

Article

The Learning of Rugby Passing Based on Different Small-Sided Games

Flávio Luiz Mazzeu, Flávio Henrique Bastos, Alexandre Moreira, Umberto Cesar Corrêa*

Universidade de São Paulo - Escola de Educação Física e Esporte, Brazil.

* Correspondence: (Umberto Cesar Corrêa) umbertoc@usp.br  ORCID ID nº 0000-0002-3465-0437

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Abstract: The small-sided, conditioned or reduced games refer to an instructional activity in which coach organizes the practice by reducing the complexity of the learning subject to the formal game. This study investigated the learning of rugby passing based on the practice of different small-sided games. Participants were 31 individuals of both sexes (23.0 ± 4.0 yr.) with no experience with rugby. The design involved three groups according to the practice/training format: 2 vs. 0, 1 + 1 vs. 1 and 2 vs. 1. The acquisition phase was carried out in three consecutive days with the performance of 60 trials of passing to the right side and 60 trials to the left side. The transfer phase was held on the last day by performing 20 trials. Performance measures involved passing direction, passing accuracy, running direction, passing zone and overall performance. Results showed that the 1 + 1 vs. 1 group was the only one that improved performance regarding the direction and accuracy of the pass in the acquisition phase and kept it in the transfer test. It was concluded that the small-sided game 1 + 1 vs. 1 made the learning of rugby passing possible.

Keywords: teaching; training; motor skill; functional structure; team sport.

1. Introduction

In the last few years has been increasing the number of studies concerned with effective methods of teaching-learning and training in team sports based on small-sided games, including the sport of rugby (e.g. (Correia, Craig, & Passos, 2011; Correia, Araújo, Cummins, & Craig, 2012; Correia, Araújo, Duarte, Travassos, Passos, & Davids, 2012; Gabett, Wake, & Abernethy, 2010; Passos et al., 2008; Passos, Cordovil, Fernandes, & Barreiros, 2012; Pavely, Adams, Di Francesco, Larkham, & Maher, 2009; Vaz, João, Pinheiro, Alpuin, & Carreras, 2013). The small-sided, conditioned or reduced games refer to a game situation with reduced motor, physical, perceptible, cognitive or social demand compared to the

formal game, as it involves smaller space, fewer players and/or shorter game time, but with the same dynamic interaction nature of it. (Davis, Araújo, Correia, & Vilar, 2013; Reis & Corrêa, 2021). Studies have been developed based on the hypotheses the small-sided games enable: (i) proximity between practice and the real actions and situations of the formal game; (ii) relationship between technical and tactical skills; (iii) learning of rules; (iv) transfer of learning or adaptive behaviour; and (v) improvement in physical parameters (Clemente & Sarmiento, 2020; Davids et al., 2013; Memmert & Roth, 2007).

Rugby studies have manipulated several small-sided games involving situations such as 1 vs. 0, 1 vs. 1, 1 vs. 2, 2 vs. 1, 3 vs. 3, 4 vs.



4, 6 vs. 6 and 7 vs. 7 (Table 1), considering motor skills such as the try and tackle (Correia et al., 2012a; Passos et al., 2008), running (Correia et al., 2012b), evasion (Vaz, Gonçalves, Figueira, & Garcia, 2016) and, in most cases, passing (Correia et al., 2011; Correia et al., 2012b; Gabett, Wake, & Abernethy, 2010; Pavely et al., 2009; Passos et al., 2012). Regarding the latter, different types of passing were considered: short and long (Correia et al., 2012b), to the right and left (Pavely et al., 2009), with fast, slow and natural speed runs (Correia et al., 2011; Correia et al., 2012b; Gabett, Wake, & Abernethy, 2010; Pavely et al., 2009; Passos et al., 2012). Overall, results showed that decision-making and performance of passing are influenced by the following aspects: (1) players' level of experience, (2) distance from the sideline, (3) support from the teammate, (4) velocity of approaching the defender, (5) direction of the pass (right or left) and (6) time-of-contact/tau between the attacker and the defender. In addition, it was found that experienced players are able to deal with divided attention (Gabett, Wake, & Abernethy, 2010).

Notwithstanding the advances provided by these studies, some have called attention to the need for further studies: all studies were carried out with experienced players, that is,

with players capable of performing the pass. Maybe, some exceptions are the studies by Correia et al. (2012b) and Vaz et al. (2012, 2013) whose aims were to investigate whether the level of experience would affect decision-making and characterise the performance of experienced and novice players, respectively. However, even in these studies, players considered to be novice had already a certain mastery of rugby motor skills. For instance, in the study by Vaz et al. (2012), the novice players had one (or less) year of rugby playing experience. Despite this, the literature is consistent in pointing out that small-sided games are important for the practice of motor skills in rugby (e.g. Correia et al., 2011; Correia et al., 2012a; Gabett, Wake, & Abernethy, 2010; Passos et al., 2012; Perassos, 2011). The main point here is whether passing in rugby is a behaviour acquired through practice like any motor skill, how small-sided games affect such acquisition needs to be investigated. This was the context of the present study: it aimed to investigate the learning of the rugby pass based on different small-sided games. We were not only concerned with improving the performance of those who already knew how to pass, but with the acquisition by those who did not know.

Table 1. Small-sided game used in studies on rugby.

Small-sided game	Components	Dynamic/Functioning
1 vs. 0 (Pavely et al., 2009)	One attacker and the ball	A player in possession of the ball runs and tries to pass it to a target
1 vs. 1 (Passos et al., 2008; Vaz et al., 2016)	One attacker, one defender and the ball	A player in possession of the ball tries to overcome an opponent to achieve your goal
1 vs. 2 (Correia et al., 2012a)	One attacker, two defenders and the ball	A player in possession of the ball tries to overcome two opponents to achieve his/her goal.
2 vs. 1 (Correia et al., 2011; Gabett, Wake, & Abernethy, 2010; Passos et al., 2012; Vaz et al., 2016)	Two attackers, one defender and the ball	A player in possession of the ball runs and tries to pass it to the teammate; the opponent tries to avoid/intercept the pass
3 vs. 3 (Correia et al., 2012b)	Three attackers, three defenders and the ball	A player in possession of the ball has two pass options (teammates); the three opponents try to prevent the attack
4 vs. 4 (Kennett et al., 2012)	Four attackers, four defenders and the ball	A player in possession of the ball has three pass options (teammates); the three opponents try to prevent the attack
6 vs. 6 (Kennett et al., 2012; Vaz et al., 2012, 2015)	Six attackers, six defenders and the ball	A player in possession of the ball has five passing options (teammates); the six opponents try to prevent the attack
7 vs. 7 (Vaz et al., 2016)	Seven attackers, seven defenders and the ball	The attacking players try to maintain the ball possession by creating and using the space. In turn, defenders try to recover the ball by denying space and tackling the ball carrier

2. Materials and Methods

Participants — Thirty-one right-handed volunteers, both male ($n = 16$) and female ($n = 15$) with an average age of 23.0 ± 4.0 years took part in this experiment. They were students from different undergraduate courses who did not play team sports at the time of the experiment and had no experience of rugby. Participation required the learner's written consent. The experimental protocol was approved by the local Institutional Review Board.

Task and materials — The learning task was passing in rugby. It refers to the act of intentionally throwing the ball with hands to a teammate positioned behind or alongside his/her attack line, in a way that does not allow the defender to reach the ball or the receiver.

The following materials were used: a camera (Casio Exilim EX-FH100 -10.1 megapixels), two rugby balls (Topper size 5), ten cones and tags-rugby.

Design and procedures — Since motor skill learning refers to those changes in behaviour that result from practice and imply relatively stable, yet adaptable, successful performances (Barros, Tani, & Corrêa, 2017; Corrêa, Correia, & Tani, 2016), by considering the small-sided games' systemic nature, it seemed reasonable to hypothesize the practice would allow learners to form a functional spatiotemporal patterning of interaction between the system's components. For instance, 2 vs. 1 is a game situation that involves three players as components that interact simultaneously in two ways: cooperation and opposition. That is, two teammates run for performing a passing while one opponent player try to avoid it in order to recover the ball. Thus, over practice the players' behaviour would stop being individual to become collective, therefore, forming a 2 vs. 1 system. In order to investigate the learning of the rugby pass we first considered the 2 vs. 1 small-sided game as that most utilized in researches (Table 1). In addition, we involved other two small-sided games taking into account the

possibility to diminish the demand for interaction, i.e. complexity, since learners were unexperienced. For this purpose, a 1 + 1 vs. 1 and 2 vs. 0 small-sided games were utilized. Both situation involves a teammate as a sine qua non passing's component. However, in the first the teammate does not move, that is, he/she occupies a fixed position and, therefore, passer does not need to pay attention to his/her displacement until he/she reaches a passing point. On the other hand, the in the second situation passer does not need to be attentional attuned to the opponent displacement.

Therefore, participants were randomly divided into three groups, each with a balanced number of men and women: 2 vs. 0 ($n = 11$), 1 + 1 vs. 1 ($n = 10$) and 2 vs. 1 ($n = 10$). At the beginning of the acquisition, each participant watched a video three times on how to perform passing the ball. During the last two times of watching the video, the experimenter called the participants' attention to essential aspects such as the passing direction and the handling of the ball. They also watched a video that showed an example of the functional structure that would be practised. After these instructional procedures, participants performed two familiarisation trials. All groups received the same general instructions for performing rugby passing: run in a straight line and pass the ball backwards or sideways; look before passing; pass with both hands and get the ball to the receiver as quickly as possible. The experimental environment of data collection was the same for all groups: a flat grassy terrain 15 m long and 12 m wide. There were cones marking the starting position, start of passing zone (4 m far from the starting position) and final of passing zone (10 m far from the starting position).

Insert Figure 1 about here

The 2 vs. 0 group involved by two teammates (a passer and a receiver). They were positioned on the starting position 7 m apart from each other, and at the experimenter's signal, they had to run in a straight line toward the passing zone (Figure 1A). The passing and reception should occur

within passing zone. The 1 + 1 vs. 1 group was characterised by two teammates and one opponent. In this small-sided game, only the passer ran to the passing zone to pass the ball to the teammate who was already there functioning as a 'joker'. At the same time, i.e. at the experimenter's signal, an opponent positioned on the final of passing zone (10 m position) should run towards the passer to intercept him by removing the tag before he/she performed a pass (Figure 1B). Finally, the 2 vs. 1 group was also characterised by two teammates and one opponent. However, in this set-up both teammates had to run to the passing zone (Figure 1C).

Three practice sessions (acquisition phase) occurred on three consecutive days, and on the last day groups also performed a learning test (transfer). Each day participants performed 40 passes, 20 for the right side and 20 for the left side, totalling 120 acquisition trials. The interval between blocks was three to five minutes. In the transfer test, the participants performed 20 trials, with 10 trials in each small-sided game not performed in the acquisition phase: the 2 vs. 0 group performed the transfer trials in 1 + 1 vs. 1 and 2 vs. 1 situations; the 1 + 1 vs. 1 group performed the transfer test in the 2 vs. 0 and 2 vs. 1 situations; and, 2 vs. 1 performed 2 vs. 0 and 1 + 1 vs. 1 situations. Each situation involved five passes for each side in a counterbalanced order. Since knowledge of results was available to participants in all trials, no augmented feedback was provided.

The performances were filmed and analysed by an expert (a former rugby athlete and currently a rugby coach with more than 5 years of experience) considering four components: (a) passing direction (if the passing was performed backwards or sideways); (b) passing accuracy (if the

passing reached the receiver or the target); (c) running direction (if the passer ran in a straight line perform the passing); and (d) passing zone (if the passing within the passing zone). Three videos were randomly selected for verifying the intra-rater reliability (same analyser) and inter-rater reliability (other expert analyser), whose results indicated a strong positive correlation ($r = 0.99$ and $r = 0.84$, respectively) (Levin & Fox, 2004).

Statistical analysis — Each of these components were analysed through a performance index representing a ratio of success in a block of 10 trials: $PI = (\Sigma S + 1) \div (\Sigma T + 1)$, where PI refers to the performance index, S is a successful trial and T refers to the trial. The additional 1 was used as a strategy to avoid compromising the calculation when the participant was not successful in all trials. Based on this calculation, the closer to 1, the better the performance. The passing direction, passing accuracy, running direction and passing zone components were also analysed in conjunction in order to obtain overall performance index. For this purpose, we calculated the arithmetic mean of foregoing PIs.

Statistical analysis considered data from blocks of 10 trials: the first (A1) and last (A12) block of the acquisition phase, and two blocks of the transfer (T1 and T2). A 3 x 4 mixed-model ANOVA (groups x blocks) was conducted on data from all performance indexes. Observed significant effects were followed up using Tukey_{HSD} post-hoc tests. These analyses were preceded by Shapiro–Wilk's W and Bartlett's tests of normality and homogeneity of variance. The level of significance was set at $p < .05$ using *Statistica*® 13.0 software (Stat Soft Inc., Tulsa, USA).

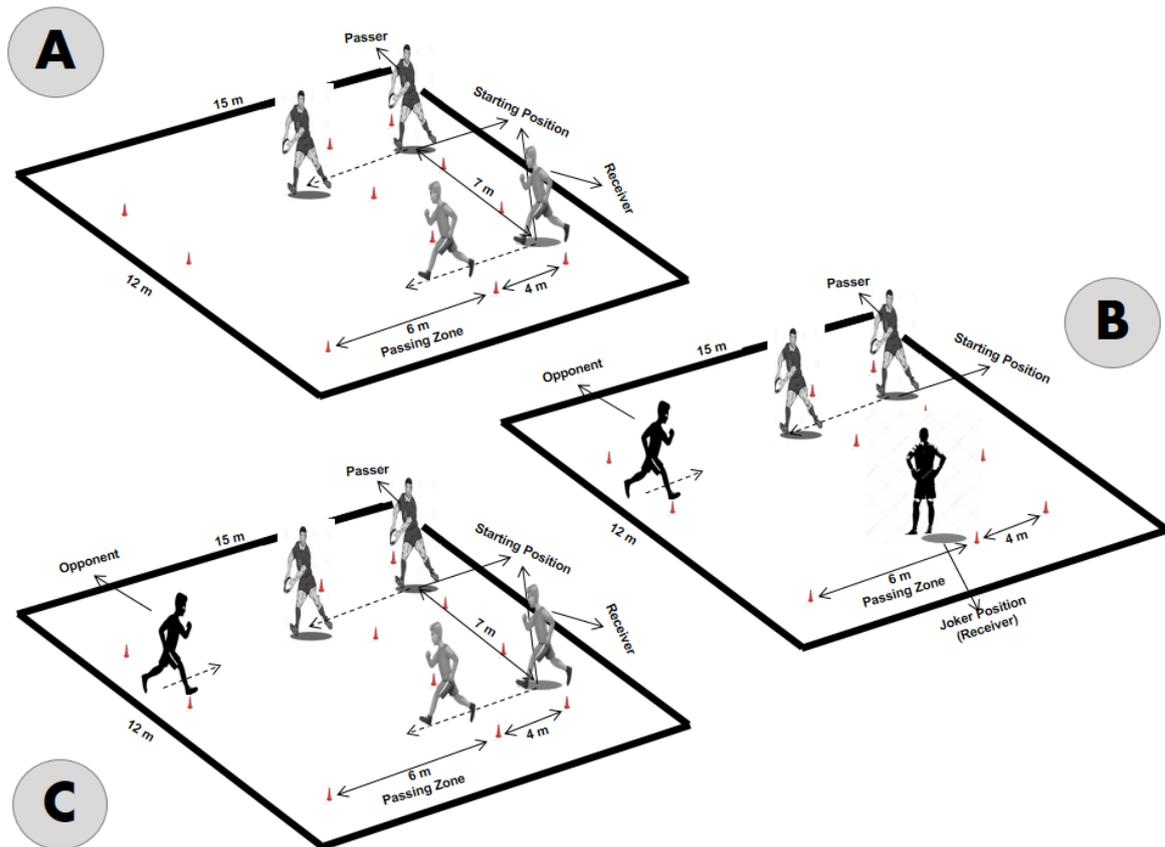


Figure 1. Illustration of experimental situations of data collection: (A) 2 vs. 0; (B) 1 + 1 vs. 1; (C) 2 vs. 1.

3. Results

Figure 2 shows the mMeans of performance indexes of the 2 vs. 0, 1 + 1 vs. 1 e 2 vs. 1 groups related to the overall performance, passing direction, passing accuracy, running direction and passing zone, in the acquisition and transfer. Concerning the overall performance, a mixed-model ANOVA revealed effects for blocks [$F(3, 84) = 2.99, p = 0.035, \eta p^2 = 0.09$] and interaction between blocks and groups [$F(6, 84) = 7.31, p = 0.0003, \eta p^2 = 0.31$]. The TukeyHSD test showed differences in the 2 vs. 0 group among A12 and the following blocks: T1 ($p = 0.0006$) and T2 ($p = 0.003$); and the 1 + 1 vs. 1 group had differences between A1 and A12 ($p = 0.006$), A1 and T1 ($p = 0.013$) and A1 and T2 ($p = 0.017$).

Regarding the passing direction, a mixed-model ANOVA revealed effects for interaction between groups and blocks [$F(6, 84) = 3.50, p = 0.003, \eta p^2 = 0.20$]. The post hoc test showed differences among 2 vs. 1 group the groups 2 vs. 0 ($p = 0.015$) and 1 + 1 vs. 1

($p = 0.015$) in the A1; it also showed differences among the 1 + 1 vs. 1 and 2 vs. 0 ($p = 0.011$) and 2 vs. 1 ($p = 0.036$) groups in T1, and between 1 + 1 vs. 1 and 2 vs. 0, in T2 ($p = 0.010$). Concerning the intra-group comparisons, it was revealed that the difference among A1 and all other blocks (A12, $p = 0.001$; T1, $p = 0.029$; T2, $p = 0.005$) in the 1 + 1 vs. 1 group; and, between blocks A12 and T2 ($p = 0.044$) in the 2 vs. 0 group. In relation to the passing accuracy, a mixed-model ANOVA revealed effects for interaction between groups and trial blocks [$F(6, 84) = 3.50, p = 0.003, \eta p^2 = 0.20$] and blocks [$F(3, 28) = 4.69, p = 0.04, \eta p^2 = 0.14$]. The TukeyHSD test showed differences in the 2 vs. 0 group, between A1 and T1 ($p = 0.004$), A1 and T2 ($p = 0.004$) and A12 and T1 ($p = 0.030$) and T2 ($p = 0.030$); in the 1 + 1 vs. 1 group the differences were between A1 and A12 ($p = 0.024$). Concerning the running direction, a mixed-model ANOVA revealed effects only for blocks [$F(3, 84) = 3.50, p = 0.018, \eta p^2 = 0.11$], with TukeyHSD post hoc

showing differences among A1 and the following two blocks: A12 ($p = 0.038$) and T1 ($p = 0.038$).

Finally, for the passing zone a mixed-model ANOVA revealed effects for interaction between groups and blocks [$F(6, 84) = 4.01$, p

$= 0.001$, $\eta^2 = 0.22$]. The post hoc test showed differences in the 2 vs. 0 group, between A12 and T1 ($p = 0.0006$) and A12 and T2 ($p = 0.049$).

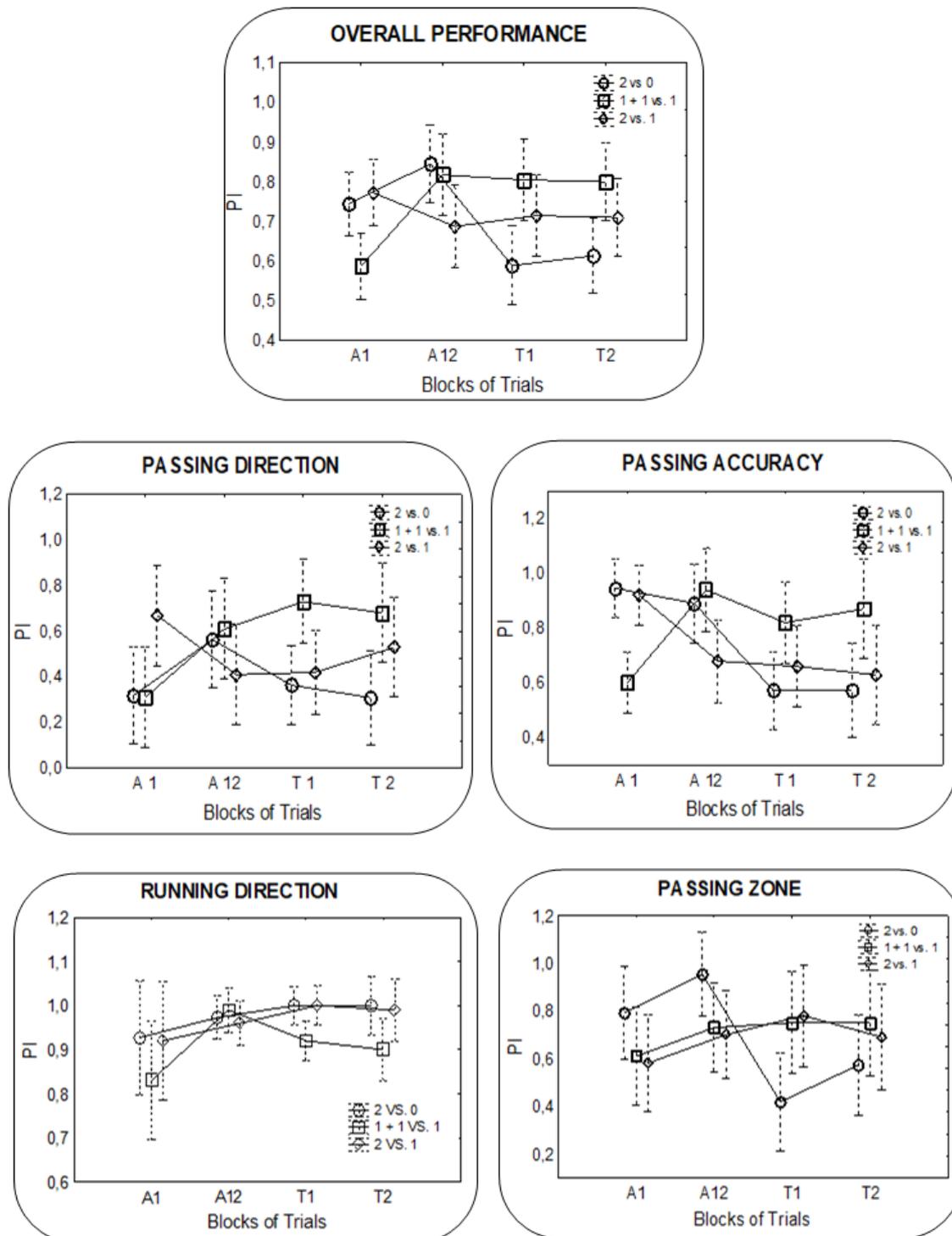


Figure 2. Means of performance indexes of the 2 vs. 0, 1 + 1 vs. 1 e 2 vs. 1 groups related to the overall performance, passing direction, passing accuracy, running direction and passing zone, in the acquisition (A1 and A12) e transfer (T1 e T2).

4. Discussion

Propositions about the practical implications of the effects of small-sided games have been based on individuals who are experts and/or have a significant level of experience in rugby. Therefore, studies have considered, at most, the effects of small-sided games on the performance improvement of skillful individuals (Correia et al., 2011; Correia et al., 2012a; Gabett Gabett, Wake, & Abernethy, 2010; Passos et al., 2012; Perassos, 2011; Vaz et al., 2012). To the authors' knowledge, no study has investigated how the aforementioned practice would affect the passing acquisition by non-skillful individuals. The aim of the study was to investigate the learning of the rugby pass based on the practice of different small-sided games. Specifically, the 2 vs. 0, 1 + 1 vs. 1 and 2 vs. 1 small-sided games were manipulated experimentally in learning rugby passing.

The results showed that the 1 + 1 vs. 1 group was the only one that improved the overall performance in the acquisition phase and maintained it in the transfer test. This group was also the only one that showed improvement regarding the direction and accuracy of the pass. Moreover, together with the others groups, it did it in relation to the direction of the running. On the other hand, it was found that 2 vs. 0 group worsened the performances regarding accuracy and passing area.

A possible explanation for the learning of the 1 + 1 vs. 1 group relates to the target (pass goal) not be moving, that is, remain stopped in the pass zone, which implied a reduction in attentional overload. For example, the passer in the group 2 vs. 0 had to consider the direction of running, the passing zone and receiver displacement in the direction of the pass. Therefore, he/she still had to predict the receiver's location. The passer of 2 vs. 1 group had the additional interaction of an opponent. Although the situation 1 + 1 vs. 1 involved an opponent, the fixed target may have functioned as a reference for both the direction of running and passing and, therefore, it was enough for the passer to

reach the passing zone. It is also possible to think that in this situation the passer had the availability to pick up essential cues from the environment for performing the pass (Hendricks et al., 2015).

According to Kluseman et al. (2012), for the practice's objectives to be achieved, it is important that the demands of the small-sided games are related to the individuals' capacities to deal with them. The 1 + 1 vs. 1 group had a situation that proved to be a facilitator for the pass, a fixed receiver in the appropriate area to receive the pass. This seems to have been the differential for learning, rather than accompanying a teammate (receiver) and the existence of opposition.

On the other hand, it is possible that the latter factor, opposition, was the influencing aspect of the worsening of 2 vs. 0 group. In other words, the ability to pass got worse with practice, due to the lack of reference to a fixed target, may have caused difficulties for the 2 vs. 0 group to deal with the addition of opposition in the transfer test.

The fact that the 2 vs. 1 group remained stable (without improving or worsening performance) allows us to think that it would need more practice to be able to deal with the interacting information in the situation practised. In other words, it is possible that three days of acquisition/120 passes were not sufficient for learning from small sided 2 vs. 1. However, this is something that needs investigation.

In summary, the findings of the present study allow us to conclude that the small-sided 1 + 1 vs. 1 made it possible the learning the rugby pass. It is important to highlight that this conclusion does not corroborate most of the literature regarding the benefits of the practice in the learning of motor skills in rugby (Correia et al., 2011; Correia et al., 2012a; Correia et al., 2012b; Gabett Gabett, Wake, & Abernethy, 2010; Passos et al., 2008; Passos et al., 2012; Pavely et al., 2009; Vaz et al., 2013).

On the one hand, it can be said that the method of data collection was one of the main limitations of the study. This is because

of the difficulty in having participants in the three days of data collection. The sample loss was significant: 11 participants. Many of them cancelled participation on one day or other for various reasons, such as rain, fatigue and other last-minute commitments, which made it impossible to use the data now collected. On the other hand, data collection was carried out in a 'real' teaching-learning environment, which allows us to reflect on the extent to which the results could be generalised. In this regard, this study provides useful insights into the design of practice tasks in rugby, suggesting that the ability of players to perform passes can be developed using small-sided 1 + 1 vs. 1.

With regard to future studies, the effects of different small-sided games could also be investigated considering the performance in the game. The pattern of movement also seems to be an important issue to focus on, as it is part of the means of achieving the goal of the task. In addition to this, it is possible that the use of measures such as, for example, the carrier's running time, the flight time of the ball and the distance from the defender at the time of the pass, would produce additional information on the learning of the rugby pass through small-sided games.

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