One-on-one situation decision-making according to equipment in youth basketball

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Abstract

The goal was to verify with which ball participants improved the attackers' decisions in one-on-one game situations during youth basketball. Participants were 88 9- to 11-year-old boys from eight teams. We organized a three-day tournament consisting of 12 games, in which four games were played with each ball among all the teams. The balls differed only in their weight (440 g, 485 g, 540 g). The videos filmed were observed by two observers trained. The dependent variables were number of decisions, appropriate decisions, inappropriate decisions and ratio of correct to incorrect decisions, in the one-on-one situation. Participants made more decisions, and more correct (but not incorrect) decisions, when using the 440-g rather than the regulation and 540-g ball. This view requires that youth coaches act as a facilitator of learning, designing practice context according the objective evidence.

Introduction

The teaching game for understanding (TGfU) approach determines that learning in team sports depends on adapting the practice context to the decision-making skill of the children in each stage of their development.[1] As a relevant element, practice has to allow children to learn how to adapt their decisions to the game while they are playing. A large number of opportunities to practice in adapted conditions help players acquire more experiences to add to their store so they will make decisions that are the most appropriate to the demands of the context.[2–4] Nevertheless, if children do not make many decisions and successful decisions, they will not enhance their motor skills. The problem is that children have few opportunities and opportunities for successful practice during the game play because coaches design practice context on their intuition or personal experience.[5,6] From a constructivist perspective, the coaches' main focus should be on providing an appropriate learning environment in which participants can make decisions.

One of the most important strategies to achieve practice that leads to success is to adapt the conditions to the context. TGfU suggests that game conditions can be adapted to children's size, age and ability.[1]

These authors introduced two fundamental pedagogical principles to be considered for modifying game play conditions (i.e. the principle of modification-representation and modification-exaggeration). Arias et al.[7] suggest that modification of the rules may be a strategy to adapt the game to the needs and possibilities of youth players. In this sense, Arias et al.[7] reviewed the rule modifications carried out in basketball to adapt it to youth players and concluded that adaptation of the rules can be considered a pedagogic variable. The prevalence of game conditions adapted to players'

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possibilities can provide more enjoyable experiences for the children, so that they choose to continue practising basketball.

Recently, Arias et al.[8] confirmed that a modified ball of lower weight contributes to increasing one-on-one game situations in youth basketball. These authors report that the increase in the number of one-on-one situations was due to the fact that the decrease of ball weight facilitated its handling, and this allowed the attackers to focus their attention on aspects related to game perception and interpretation (i.e. decision-making). This means the participants perceived more adequate one-on-one game situations, because they detected facilities allowed by the lighter ball to overcome the opponents. To detect such information, the children needed an intrinsic metric that could by specified by dimensions of his system.[9] In practical terms, they suggested the lighter ball made ball-handling easier, allowing attention to be allocated towards opponents and team-mates rather than towards the handling of the ball. The attackers decided to directly face their opponent more frequently because they found it was easier to destabilize him. However, this is only a possible explanation. To corroborate their argument, the authors did not verify whether the reduction of ball weight allowed the attacker to make better decisions in one-on-one game situations.

The goal of the present study was to verify whether the lighter ball improved the attackers' decisions in one-on-one game situations. Specifically, we examined whether the lighter ball led to the increase of attackers appropriate decisions in one-on-one situations. Based on previous findings, we hypothesized more decisions and appropriate decisions in one-on-one situations with the lighter ball and more inappropriate decisions with the heavier ball.

Method

Participants

The participants were 88 boys from eight basketball teams, ages between 9 and 11 years ($M = 10.72$, $SD = 0.32$ years). They had practiced basketball on official, federated teams for 2.64 years ($SD = 0.54$). Each week, they practiced an average of 3.67 ($SD = 0.45$) days for a total of 5.24 h ($SD = 0.65$). The selection of the teams and players was deliberate, because the teams were selected from the league that had the highest playing level and were the most homogeneous in age, previous experience and game level. The parents of the participants and the coaches completed an informed consent form to participate in the study. The Research Ethics Committee of the university approved the study.

Experimental set-up

We organized a three-day tournament consisting of 12 games in which the eight teams were randomly matched. Four games were played with each ball among all the teams. The balls differed only in their weight (lighter ball: 440 g, regulation ball: 485 g, and heavier ball: 540 g) and were the same size (69–71 cm). Each day, the teams played one game. The ball for each game was counterbalanced. Each team played one game with each ball. The coaches and players did not know the objective of the study. The teams played a tournament[8]: (a) with the balls that the organizing committee provided, (b) in which the games would be previously determined, (c) in which all the participants would receive a diploma and (d) in which they would have to respect the inclusion criteria as well as the requisites of inter-sessional consistency. Games were played between two teams of five players each, who are 11 years of age and under, during four periods of 10 min, on a court measuring 28×15 m., in which there are two basketball hoops at a height of 2.60 m. The game ball was the same in texture, colour, circumference and bounce. The game regulations were the same along the tournament. As in Arias et al.,[8] we only analysed the one-on-one situations that occurred on the frontcourt and during the four game periods, we did not establish any strategic instruction about one-on-one situations, and the coaches were not supposed to change their instructions to the players because of the study.

Procedure and data collection

The dependent variables recorded and compared per ball possessions were: (a) number of decisions made in the one-on-one situation, (b) number of appropriate decisions made in the one-on-one situation, (c) number of inappropriate decisions made in the one-on-one situation and (d) ratio of correct to incorrect decisions in the one-on-one situation. The appropriate decisions made were those that allowed the attacker achieve one or several of the following results: (a) to overcome the opponent who was hindering his progress towards the basket and to continue this progress, (b) to shoot with a chance to score a basket, (c) to receive a personal foul from the defender and/or (d) to fix the odd player (i.e. attract the attention of another teammate's defender) and pass the ball to another teammate who was better placed to score a basket. The inappropriate decisions made were the ones in which the attacker achieve one or several of the following results: (a) did not overcome the opponent who hindered his progress, (b) did not manage to shoot and/or (c) did not pass the ball to another teammate who was better placed to shoot, after fixing the odd opponent. The variables were

calculated per ball possessions to compare the results with the results from previous studies. The one-on-one situation was defined as a direct confrontation with the opponent in the front court, that keep the following key aspects[8]: (a) the offensive player with the ball had to dribble intensely toward the basket, (b) the defender had to be on the imaginary line between the hoop and the player with the ball, (c) the defender had to be facing the player with the ball and (d) the one-on-one ended when the defender was no longer on the imaginary line between the hoop and the player with the ball.

Two observers were trained until they reached inter-observer reliability values higher than .95. During this period, the observers accumulated a minimum of 100 h of experience in observation of games filmed, different from the ones in the study. The reliability of the observation was calculated by means of the intra-class correlation coefficient (measured through an inter-observer evaluation at the end of the observation process) and reached values higher than .96. The observers were blind to the weight of the ball being used in the games they observed.

Four collaborators recorded the games, each one with a video camera. The camera was situated transversally to the basketball court, on the opposite side from the scoring table. The two observers recorded the data to the dependent variables of the present work utilizing a systematized register from the observation of the game videos. The register technique consisted of indicating the number of times that the variable appeared per ball possession on the register instrument. The observers analysed the one-on-one situations that occurred on the frontcourt. They collected data for all one-on-one game situations after the first 3 min of each game. This was done to avoid the effects of the initial disturbance in the participants' adaptation to each ball. Furthermore, we compare whether the dependent variables were affected by: (a) the first and last 5 min in each game period, (b) the winner and lost teams, (c) the points differences between teams (>10, 10 to 1, 0, −1 to −10, <−10), (d) the number of personal fouls of attacker (1, 2, 3, 4), (e) the number of personal fouls of defender (1, 2, 3, 4), (f) the minutes played by the attacker (>15, ≤15), (g) the minutes played by the defender (>15, ≤15) and (h) the effect of the confrontation repetition between the same attacker and defender. After reviewing the influence of these variables there were no statistically significant differences ($p > .05$), then all the one-on-one situations were analysed. This means with these participants and in the present work, the moment of the match and game conditions did not affect the result in one-on-one situations. The sample consisted of 352 one-on-one situations from games played with the regulation ball, 497 from games played with the lighter ball and 264 from games played with the heavier ball.

Data analysis

The normality of the data was determined with the Kolmogorov–Smirnov test, which showed that the data were nonparametric. The Kruskal–Wallis H test was used to compare the data of all the games played with the same ball and to verify whether the results were influenced by the effect of the randomization of the matches between teams and the counterbalancing of the balls. Subsequently, the Kruskal–Wallis H was also used to assess whether there were significant differences between balls. Then, post hoc comparisons were performed using the Mann-Whitney U to determine with which balls these differences occurred. Statistical significance was set at $p \leq .05$. The effect sizes (ES) for significant differences in the compared variables among different ball weights were also determined.

Results

The results yielded statistically significant differences for the number of decisions, $\chi^2(2, N = 1113) = 44.51$, $p = .000$, appropriate decisions, $\chi^2(2, N = 1113) = 43.41$, $p = .000$ and ratio of correct to incorrect decisions, $\chi^2(2, N = 1113) = 21.83$, $p = .000$, but not for inappropriate decisions, $\chi^2(2, N = 1,113) = 8.45$, $p = .150$. The participants showed more favourable results (Figure 1) with the 440-g ball in comparison to the regulation ball (decisions: $U = 236,322$, $p = .000$, $ES = 0.27$; appropriate decisions: $U = 205,213$, $p = .000$, $ES = 0.61$; ratio: $U = 228,175$, $p = .022$, $ES = 0.17$) and the 540-g ball (decisions: $U = 235,313$, $p = .000$, $ES = 0.40$, appropriate decisions: $U = 199,772.5$, $p = .000$, $ES = 0.62$, ratio: $U = 204,074$, $p = .000$, $ES = 0.28$). However, the attackers made a similar number of inappropriate decisions with the 440-g ball in comparison to the regulation ball ($M = 0.32$, $SD = 0.58$ vs. $M = 0.24$, $SD = 0.56$) and the 540-g ball ($M = 0.32$, $SD = 0.58$ vs. $M = 0.32$, $SD = 0.55$), and with the regulation ball in comparison to the 540-g ball ($M = 0.24$, $SD = 0.53$ vs. $M = 0.32$, $SD = 0.55$). Also, the results were similar to compare the regulation ball in comparison to the 540-g ball (decisions: $M = 0.61$, $SD = 0.73$ vs. $M = 0.53$, $SD = 0.71$, appropriate decisions: $M = 0.20$, $SD = 0.45$ vs. $M = 0.20$, $SD = 0.43$, ratio: $M = −0.04$, $SD = 0.70$ vs. $M = −0.11$, $SD = 0.70$). Data from games played with the same ball were not influenced by the effect of the randomization of the matches between teams and the counterbalancing of the balls ($p > .05$). The ESs for significant differences found in the appropriate decisions was between medium and large, and in the decisions made and the ratio of correct to incorrect decisions was between medium and small.
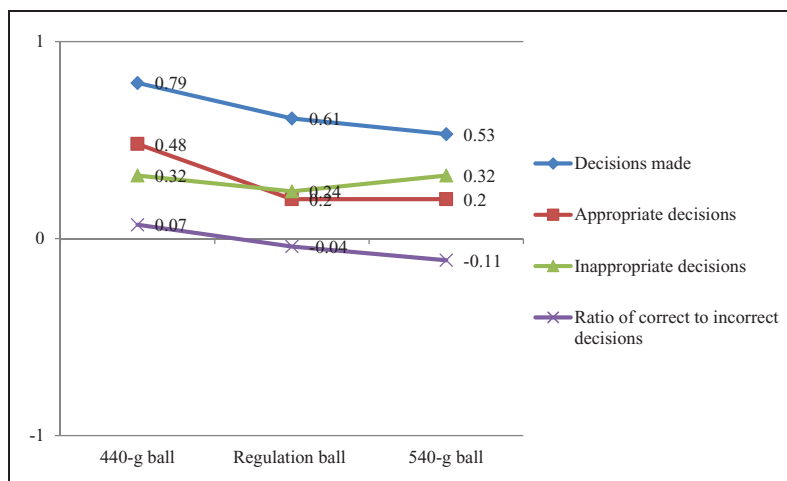
Figure 1. Mean values of the compared variables.

Discussion

The goal of this study was to verify the argument defended by Arias et al.[8] that, when reducing the weight of ball, the attackers could have decided to face the opponent more frequently in one-on-one situations because they might have found it easier to be successful. This implies assuming that the attacker's decisions were more appropriate in the game situations analysed. The results confirmed the hypothesis, because there were more decisions and appropriate attackers' decisions with the lighter ball used in the present study, but the inappropriate decisions did not increase with the heavier ball. Nevertheless, the relation between the attackers' appropriate and inappropriate decisions showed that the ratio was higher with the lighter ball. These results seem to be in line with the studies consulted about facilitation of ball handling when reducing ball weight.[5,10,11] According to these studies, a lighter ball could have favoured better skills to play with the ball and a greater game understanding. As dribbling skills improve as body size increases,[11] the improvements with the lighter ball might have been because it does not require the application of greater force to maintain a dribble at a constant height than heavier balls.[11] This means, the lighter ball could have allowed to the participants an easier ball-handling. Then, they were able to change their attentional focus from ball-handling to others game key aspects (e.g. opponents and team-mates places and movements) more important than ball-handling technique, when there are opponents and team-mates in the game. Araújo et al.[12] showed that, in one-on-one situations, attackers attempt to perturb the opponents by dribbling past the defender towards the basket. This could means that players perceived the game environment adequate to his own action capabilities in relation to the opponent,

his body, the spatial location and the ball.[9] In practical terms, the dribbling was easier to the participants and they decided to use it to past the defender in the one-on-one situations. However, the results from the present work do not allow going into detail to know the reasons by which the participants improved. New studies that show direct evidence to know exactly why a lighter ball leads its handling and in particular to increase the number of decisions and appropriate attackers' decisions in one-on-one situations are necessary. This involves to know the participants opinion and to design research in laboratory conditions.

The number of decisions made in the present work also were greater than those showed by Arias[13] ($M = 0.53$, $SD = 0.78$), when participants playing with the regulation ball, and by Arias et al.,[14] using the regulation ball and two different designs of the three-point line. As recently found by Arias et al.,[8] the ball of lower weight led to increase one-on-one game decisions as in the present work. This means, the lighter ball led to a practice context more adapted to the participants capacities in the present work. According to constructivism, if we assume that learning is an interpretative process shaped by previous experience through which the participants construct their own particular versions of reality,[15] it is very important that game can be adapted to the children possibilities. This could have led to develop their game understanding.[1]

Arias[13] assessed the suitability of the decisions of the attacker with the ball on 1565 one-on-one situations from 16 games and found a mean of 0.22 ($SD = 0.50$) successful decisions. This result was similar to that obtained in the present study with heavier balls. This reaffirms, along with the rest of the literature consulted, that the 440-g ball leads to more appropriate decisions in the one-on-one situation. The game conditions

promoted by the 440-g ball may be the most adequate for attackers to be more successful in one-on-one situations. That is, in the present work, the reduction of ball weight seems to have led to a better quality practice context that allowed the children to go from attending aspects related to handling the ball to aspects of game perception and interpretation, as hypothesized by Arias et al.[8]

Attending to the ratio calculated, the attackers' decisions became less appropriate as the weight of the ball increased. Arias[13] also calculated this ratio and obtained a similar result (0.89) to that found in the present work when the participants played with the regulation ball. Being the attacker in this game situation implies possessing the ball and, to some extent, taking the initiative in the game, and it may contribute to the fact that children have to face a high number of stimuli and it is harder for them to focus on perception and interpretation aspects of the game, in contrast to when they are the defender.[16] This suggests that the attacker involved in the one-on-one situation would not have managed to break the period of stability that characterizes this game situation[9,17] when using heavier balls. That is, the player with ball would not have discovered his decision possibilities with regard to the context,[9,18] and the defender would have been capable of anticipating him or of countering his decision. However, only when the participants played with the lighter ball was the decision made ratio positive for the attacker. This indicates that the lighter ball contributed to simplifying the game situation for the attacker.

According to Graça,[2] children focus on the context when the game is suited to them. However, it seems that the one-on-one situation is complex for children and more complex when they are less skilled children, which makes appropriate decision-making more difficult. Chen et al.[19] found that in a complex dribbling task, like a one-on-one situation, higher skilled children maintained heads up and looking around, whereas the less skilled children did not look up. The complexity of the situation may be a relevant explanation of why the situation is unusual during the game in youth basketball in comparison to senior basketball.[8,13,14] However, diverse authors who have attempted to adapt the game to increase the number of one-on-one situations have normally obtained a favourable result.[8,14] This makes one think that the practice conditions of habitual basketball playing are not very well suited to the characteristics of the youth players who were the object of study. The development of the players' decision-making skills should not be impaired because practice conditions are not adapted to their possibilities, and more so in team sports, where decision-making is just as or more relevant than skill execution for successful performance.[19,20]

To conclude, the attackers' participants of this study improved their number of decisions and adequate decisions in the one-on-one situation with the 440-g ball. A modification that allows achieving these results is very important in such a complex sport as basketball. If, in similar studies, the investigators obtain indications that the modification of equipment allows adapting the practice contexts to children, then physical educational teachers and youth sport coaches should act responsibly and attempt to design game conditions that allow students and youth players to improve. This view requires that youth coaches act not as an instructor transmitting objective knowledge but as a facilitator of learning. However, the results do not ensure that a ball lighter than the 440-g ball will lead to more improvement in decision-making.

The cost and dedication involved in studying decision-making across the elementary years and in game play settings is prohibitive for most researchers. In spite of this, the present work contributes three important achievements: (a) it helps to resolve conflicting findings and interpretations regarding the study of Arias et al.,[8] (b) it contributes useful results for physical education teachers and youth sport coaches to design practice conditions suited to children and (c) it generates a knowledge base from which the results can be corroborated in future studies.

Declaration of conflicting interests

Funding

References

1. Thorpe R, Bunker D and Almond L. *Rethinking games teaching*. Loughborough: University of Technology, 1986.
2. Graça A. Comparing the high and the low achievers' opportunity to participate in basketball game within physical education classes. In: Hughes M and Tavares F (eds) *IV world Congress of notational analysis of sport*. FCDEF-UP, Porto, 1998, pp.127–134.
3. Memmert D and Harvey S. The game performance assessment instrument (GPAI): some concerns and solutions for further development. *J Teach Phys Educ* 2008; 27: 220–240.
4. Thomas K. The development of sport expertise: from Leeds to MVP legend. *Quest* 1994; 46: 199–210.
5. Pellett TL, Henschel-Pellett HA and Harrison JM. Influence of ball weight on junior high-school girls' volleyball performance. *Percept Motor Skill* 1994; 78: 1379–1384.

6. Siedentop D, Doutis P, Tsangaridou N, et al. Don't sweat gym! An analysis of curriculum and instruction. *J Teach Phys Educ* 1994; 13: 375–394.

7. Arias JL, Argudo FM and Alonso JI. Las reglas como variables didácticas. Ejemplo en baloncesto de formación [Rules as didactical variables. An example in youth basketball]. *Rev Int Med Cienc Ac* 2011; 11: 491–512.

8. Arias JL, Argudo FM and Alonso JI. Effect of the ball mass on the one-on-one game situation in 9–11 year old boys' basketball. *Eur J Sport Sci* 2012; 12: 225–230.

9. Cordovil R, Araújo D, Davids K, et al. The influence of instructions and body-scaling as constraints on decision-making processes in team sports. *Eur J Sport Sci* 2009; 9: 169–179.

10. Burton A and Welch B. Dribbling performance in first-grade children: effect of ball and hand size and ball-size preferences. *Phys Educ* 1990; 47: 48–52.

11. Arias JL, Argudo FM and Alonso JI. Effect of ball mass on dribble, pass, and pass reception in 9–11-year-old boys' basketball. *Res Q Exerc Sport* 2012; 83: 407–412.

12. Araújo D, Davids K, Bennett S, et al. Emergence of sport skills under constraints. In: Williams AM and Hodges NJ (eds) *Skill acquisition in sport: research, theory and practice*. London: Routledge, Taylor & Francis, 2004, pp.409–433.

13. Arias JL. Las oportunidades y el éxito en el lanzamiento en la situación de uno contra uno en minibásquet [Opportunities and success in shot after one-on-one game situation in mini-basketball]. *Rev Int Med Cienc Ac* 2012; 12: 23–34.

14. Arias JL, Argudo FM and Alonso JI. Effect of the three-point line change on the game dynamics in girls' mini-basketball. *Res Q Exerc Sport* 2009; 80: 502–509.

15. Cobb P. Where is the mind? A coordination of sociocultural and cognitive constructivist perspectives. In: Fosnot CT (ed.) *Constructivism: theory, perspectives and practice*. New York, NY: Columbia University, 1996, pp.34–52.

16. Duarte R, Araújo D, Davids K, et al. Interpersonal coordination tendencies shape 1-vs-1 sub-phase performance outcomes in youth soccer. *J Sport Sci* 2012; 30: 871–877.

17. Passos P, Araújo D, Davids K, et al. Information governing dynamics of attacker–defender interactions in youth rugby union. *J Sport Sci* 2008; 26: 1421–1429.

18. Turvey MT. Affordances and prospective control: an outline of the ontology. *Ecol Psychol* 1992; 4: 173–187.

19. Chen W, Rovegno I, Todorovich J, et al. Third grade children's movement responses to dribbling tasks presented by accomplished teachers. *J Teach Phys Educ* 2003; 22: 450–466.

20. MacPhail A, Kirk D and Griffin L. Throwing and catching as relational skills in game play: situated learning in a modified game unit. *J Teach Phys Educ* 2008; 27: 100–115.