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STUDENT PRECISION AND RELIABILITY OF THE TEAM SPORT ASSESSMENT IN BASKETBALL: A PRIMARY EDUCATION CASE STUDY

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ABSTRACT

The main aim of this study was to apply the Team Sport Assessment Procedure (TSAP) and formative assessment of invasion sport. The specific objectives were to determine the degree of agreement among expert observers, inter-observer reliability (internal consistency), and intra-observer reliability (temporal reliability). Elementary sixth grade pupils (N=52; age 11.35±0.77), from a state school in Seville (Spain) participated. The pupils followed a training process using the Team Sport Assessment Procedure, which features six variables distributed between the game phases, attack and defence. Training consisted of five sessions of 45 minutes each. After the training process, the pupils observed and assessed the edited sequences for subsequent analysis. In four of the five variables chosen, 80% of the 52 pupils obtained intraclass correlation scores of ≥0.80. For 'volume of play', 82.46% of the observers obtained a precision coefficient of ≥0.80. In contrast, the 'efficiency index', recorded a moderate precision coefficient. What is new in this study is the presentation of situations of superiority and the monitoring of participation of primary school children. The positive results obtained from observer precision reliability, reinforce the possibility of using this tool as a method of assessment in primary education.

Key words: TSAP; Pupils; Primary school; Invasion games; Formative assessment.

INTRODUCTION

Invasion sport (basketball, football, handball, hockey, rugby, waterpolo), are the most popular forms of physical activity among the general population (Otero-Saborido *et al*., 2014a). In the educational sphere, both physical education teachers and learners from different countries concur that they are the most frequently taught by teachers and the favourite sport for learners (Shropshire & Carroll, 1998; Hill & Cleven, 2006; Gutiérrez *et al*., 2007).

Traditionally, teachers have taught these games with a focus on mastering technical skills (Martin *et al*., 2005; Arias & Castejón, 2012; Otero-Saborido *et al*., 2014a). However, this teaching model has been criticised by the approach of Teaching Games for Understanding (TGfU) (Bunker & Thorpe, 1982). TGfU suggests a technical skills approach to developing game knowledge and understanding (knowing what to do, and when and how to do it). Tactical models, as opposed to a technical approach, develop a better understanding of the game according to Bunker and Thorpe (1982). Tactical models have been referred to as, 'Play

Practice' by Launder (2001), as the 'Tactical Games Model' by Mitchell *et al*. (2006) and as the 'Tactical-Decision Learning Model' by Gréhaigne *et al*. (2005). From the perspective of teaching for understanding, different studies claim that little declared knowledge leads to a low quality of game decision-making (French & Thomas, 1987; Figueiredo *et al.*, 2008; Moreno *et al*., 2010). Therefore, assessment tools are needed to promote tactical understanding of the game and not only for assessing the pupils' technical skills.

However, opinions of teachers about the assessment of invasion sport were that tactical complexity was one of the aspects, which makes assessment difficult (Otero-Saborido *et al*., 2014a). Traditional assessment in invasion sport has two characteristics (López, 1999). Firstly, with regard to pupil participation, hetero-evaluation was used, where the teacher alone evaluated the pupil and there was no cognitive involvement on the part of the pupil in the assessment process. In the traditional assessment model, pupils do not participate in the assessment (Vera *et al.*, 2009; Lorente-Catalán & Kirk, 2014). Therefore, assessment was synonymous with assigning a grade or mark. Secondly, the instruments used, in the case of team sport, were standardised tests, which focused on the motor dimension and technical performance, omitting such vital elements as decision-making (Figueiredo *et al*., 2008; Memmert & Harvey, 2008).

In recent years, however, there have been concerns voiced by different researchers towards changing these two aspects: firstly, by involving pupils cognitively in their assessment through participation in the assessment, either through self-evaluation methods or through peer or co-evaluation; and secondly, traditional tests, which only evaluated isolated technical aspects of the game. This evolved to a point where they can assess decision-making and tactical aspects in all the game situations, which can arise from a game/match.

Research studies published in recent years confirm that both these characteristics should be involved in the assessment of invasion sport (Oslin *et al*., 1995; Gréhaigne *et al*., 1997; Méndez, 2005; López *et al*., 2007; Figueiredo *et al*., 2008; Memmert & Harvey, 2008; Nadeau *et al*., 2008a; Pérez *et al*., 2008; Santos, 2010; Arias & Castejón, 2012; Arias-Estero & Castejón, 2014; Lorente-Catalán & Kirk, 2014; Otero-Saborido *et al*., 2014a; Otero *et al*., 2014b; Morillo & Hernández-Mendo, 2015). These studies are all unanimous that pupils should participate in assessment and be more than just a recipient of a grade. Moreover, all the authors use whole-game situations to evaluate decision-making, casting aside traditional technical tests isolated from real play, which do not reflect the idiosyncrasies of invasion sport. Within this tendency towards a more comprehensive assessment of invasion sport regarding pupil participation, the foundation was established by Oslin *et al*. (1995), with the Game Performance Assessment Instrument (GPAI), and by Gréhaigne *et al*. (1997 with the Team Sport Assessment Procedure (TSAP). The latter was applied in this present study.

The GPAI is a tool, which contains different variables (base, adjusting, decision-making, skill execution, covering, supporting and saving/scoring), and quantifies the appropriateness of the decisions made by the pupil. However, the TSAP is a tool, which quantifies the player's total offensive performance based on two actions, namely what the player does with the ball when in possession and how he/she obtains the ball. The TSAP is an assessment procedure developed by Gréhaigne *et al*. (1997) and for which evidence of validity (content, concurrent, ecological), and reliability (inter-observer reliability >0.82, performance stability >0.86), is provided. The GPAI and TSAP are instruments, which are useful for helping pupils to understand the game better. The TSAP encodes objective decisions, while the GPAI encodes subjective decisions (an observer judges the performance of the player to ascertain whether a decision is, or is not, appropriate). This subjective coding, however, does not contribute to accurate calculations of reliability.

With the TSAP at the centre of this study, a review of the literature shows that only five research papers have been published on the TSAP (Richard *et al*., 1998, 1999, 2000; Nadeau *et al*., 2008a; Nadeau *et al*., 2008b). A recent review of the TSAP by Arias and Castejón (2012), highlights some interesting data concerning the use of this tool. First, the TSAP was used more in invasion games (88.9%) and to a lesser extent in net/wall games (11.1%). Secondly, the five studies using the TSAP included each of the components of the original instrument. One of the contributions of the current study is that it modifies the original and adds a neutral player. Finally, the TSAP was used in Physical Education classes (60%) and in extra-curricular sports (40%), and the age group used (60%), was between 10 and 14 years (Arias-Estero & Castejón, 2014). The data confirm that the strength of this tool is its adaptability to different educational contexts, such as primary education, and that pupils can observe their teammates from the age of 10 years old (Méndez, 2005).

AIM OF THE RESEARCH

The aim of the present study was to implement the TSAP with pupils from Year Six in Primary School (6th Grade in Elementary School). The different reliability and concordance indicators were investigated after applying the experiment with the specific objective to assess the possible implementation of this tool in the school curriculum. In this context, past research on the use of the TSAP (Gréhaigne *et al*., 1997; Richard *et al*., 1998, 1999, 2000; Nadeau *et al*., 2008a; Nadeau *et al*., 2008b), were very helpful in enabling the researchers to make comparisons with the results of the current study.

METHODOLOGY

Research design

This research typifies an observational design. The research is quantitative because the TSAP is a very structured instrument, which codes the number of events. According to the classification of observational studies in sport (Anguera & Hernández, 2013), this study can be classified as ideographic, multi-dimensional and an individual components research.

Sample

The observations of 52 pupils (6th Grade) at a state school in Seville (Spain) were recorded and analysed in this study. The average age of the group was 11.35±0.77 years, with 53.84% (n=28) girls and 46.15% (n=24) boys. The pupils observed and analysed themselves. All of the 6th Grade pupils in the school took part in the research, but the results of pupils with extreme learning difficulties were not taken into account, following the control protocol of extraneous variables found in similar studies (Cuéllar *et al.*, 2004; Otero-Saborido *et al*., 2012a; Otero-Saborido *et al*., 2012b). The Research Ethics Committee of the University approved the study.

Instruments

The 3 university lecturers, who participated in the study, were all specialists in team sport. These experts designed game situations, recorded sequences and conducted the pupils' training programmes. The pupils were video recorded during 4 sessions of Physical Education. Sequences of game play were filmed using 2 Sony cameras DSC-HXU. The different video sequences of play were edited using Dartfish Team Pro 5.5 – the version adapted for team sport. Finally, the researchers used a Promethean 2011 digital whiteboard to project game situations to the pupils for their subsequent assessment.

Observation instrument

The initial proposal of the TSAP by Gréhaigne *et al.* (1997) features 6 variables distributed between the 2 phases of the game, attack and defence. One of the advantages of the TSAP is its adaptability to educational contexts and the motor skills of pupils. Table 1 shows the TSAP variables adapted for this study. For this study, basketball was used as the invasion sport, following Méndez's (2005) recommendation that the 6 variables be reduced to 5 (Table 1), enabling assessment of the pupils. In this case, the neutral ball category was eliminated, since it is difficult for pupils to discern when a pass is dangerous for an opponent and when it is not. In the same way, the application of the TSAP by Richard *et al*. (2000), in a similar educational context to this study, also omitted computation of the results of the neutral ball category given its complexity.

TABLE 1. **VARIABLES OF TEAM SPORT ASSESSMENT PROCEDURE: ADAPTATION OF ORIGINAL TSAP** (Gréhaigne *et al.,* 1997:507)

Phases	**Actions observed**	**Code**	**Description**
How I get the ball	Received Ball	RB	I received it from a teammate and was not immediately lost.
	Conquered Ball	CB	I take it from an opponent; I intercept a pass; I pick up a rebound from the opposing team's shot.
How I play the ball	Lost Ball	LB	I lose it to an opponent I throw it off court
	Offensive Ball	OB	I pass ball to a teammate
	Basket Shot	BS	Shot at basket which scores points Shot which misses the basket but rebound goes to a teammate

Volume of Play index (VP)= RB+CB Efficiency Index (IE)= $\frac{CB+OB+BS}{10 + LB}$

Procedure

Selection of the participating groups

One of the characteristics of sport at primary school level is the heterogeneity of the pupils (Otero-Saborido, 2005). In the setting of extracurricular sport, the level of learners is more homogeneous, which has made different specialist authors on the subject to point out 2 different education modalities in the initiation of a sport: Physical Education and extracurricular sport (Hernández *et al*., 2000; Fradua & Moreno, 2001). Based on this, the pass and bounce tests, proposed by Strand and Wilson (1993) for basketball, were used, as was the case in a similar study by Yáñez and Castejón (2011). The current study had 2 objectives. Firstly, to determine 3 levels of skill to divide the pupils into groups where participation in the game would be as homogenous as possible, thereby avoiding situations where the more skilful players dominate play to the detriment of the less skilful ones. Secondly, tests were administered to ascertain whether the technical level of the pupils would determine the whole-game situation as the researchers had proposed.

Game situation

Situations of numerical superiority take on a very important role following the logical scheme for education of firstly, situations of numerical superiority, then situations of equality, and finally inferiority (Sans & Frattarola, 1993), as they facilitate the teaching of team sport to adapt to the abilities of the pupils. With this pedagogical criterion, situations of superiority with the presence of neutral players prevail over situations of equality, above all in the primary school context.

Various specialist researchers in sport initiation have commented in similar terms concerning the use of wildcards and adapted game situations (Antón, 1990; Sans & Frattarola, 1993; Fradua & Moreno, 2001; Pintor & Cárdenas, 2001; Ardá & Casal, 2003; Bengué, 2005). The game situation in the current study was ‘3 versus 3’; plus a neutral player, who played with the team that had possession of the ball (Lisbona & Mingorance, 2010), which is unlike previous studies where game situations in a primary school context involved only an equal number of players.

Observer training

Before applying the instrument of observation, the pupils went through a training process as recommended by various authors (Medina & Delgado, 1999; García *et al.*, 2002). The number of training sessions proposed by Richard *et al*. (2000), in a similar study was increased to consist of 5 sessions of 45 minutes per session. The first session explained the theory of the TSAP and its variables. In the following 2 sessions, the pupils analysed and assessed game situations by observing live matches of ‘3 vs. 3 + 1’ of fellow pupils. To finalise the procedure, the last 2 sessions were centred on the analysis of video sequences of players of different levels by the pupils and clarifying observation queries in the various categories. Once the training process was completed, 6 video sequences were produced and presented to 6 pupils from the 3 different levels of play. Each sequence lasted between 3 and 4 minutes (periods where play had stopped were deleted). From this point, all the pupils who participated in the present study (N=52), observed and assessed the edited sequences for subsequent analysis.

Data analysis

There were 3 aims for the data analysis: (1) to determine the degree of agreement with the expert observers; (2) to determine inter-observer reliability by means of internal consistency; and (3) to determine intra-observer reliability for temporal reliability.

To determine the above aims, the researchers used an intraclass correlation coefficient, as has been used by researchers of similar studies (Gréhaigne *et al.*, 1997; Richard *et al.*, 2000; Nadeau *et al.*, 2008a), utilising the Two-way random absolute agreement model. In the case of agreement with expert observer and inter-observer reliability, two performance indices were used ('volume of play' and 'efficiency index'), and the 5 categories selected for the present study. For temporal reliability, performance scores were used. With regard to acceptable levels of reliability, a scale of 3 levels was determined. Firstly, scores less than 0.60 were considered unacceptable. The second level between 0.60 and 0.79 were proposed as having moderate reliability, and finally, a score of 0.80 and above represented a high level of reliability. Microsoft Office Excel 2007 was used to process the data recorded, and the SPSS V.15 for Windows statistics programme was used to analyse the data.

RESULTS

Agreement in observation

The results for the 5 variables chosen from the TSAP and of the 2 performance indices can be found in Tables 2 and 3.

Table 2 shows the levels of intraclass correlation. In general terms, and in the case of the variables, in 4 of the 5 variables chosen, approximately 80% of the pupils obtained intraclass correlation scores equal to or higher than 0.80. Within these high levels of precision in observation in the 'Basket Shot' and 'Received Ball' categories, 98.09% and 88.46% (respectively) of the pupils scored a precision level above 0.80 with regard to the observations of the experts.

TABLE 2. **LEVEL OF INTRACLASS CORRELATION BETWEEN 52 PUPILS AND EXPERTS FOR FIVE VARIABLES**

Levels of reliability	Conquered ball (CB)	Received ball (RB)	Lost ball (LB)	Offensive ball (OB)	Basket shot (BS)
Range of reliability	0.75–0.97*	0.80–0.98	0.34–0.86	0.94–0.97	0.94–1
≥0.80	43/52 (82.69%)	46/52 (88.46%)	24/52 (46.15%)	41/52 (78.80%)	51/52 (98.09%)
0.60 - 0.79	8/52 (15.34%)	4/52 (7.69%)	9/52 (17.30%)	4/52 (7.69%)	1/52 (1.29%)
> 0.60	1/52 (1.94%)	2/52 (3.85%)	19/52 (36.53%)	7/52 (13.46%)	0/52 (0%)

*Intraclass correlation coefficient (range)

'Lost Balls' is the variable which obtained the worst precision results among the experts. A descriptive analysis of the results shows that only 36.53% of the pupils computed the same number of 'Lost Balls' like the experts. This data indicates that 46.15% of the pupils obtained the same or higher than 0.80 precision in their observations. Finally, in the 'Conquered Ball' category, an accumulated frequency of 98.03% of observers provided precision coefficients above 0.60. More specifically, 82.69% of pupils scored a precision level equal to or higher than 0.80.

TABLE 3. **AGREEMENT IN OBSERVATION BETWEEN 52 PUPILS AND EXPERTS FOR TWO EXECUTION INDICES: VP/IE**

Levels of reliability	**Volume of play**	**Efficiency index**
Range	0.86–0.98	0.73–0.97
≥0.80	46/52 (88.46%)	22/52 (42.31%)
0.60 - 0.79	4/52 (7.69%)	25/52 (48.08%)
> 0.60	2/52 (3.85%)	5/52 (9.61%)

Volume of Play index (VP)= RB+CB Efficiency Index (IE)= $\frac{CB+OB+BS}{10 + LB}$

Table 3 shows agreement in observation between the pupils and the experts. In the case of the performance indices, 'Volume of Play' and 'Efficiency Index', high levels of precision were registered in the first category and moderate in the second category. For 'Volume of Play', 88.46% of the observers obtained a precision coefficient equal to or greater than 0.80 because of the excellent coefficients of the two categories comprising this index ('Received Ball' and 'Conquered Ball').

Inter-observer reliability

TABLE 4. **INTER-OBSERVER RELIABILITY FOR TWO INDICES (VP/IE) AND FIVE VARIABLES (CB/RB/LB/OB/BS) IN TSAP**

Indicator	**Intraclass**	**Corrected intraclass**
Volume of Play (VP)	0.93	0.94 (1 case omitted)
Efficiency Index (IE)	0.87	0.87 (5 cases omitted)
Received Ball (RB)	0.81	0.83 (2 cases omitted)
Conquered Ball (CB)	0.88	0.88 (1 case omitted)
Lost Ball (LB)	0.56	0.70 (19 cases omitted)
Offensive Ball (OB)	0.87	0.96 (7 cases omitted)
Offensive Ball (BS)	0.92	0.92 (0 cases omitted)

To establish the reliability of the observing pupils, the intraclass correlation coefficient with the Two-way random absolute agreement model was applied. Table 4 shows the inter-observer reliability for 2 indices (VP/IE). The results obtained show high levels of reliability among observers of all categories except for 'lost balls'. However, in the same terms as the study by Richard *et al*. (2000), they reported a corrected intraclass correlation coefficient, omitting cases with reliability levels below 0.60. The new coefficient indicates high reliability in all categories.

Temporal reliability

In the current study, temporal reliability was considered an indicator to assess the benefits of the procedure and the stability of the results. There was a period of 3 weeks between both readings. Pupils observed and analysed identical situations obtaining a coefficient of 0.72 for the performance scores, which suggests the results had moderate stability.

DISCUSSION

Regarding *observer precision*, differences were found in the results when compared with those obtained by Richard *et al*. (2000), for a group of pupils of the same age as in the current study. The results of Richard *et al*. (2000), contain higher precision scores in 'conquered balls', 'basket shots' and 'received balls'. High scores for the 'basket shot' variable were surprising considering its complexity, given that the offensive rebound also had to be identified. For this reason, the researchers insisted on observer training. Results for 'lost balls' were significantly lower. Such low results do not concur with a clear definition of the 'lost ball' category. Nevertheless, when play is in the area of the basket, situations occur, especially in the case of rebounds, which are far from clear for the accurate observation and scoring of this category. At the same time, the low frequency of 'lost balls' for the six players observed by the pupils scored negatively for the precision indicators in cases where there was no congruence with the observers.

As for the *execution indicators*, there was a similar coefficient for 'Volume of Play', while reliability of the 'Efficiency Index' was lower in the current study due to the low reliability scores in the 'lost balls' category. In contrast, the moderate precision coefficient of the 'Efficiency Index' (only 42.30% of observers scored high levels of validity), concurs with the low results obtained in the 'lost balls' category, which is part of this same indicator. Other studies that applied the TSAP did not find reliability with regard to the group of experts (Gréhaigne *et al.*, 1997; Nadeau *et al.*, 2008a). García *et al*. (2002) obtained much lower coefficients in observer precision with experts in water polo game situations, although a comparison cannot be made with the present study since the context and subjects were different.

In the case of *inter-observer reliability*, there were hardly any differences with the results obtained by Gréhaigne *et al*. (1997) in 'Volume of Play' (0.94 and 0.99), and 'Efficiency Index' (0.82 and 0.90). Although the results were slightly higher than the current study, the pupils assessed by Gréhaigne *et al*. (1997) were from an older age range than in the current study. The opposite occurred in the work by Richard *et al*. (2000), where the pupils were the same age as in the current study. In indices, 'volume of play' (0.89), and 'Efficiency Index' (0.78), the results for inter-observer reliability were noticeably higher in the present study, which may suggest the positive influence of the greater number of training hours of the observers. Nadeau *et al.* (2008a) obtained similar reliability results to the current study with adolescent hockey players.

Temporal reliability has already been used as a way to measure performance in education and assessment of team sports (Gréhaigne *et al.*, 1997; Nadeau *et al.*, 2008a; Moreno *et al.*, 2010; Otero-Saborido & Silva, 2015). The temporal stability obtained in this study is acceptable as psychometric evidence (0.72). However, Tritschler (2000) provides coefficients equal to or superior to 0.80 as the most desirable to be able to talk about permanence across time for the results. The temporal reliability result obtained by Nadeau *et al.* (2008a), was inferior to that in the present study (0.26, 0.59 and 0.16). For their part, Gréhaigne *et al.* (1997) obtained a greater stability of results (0.87), which could be because the subjects in their study were older than the subjects in the current study.

CONCLUSIONS

From the application of the TSAP in this study as an assessment tool for team sport, which involves the pupils cognitively, it can be deduced that there is a high level of concordance with the group of experts. Likewise, inter-observer reliability and stability obtained over time are more than acceptable. In conclusion, the psychometric indicators provide optimism with regard to the usefulness of such tools and their potential for implementation in schools. It is important to highlight two notable findings of the current study, which is similar to research previously initiated by a range of other researchers. Firstly, the use of game situations with numerical superiority and with neutral or wildcard players are situations that are the most appropriate for favouring the person in possession of the ball in a primary school context, where technical levels are more heterogeneous and less developed than in a sporting context. Secondly, the adaptation of the instrument to the abilities of 11-year-old pupils may require eliminating categories. Researchers should note that most studies applied the TSAP with adolescent pupils, whereas the 10 to 11 age groups have not been studied extensively to date.

Finally, from the perspective of the physical education teacher, the problem is that it is a very complex process involving multiple tasks (tool design, recording and editing of games, observer training, computing data via Excel, later to SPSS, reliability calculations, etc.), which makes it impractical as an assessment tool for the teacher or for assigning grades to pupils. This multitude of tasks means that an extraordinary scientific tool cannot be recommended for use in primary school. The computer automation of a large part of these processes could render its feasible integration into teaching processes.

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