Learning in Research on Sport Education: Future Research and Practice. *Journal of Sports Science and Medicine, 13*(4), 846-858.

Bar-Eli, M., Plessner, H., & Raab, M. (2011). *Judgement, decision making and success in sport.* West Sussex: Wiley-Blackwell.

Chow, J. Y., Davids, K., Button, C., Shuttleworth, R., Renshaw, I., & Araújo, D. (2006). Nonlinear pedagogy: A constrints-led framework for understanding emergence of game play and movement skills. *Nonlinear Dynamics, Psychology, and Life Science, 10*(1), 71–103.

Chow, J.Y., Davids, K., Button, C., & Renshaw, I. (2016). *Nonlinear Pedagogy in Skill Acquisition: An Introduction*. Routledge: London.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum.

Davids, K., Araújo, D., Correia, V., Vilar, L. (2013a). How small-sided and conditioned games enhance acquisition of movement and decision-making skills. *Exercise and Sport Sciences Reviews, 41*(3),154–161.

Davids, K., Araújo, D., Vilar, L., Renshaw, I., Pinder, R. (2013b). An Ecological Dynamics Approach to Skill Acquisition: Implications for Development of Talent in Sport. *Talent Development and Excellence, 5*(1), 21–34.

Davids, K., Güllich, A., Shuttleworth., R., & Araújo, D. (2017). Understanding Environmental and Task Constraints on Talent Development, In J. Baker, S. Cobley, J. Schorer & N. Wattie (Eds.), *Routledge Handbook of Talent Identification and Development in Sport.* Abingdon: Routledge.

Ericsson, K. A. (2003). Development of elite performance and deliberate practice: An update from the perspective of expert performance approach. In J. L. Starkes & K. A. Ericsson (Eds.), *Expert perfomance in sports: Advances in research on sport expertise* (pp. 49–84). Champaign, IL: Human Kinetics.

Fleiss, J. L., Levi, B., & Cho Paik, M. (2003). *Statistical methods for rates and proportions*. (Wiley, Ed.) (Third). New York.

Folgado, H., Lemmink, K. A. P. M., Frencken, W., & Sampaio J. (2012). Length, width and centroid distance as measures of teams tactical performance in youth football. *European Journal of Sport Science*, *14*, 1–6. doi.org/10.1080/17461391.2012.730060

Gabbett, T., Jenkins, D., & Abernethy, B. (2009). Game-based training for improving skill and physical fitness in team sport athletes. *International Journal of Sports Sciences and Coaching*, *4*(2), 273–283.

García-González, L., Moreno, A., Gil, A., Moreno, M. P., & Villar, F. Del. (2014). Effects of Decision Training on Decision Making and Performance in Young Tennis Players: An Applied Research. *Journal of Applied Sport Psychology*, *26*(4), 426–440. http://doi.org/10.1080/10413200.2014.917441

García-López, L. M., González-Víllora, S., Gutiérrez, D., & Serra, J. (2013). Development and validation of the Game Performance Evaluation Tool (GPET) in soccer. *Revista Euroamericana de Ciencias Del Deporte*, *2*(1), 89–99.

Gil-Arias, A., Moreno, M. P., García-Mas, A., Moreno, A., García-González, L., & del Villar, F. (2016). MorenoReasoning and Action: Implementation of a Decision-Making Program in Sport. *The Spanish Journal of Psychology*, *19*, E60.

Gibson, J. J. (1979/1986). *The ecological approach to visual perception*. Boston, MA: Houghton Mifflin.

Gutiérrez, D., Fisette, J., García-López, L. M., & Contreras, O. (2014). Assessment of Secondary School Students ' Game Performance Related to Tactical Contexts. *Journal of Human Kinetics*, *42*, 223–234.

Harvey, S., Cushion, C. J., Wegis, H. M., & Massa-gonzalez, A. N. (2010). Teaching games for understanding in American high-school soccer: a quantitative data

analysis using the game performance assessment instrument. *Physical Education & Sport Pedagogy*, *15*(1), 37–41. http://doi.org/10.1080/17408980902729354

Headrick, J.J., Renshaw, I., Davids, K., Pinder, R & Araújo, D. (2015). The Dynamics of Expertise Acquisition in Sport: A Conceptual Model of Affective Learning Design. Psychology of Sport and Exercise 16, 83-90.

Hill-Haas, S. V., Dowson, B. T., Couts, A. J., Rowsell, G. J. (2010). Time-motion characteristics and physiological responses of Small-Sided and Conditioned Games in elite youth players: the influence of player number and rule changes. *Journal of Strength and Conditioned Research, 24*(8), 2149–2156.

Hohmann, T., Obeloer, H., Schlapkohl, N., & Raab, M. (2016). Does training with 3D videos improve decision-making in team invasion sports? *Journal of Sports Sciences*, *34*(8), 746–755. doi:10.1080/02640414.2015.1069380

Koklu, Y., Asci, A., Kocak, F. U., Alemdaroglu, U., & Dundar, U. (2011). Comparison of the physiological responses to different Small-Sided and Conditioned Games in elite young soccer players. *Journal of Strength and Conditioning Research*, *25*(6), 1522–1528.

Mañero, J., & Rrodríguez, H. (2011). Propuesta para abordar el qué y cómo enseñar las habilidades motrices en secundaria: un ejemplo a través del patinaje. *Ágora para la Educación Física y el Deporte, 13*(2), 197-228.

Martins, D. A., Gonçalves, S., Varanda, B. S., Margarida, A., da Eira, A. J., & Correia, N. M. (2016). Manipulating the number of players and targets in team sports. Small-Sided and Conditioned Games during Physical Education classes. *Revista de Psicologia Del Deporte*, *25*(1), 169–177.

Mitchell, S., Oslin, J., & Griffin, L. (2006). *Teaching sport concepts and skills: A tactical games approach (2a ed.).* Illinois: Human Kinetics.

Nielsen, T. M., & McPherson, S. L. (2001). Response selection and execution skills of professionals and novices during singles tennis competition. *Perceptual and Motor Skills*, *93*, 541–555.

Oslin, J. L., Mitchell, S. A., & Griffin, L. . (1998). The game performance assessment instrument (GPAI): Development and preliminary validation. *Journal of Teaching in Physical Education*, *17*, 231–243.

Passos, P., Araújo, D., Davids, K., & Shuttleworth, R. (2008). Manipulating constraints to train decision making in Rugby Union. *International Journal of Sport Sciences & Coaching*, *3*(1), 125–140.

Pinder R, Davids K, Renshaw I, & Araújo D. (2011). Representative learning design and functionality of research and practice in sport. *Journal of Sport and Exercise Psychology, 33*, 146-155.

Pinder, R.A., Renshaw, I., & Davids, K. (2009). Information – movement coupling in developing cricketers under changing ecological practice constraints. *Human Movement Science 28*, 468–79.

Práxedes, A., García-González, L., Moreno, Á., Moreno, M. P., & Moreno, A. (2016a). Aplicación de un programa de intervención para mejorar la comprensión táctica en fútbol sala. Un estudio en contexto educativo. *Movimento, 22*(1), 51–62.

Práxedes, A., Moreno, A., Sevil, J., García-González, L., & Del Villar, F. (2016b). A Preliminary Study of the Effects of a Comprehensive Teaching Program, Based on Questioning, to Improve Tactical Actions in Young Footballers. *Perceptual & Motor Skills*, *122*(3), 742–756. http://doi.org/10.1177/0031512516649716

Práxedes, A., Moreno, A., Sevil, J., García-González, L., & del Villar, F. (2017). The Effects of a Comprehensive Teaching Program on Dribbling and Passing Decision-Making and Execution Skills of Young Footballers. Kine, 49(1), 74–83

Práxedes, A., Moreno, A., Sevil, J., Pizarro, D., & Del Villar, F. (2016c). Efecto de la igualdad y desigualdad numérica en juegos modificados sobre el rendimiento táctico en jóvenes futbolistas. [Effect of equal and unequal numbers of players in small-sided football games on tactical performance in young players]. *Journal of Sport Pedagogy & Research*, *2*(1), 22–29.

Práxedes, A., Pizarro, D., Conejero, M., González-Silva, J., & Moreno, A. (2016). Manipulación del número de jugadores por equipo en juegos modificados en fútbol: Análisis del rendimiento e implicaciones prácticas. III Congreso Internacional de optimización del entrenamiento y readaptación físico-deportiva. Sevilla, España.

Renshaw, I. J., Chow, Y., Davids, K., & Hammond, J. (2010). A constraints-led perspective to understanding skill acquisition and game play: A basis for integration of motor learning theory and physical education praxis? *Physical Education and Sport Pedagogy, 15*, 117–137.

Renshaw, I., Davids, K., Shuttleworth, R., Chow, J. Y. (2009). Insights from ecological psychology and dynamical systems theory can underpin a philosophy of coaching. *International Journal of Sport Psychology, 40*(4), 540-602.

Ric, A., Hristovski, R., & Torrents, C. (2015). Can joker players favor the exploratory behaviour in football Small-Sided and Conditioned Games? *Research in Physical Education, Sport and Health*, 4(2), 35–39.

Rietveld, E., & Kiverstein, J. (2014). A rich landscape of affor- dances. *Ecological Psychology, 26*, 325–352. doi:10.1080/ 10407413.2014.958035

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics (5th ed.)*. New York: Pearson Education Inc.

Tan, C., Chow, J. Y., & Davids, K. (2012). "How does TGfU work?": examining the relationship between learning design in TGfU and a nonlinear pedagogy. *Physical Education and Sport Pedagogy, 17*(4), 331–348. doi.org/10.1080/17408989.2011.582486

Thorpe, R. D., Bunker, D. J., & Almond, L. (1984). A change in focus for the teaching of games. In M. Pieron & G. Graham (Eds.), *In Sport pedagogy: Olympic*

Travassos, B., Araújo, D., Davids, K., O'Hara, K., Leitão, J., & Cortinhas, A. (2013). Expertise effects on decision-making in sport are constrained by requisite response behaviours – A meta-analysis. *Psychology of Sport and Exercise, 14*, 211–219. http://doi.org/10.1016/j.psychsport.2012.11.002

Travassos B, Gonçalves B, Marcelino R, Monteiro R, Sampaio J. (2014). How perceiving additional targets modifies teams' tactical behavior during football Small-Sided and Conditioned Games. *Human Movement Science*. 2014;38:241–250. doi.org/10.1016/j.humov.2014.10.005

Travassos, B., Vilar, L., Araújo, D., & McGarry, T. (2014). Tactical performance changes with equal vs unequal numbers of players in small-sided football games. *International Journal of Performan Analysis in Sport, 14*, 594–605.

Verburgh, L., Scherder, E. J. a, van Lange, P. a M., & Oosterlaan, J. (2016). The key to success in elite athletes? Explicit and implicit motor learning in youth elite and non-elite soccer players. *Journal of Sports Sciences, 34*(18), 1782–90. https://doi.org/10.1080/02640414.2015.1137344

Vilar, L., Duarte, R., Silva, P., Chow, J. Y., & Davids, K. (2014). The influence of pitch dimensions on performance during small-sided and condictioned soccer games. *Journal of Sports Sciences, 32*(19), 1751–1759. doi.org/10.1080/02640414.2014.918640

Withagen, R., Araújo, D., & de Poel, H.J. (2017). Inviting affordances and agency. *New Ideas in Psychology, 45*, 11-18.