



Sports Education and Introduction to Invasion Sports in Early Primary Education

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Abstract

The purpose of this paper was to examine the evolution of the game performance and the game knowledge of second-year primary education students when the sports education model is used in the introduction to invasion sports. The season was based on the modified “the five passes” game. The sample consisted of 34 students (22 boys and 12 girls, 11 indigenous and 23 immigrants) between the ages of 7 and 8 years ($M=7.53$; $SD=.50$). Two specialist teachers led the course, one a beginner and the other an expert. A quasi-experimental design was conducted featuring pre-test, posttest and retest measures. Qualitative and quantitative measures and instruments were used to capture teacher and student perspectives. Video analysis (game performance using the Game Performance Assessment Instrument, [GPAI]), interviews, diaries and expert analyses were employed. With respect to the GPAI, the intragroup comparisons reported significant pretest-retest increases in the total sample both in decision-making ($Z=-2.294$; $p=.022$) and in game performance ($Z=-2.254$; $p=.024$). Significant differences were also observed in relation to nationality. The qualitative analysis and the experts’ analyses coincided with the quantitative findings concerning the improvement of tactical-technical aspects and game knowledge. The model proved to be effective in introducing young students to invasion games.

Keywords: tactical understanding, gender, nationality, invasion games

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Introduction

The performance of physical activity (PA) in school-age students has been associated with positive health outcomes (Janssen and LeBlanc, 2010). Schools are a prime setting for promoting and adhering to PA. Specifically, the Physical Education (PE) subject plays a key role by accepting this challenge as one of its main objectives. Among the many variables that evaluate PA levels, several studies have centred on ascertaining students' game performance (GP) (Harvey & Jarrett, 2014), paying special attention to the processes that impact the technical-tactical dimension of learning.

Instructional models (Metzler, 2017) are no strangers to these processes. The initiatives undertaken demonstrate their potential for technical-tactical development as well as their superiority over traditional teaching (*direct instruction*). The Sport Education Model (SEM, Siedentop, 1994) has also been explored in terms of GP. Several reviews (Hastie et al., 2011) underscore its potential in technical-tactical development. The review by Araujo et al. (2014) presents disparate results, explained, among other reasons, by the intervention times. Successive studies have sought to overcome these limitations. Thus, the longitudinal experience of Araujo et al. (2017), based on a hybrid proposal, reported improvements in pre-adolescents in GP.

Studies which have evaluated GP have considered gender (Hastie et al., 2009), skill level (Mahedero et al., 2015) or both conditions (Araujo et al., 2017) as independent variables. Mirroring the disparity found by Araujo et al. (2014), the results point to significant improvements in both low (Araujo et al., 2016) and moderate (Mahedero et al., 2015) ability level students. They also report positive effects on females (Mesquita et al., 2012) and males (Hastie et al., 2009). Gender is a variable of special importance in PE. For example, previous studies noted stereotyped participation, more pronounced in invasion sports, with women being relegated to the role of "spectators" (Gutiérrez & García-López, 2012).

Aside from these contributions, there are no SEM studies on GP that have considered students' nationality as a distinctive variable. Assessing the model's impact by cultural group might be an approach to the search for more equitable participation, which is recognised as one of the aims of the SEM (Siedentop, 1994) and has been a constant in studies on the SEM and GP (Araujo et al., 2017; Mahedero et al., 2015).

Nationality can be viewed dichotomously, with students belonging to the hegemonic group, described as *indigenous*, and on the other hand students with a different nationality from the hegemonic group, i.e., *immigrants*. Apart from any possible variation in this latter group, one extremely interesting shared aspect is the fact they have gone through a migratory process. The potential differences by nationality are especially appealing. Previous research found that motor skills varied by student nationality, not due to ethnicity or culture, but rather to the PE curriculum used in the country of origin (Contreras et al., 2007). As for the relationship between the model and interculturality, recent studies report significant improvements in the perceived competence of indigenous students without finding any impact on immigrants (Puente-Maxera et al., 2018). This evidence seems to suggest that it would be advisable to analyse GP by students' nationality.

The proposals implemented under the SEM (Hastie et al., 2011) have found invasion sports to be attractive content given their pre-eminence in the curricular framework. This type of sport stands out for its high degree of spontaneity and is characterised by a series of common tactical principles, including (Bayer, 1979) holding onto the ball and advancing towards the opposition goal.

Considering the population being studied, the bulk of the research included in the review by Araujo et al. (2014) was conducted in secondary education contexts (SEd, $n = 9$) and in the final stage of primary education (PEd, $n = 4$). Only one study (Calderón et al., 2010) involved students in the second stage (third year of PEd). The authors reported improvements in students' technique and game knowledge (GK). These data underscore the paucity of and the need for SEM studies which examine GP in first-stage PEd students (Layne & Hastie, 2016).

Accordingly, this study sought to analyse the prolonged effect of an SEM-based unit of teaching on the level of execution in attack (EX-A), decision-making (DM), and GK in a group of second-year PEd students. Additionally, it sought to ascertain the incidence of gender and nationality on the results obtained. It was hypothesised that the intervention would lead to significant improvements (a) in GP (EX-A and DM); and (b) in students' GK (rules), regardless of gender and nationality.

Methodology

Research design

This study adhered to a quasi-experimental design with pretest, posttest and retest measures. Studies with the SEM have followed these types of designs (Mesquita et al., 2012). Similarly, the research adopted a multimethod approach combining quantitative and qualitative instruments as in previous research (Mahedero et al., 2015). The fidelity of the implementation of the model was enhanced by Hastie and Casey's (2014) guidelines, which call for: a) a detailed description of the programme context; b) a detailed validation of model implementation; and c) an extensive description of the curricular elements of the unit.

Participants and context

Context. The intervention was carried out in a state co-educational PE school in a town in southern Spain.

Students. The sample was selected following a non-probabilistic convenience model. It was comprised of a group of 34 students (22 boys and 12 girls) aged between seven and eight years ($M = 7.53$; $SD = .50$) and consisted of the combination of two previously formed groups in second year PEd. As for nationality, 11 students were indigenous (Spanish) and 23 immigrants. No student had had any experience with the SEM prior to this intervention. Similarly, they lacked experience of federation-registered invasion sports according to the data obtained through a sociogram featuring assorted questions administered at the beginning of the course.

Teachers. The teaching was undertaken by two specialist PE teachers with different levels of experience with the model (one expert with four years of using it and the other a beginner). Informed consent was obtained from the school administration, the PE department and the students' legal guardians. The study was approved by the ethics committee of the University of Oviedo.

Procedure

The programme was designed by the teacher who was an expert in the SEM with the assistance of their new colleague. The validity of the model was certified based on the instrument developed by Sinelnikov (2009, Spanish version by Calderón et al., 2010). Due to age and inexperience with the model, the following items were not

considered: a) the teacher includes shared assessment as part of the data collection process, and b) the students participate in team selection.

A programme of 12 sessions (two per week) lasting 60 minutes was conducted to teach a pre-sport game as an introduction to handball called *the five passes*. The players were not allowed to bounce the ball or move when in possession of it, while they could move freely when not in possession. A competition schedule was drawn up to ensure the greatest possible equal participation. The season progressed through the following phases: (a) introductory, (b) directed, (c) autonomous practise, (d) formal competition and (e) final event. In terms of social organisation, the 34 students were divided into eight heterogeneous (gender, nationality) groups of four members (except for two teams of five students). The students took on roles other than that of player: coach, physical trainer, equipment manager and occupational health and safety officer.

Instruments

Systematic video monitoring. Two students were not evaluated because they changed schools before the start of the recording, resulting in a final sample of $n = 32$. A total of 12 recordings lasting 10 minutes each one documented the students' performance in 4 vs. 4 games. Two cameras (one in each half of the court) were placed in one of the corners of the court to cover the entire playing area. The recordings were made at three different times: before the start of the unit (pretest), after the end of the unit (posttest) and two weeks after the end of the unit (retest). A body expression unit of study was taught during the retention time.

Student interviews. After the intervention, interviews were conducted in groups of five to six students (Ennis & Chen, 2012). A total of eight semi-structured interviews were recorded in which respondents shared their knowledge of the programme implemented. The interview scripts were reviewed by four experts (two doctors and two teachers with at least 10 years of experience).

Teacher interviews. Semi-structured interviews (Cohen & Manion, 2002) were conducted individually with each of the participating teachers at three points: before, during (after the sixth session) and after the intervention. The interviews, which dealt with technical-tactical issues and methodological components, were recorded in audio files and later transcribed. They had an average length of approximately 10 minutes.

Teachers' diaries. Each of the participating teachers compiled their most significant observations in a diary. The instrument was structured by prioritising the following aspects: variables under study (EX-A, DM, etc.) and their relationship with the factors intrinsic to the SEM (e.g. roles).

Qualitative inter-evaluator evaluation. Following the guidelines of Hastie et al., (2013), inter-evaluator qualitative analyses were used. Three experts in the field (one PhD in PA science and two PE teachers) were asked to comment on the findings, identifying strengths and weaknesses with respect to the components under analysis.

Qualitative data analysis

Interviews and diaries. The diaries and interviews were analysed manually using inductive techniques and based on the summary, coding and comparison of participants' responses through information reduction and display processes. After several readings, the information was broken down into a number of ideas or perceptions which were then coded and classified into various categories. A further analysis led to the selection of two categories that seemed to summarise the information best: a) development of technical-tactical skills, and b) game knowledge.

Inter-evaluator analysis. The experts' evaluation generated a total of 191 comments, which were coded using previously established categories according to the variables under study (losing your marker) and other emerging variables (knowledge of the rules). Nineteen comments were grouped around a "neutral" category given their discrepancy with the rest of the categories. A frequency matrix determined the degree of significance of the categories and their interrelationship, resulting in the components shown in the qualitative results (Table 2).

Quantitative data analysis

Video recordings. The students' performance was evaluated using the Game Performance Assessment Instrument (GPAI, Oslin et al., 1998). Offensive ball actions (passing/receiving) loaded on the EX-A component, while non-ball actions (support/defence) loaded on DM. Two experts (PhDs in Physical Activity Sciences) were tasked with coding the actions. The criteria and descriptors were formulated and reformulated until the greatest consensus was reached among the experts. The quality of the components was evaluated in order to make them observable and measurable. The scoring system used was the record of events that rates each

action dichotomously (effective/ineffective for executions; appropriate/inappropriate for decisions). This scoring system is recommended when observers evaluate actions by means of video recordings.

The resulting components and their descriptors were: (a) passing (effective: the ball reaches an unmarked teammate at an appropriate speed; ineffective: it goes too high, too far (backward or forward), or is intercepted by an opponent); (b) receiving (effective: the player catches the pass and takes possession of the ball; ineffective: the player fails to catch the pass); c) offensive support (appropriate: moving to a suitable position to receive a pass (finds a free space); inappropriate: (not in a suitable position to receive the ball; remains static), and (d) defence (appropriate: stands in the path between the ball and the attacker without the ball, remaining active; inappropriate: standing outside the path between the ball and the attacker without the ball, remaining static and/or not involved in the game). The rates of EX-A (effective executions/sum of effective and ineffective executions), DM (appropriate decisions/sum of appropriate and inappropriate decisions), GP $[(E+D)/2]$ and game involvement (GI = sum of all actions taken by a subject) were derived.

Reliability

Following inter-evaluator processes, one evaluator (a PE teacher) not involved in the compilation process followed a 90-minute training session, successively viewing three different matches corresponding to the autonomous practise phase in order to code the actions based on the stipulated criteria. Discrepancies were resolved, and mainly concerned off-the-ball situations (offensive and defensive support). After this phase, the test-retest method was used after an interval of two weeks and under identical conditions. The intraclass correlation coefficient (ICC, Atkinson and Nevill, 1998) was calculated, yielding excellent values (ICC > .90) for all the variables analysed with the exception of EX-A in PosT (.69). Under these conditions, 818 decisions and 802 executions were analysed, which represented 40% of the total sample, far exceeding the 10% recommended by Tabachnick and Fidell (2007).

Statistical analysis

The IBM-SPSS statistical software (version 23.0) was used for the analysis of the information. Descriptive statistics (means and standard deviations) were calculated for each of the variables. Exploratory analysis revealed that the data distribution did not meet

the criteria of normality (Shapiro-Wilk test) and homogeneity of variance (Levene’s test). Consequently, non-parametric tests were performed. Intragroup differences over time were calculated with the Wilcoxon signed-rank test for two related samples. Intergroup comparisons were made using the Mann-Whitney U-test for two independent samples (gender and nationality). In each case the value of statistical significance was set at $p < .05$.

Triangulation

In terms of methodological complementarity, the use of quantitative and qualitative instruments made it possible to gain a more accurate and holistic picture of the phenomenon under study, while also overcoming the limitations of the quantitative and qualitative paradigms when used in isolation.

Results

Quantitative results

Table 1 shows the results of each of the performance indexes evaluated. Intragroup comparisons reported significant PreT-ReT increases in the total sample in both DM ($Z = -2.294$; $p = .022$) and in GP ($Z = -2.254$; $p = .024$). In terms of student origin, improvements were observed in indigenous students in the PosT-ReT DM ($Z = -1.992$; $p = .046$) and in students from immigrant backgrounds in the PreT-PosT EX-A ($Z = -2.357$; $p = .018$), in DM PreT-PosT ($Z = -2.023$; $p = .043$) and PreT-ReT ($Z = -2.015$; $p = .044$), and in GP PreT-PosT ($Z = -2.171$; $p = .030$) and PreT-ReT ($Z = -2.486$; $p = .013$). No significant changes were found in terms of gender.

The analysis using the Mann-Whitney U test determined significant gender differences in DM PreT ($p = .006$), PosT ($p = .003$) and ReT ($p = .008$), in GP PreT ($p = .007$), PosT ($p = .013$) and ReT ($p = .014$) and in GI PreT ($p = .015$), PosT ($p = .011$) and ReT ($p = .045$). There were no significant differences by origin.

Qualitative results

Interviews and diaries. The qualitative information considering the two categories extracted from the analysis of the teaching diaries and the interviews with both teachers and students is set out below.

Technical-tactical dimension. With regard to the development of technical-tactical skills, the inexperienced teacher pointed out that most of the students started from a low level, although they noted that some students showed a good command of the basic requirements of pre-sport games. The first changes were reported by the new teacher after the fifth session: “Skills in passing and receiving are increasing and they are also beginning to master the tactics of the game”. On a teaching level, the expert teacher attached special importance to real game situations as they are decisive for the students’ learning. As a result of the intervention, both teachers reported an increase in motor skills: “The level of competence has risen very significantly”; “Competence has come on a lot, not only technically but also tactically”. The expert teacher underscored changes in the participation of students with a low skill level (“normally static, in this type of game I see them as very participatory”), as well as in female students (“initially relegated to a secondary and less participatory role, they are now more prominent”).

Game knowledge. Both teachers forecast that the students would gain a high level of knowledge of the game.

Table 1

Means (standard deviations) of game execution, decision-making, performance and involvement rates for the total sample, gender and origin

	Execution			Decision-making			Performance			Involvement		
	PreT	PosT	ReT	PreT	PosT	ReT	PreT	PosT	ReT	PreT	PosT	ReT
<i>n</i>	.69 (.18)	.78 (.15)	.75 (.12)	.50 ^a (.29)	.57 ^{ab} (.29)	.58 ^b (.28)	.59 ^a (.19)	.66 ^{ab} (.20)	.67 ^b (.14)	12.50 (5.71)	13.06 (7.65)	14.29 (7.53)
Males	.73 (.11)	.76 (.14)	.74 (.14)	.61 (.23)	.69 (.23)	.69 (.23)	.67 (.14)	.73 (.15)	.71 (.11)	14.40 (5.23)	15.65 (7.69)	16.20 (8.28)
Females	.62 (.26)	.82 (.16)	.76 (.08)	.30 (.27)	.36 (.27)	.40 (.26)	.46 (.21)	.55 (.23)	.58 (.14)	9.33 (5.21)	8.75 (5.48)	10.82 (4.40)
Indigenous	.73 (.17)	.72 (.16)	.69 (.14)	.60 ^{ab} (.30)	.59 ^a (.25)	.68 ^b (.24)	.66 (.21)	.66 (.15)	.68 (.10)	13.86 (6.04)	13.14 (4.67)	14.42 (4.64)
Immigrants	.68 ^a (.19)	.80 ^b (.15)	.77 ^{ab} (.11)	.47 ^a (.28)	.56 ^b (.30)	.56 ^b (.29)	.57 ^a (.19)	.66 ^b (.22)	.66 ^b (.15)	12.12 (5.68)	13.04 (8.37)	14.25 (8.27)

Note. In each row, the means with different superscripts differ at least to a level of $p < .05$.

Table 2*Results of the inter-evaluator qualitative analysis for each of the components analysed*

	Example remark	
Passing (11%)	PreT	• The passes are not that good and sometimes they “mess it up”.
	PosT	• They get better over time, which you see in terms of the quantity and quality of the passes, which translates into a higher number of points.
	ReT	• They really throw it hard and are usually very successful.
Receiving (8.4%)	PreT	• At first, the team in possession of the ball is poor at both catching and implementing moves.
	PosT	• In this match, the players without the ball constantly ask for it from their teammates and make successful receptions.
	ReT	• They perform receptions successfully which results in high-quality play; active and effective.
Support (24%)	PreT	• They don't look for gaps or ask the player with the ball to pass properly, i.e. they don't usually say positions (pass over the top, low down, etc.).
	PosT	• As they get better, they move more off the ball both to lose their marker and score when they attack and to intercept the pass when they are defending.
	ReT	• In this game, players without the ball move very actively, constantly asking for the ball from their teammates.
Defensa (25.6%)	PreT	• At first, the most significant thing is that they crowd around the player who has the ball too much, pushing and constantly committing fouls.
	PosT	• Signs of defensive actions such as covering team members in possession of the ball are starting to emerge.
	ReT	• Not only do they move to look for the ball, but sometimes they take up very significant defensive positions.
Game knowledge (12.5%)	PreT	• At first, they don't seem to know the rules very well, as they continually walk around holding the ball when that's not allowed.
	PosT	• There has been obvious progress from the groups' first contact with the activity to an understanding of the rules and purpose of the game.
	ReT	• After some time, you can see that most of the contents worked on have been retained.

Note. In brackets, percentage of comments in relation to the total information.

They mentioned the kind of content: “We are talking about a fairly simple pre-sport game. They will have no difficulty in fully understanding the game in all its facets,” said the new teacher. As the intervention moved forward, the expert teacher confirmed these predictions: “As a whole, the students have a good understanding of the game”. They said that the theoretical session on refereeing was a crucial factor.

The students associated the knowledge acquired with the opportunity to perform various functions: “It is not only about playing, but also about refereeing and making notes”. Several students acknowledged better use of time. When asked about their involvement and its comparison with previous units, most of the respondents stated that they had increased their levels of concentration in the game. The reasons given included the model's competition format. This is shown by the following comments: “There are points at stake”; “These games are more important”; “This is the league”.

Inter-evaluator analysis

The results of the inter-evaluator qualitative analysis are shown in Table 2, in which representative comments

about the components analysed at each of the data gathering stages are presented.

Discussion

This study set out to examine the evolution of game performance and game knowledge of second-year primary school students participating in an SEM season on introduction to invasion sports. Specifically, the effects were analysed by the gender and nationality of the participating students. In general, the results confirm the hypotheses proposed, particularly improvements in general performance, decision-making and game knowledge. Changes of special significance by nationality were also observed, albeit not accompanied by effects in relation to gender.

The progress in overall performance and decision-making of the total sample are in line with the conclusions reported by Mesquita et al. (2012), who found greater gains in the retention phase. The results of this study seem to point to short-term improvements and call for further longitudinal experimentation. However, the slight differences in posttest-retest values in both dimensions seem to suggest the intervention had a maintenance

effect, similar to the one reported in previous studies on the SEM (Araujo et al., 2016). With respect to DM, and in line with the findings of this study from a qualitative perspective, Mesquita et al. (2012) noted the positive effect of learning in real game situations. One distinctive aspect in this study was the notable improvements in offensive DM, which was rarely observed by Mesquita et al. (2012), who cited lack of precision in teacher planning.

The largest number of changes was observed in relation to nationality, with students of immigrant origin being the only group to experience technical improvements. From the qualitative point of view, substantive changes were found in various aspects of execution (precision or variety of throws). The teachers pointed out the constructive impact of the content worked on, especially in relation to technical requirements. These findings are consistent with Hastie et al. (2009), who associated the approach of low technical requirement content (handball games) with higher probabilities of success in SEM seasons. The content was appropriate not only in execution but also in tactical development. Mesquita et al. (2012) pointed out the positive impact of the forms played on DM, which are equally germane in talent identification (Serra-Olivares et al., 2017). Improvements in dynamism and spatial distribution were particularly significant, the latter having been reported previously (Mahedero et al., 2015). Several reasons seem to account for these changes. First, the number of sessions performed, with the first changes observed towards the middle of the season, reflects the positive impact of programming long-term units. Second, the competition format itself, with a large number of matches (Hastie et al., 2009), was cited by students as a key factor in tactical learning and GK. In relation to the latter variable, the positive effect of performing roles other than players was evident for many students. Hastie et al. (2009) found that when students acted as “active observers” their DM and GK improved.

Finally, no significant changes were found in relation to gender, contrary to what had been suggested by the literature (Araujo et al., 2014). Given the high starting values in terms of execution, the absence of improvement in male students could be explained by a “ceiling effect”, something which has been previously observed (Mesquita et al., 2012). Although they are not analysed in this study, qualitative improvements were found in students with low skill levels. Future interventions should consider skill level, along with other independent variables included in this study (nationality) and explore their impact on GP in young students.

Conclusions

The results of this study would seem to confirm the potential of the SEM with respect to an introduction to invasion sports, meaning that its benefits can be extrapolated for the first time to contexts of high cultural diversity and with young students. The improvements in game performance are particularly relevant given the age of the students and their lack of experience with the SEM, suggesting that the version of the model applied was extremely successful. Moreover, the impact generated in both cultural groups (indigenous and immigrants) suggests that the intervention included teaching elements (roles) consistent with the principles of fairness.

However, a number of limitations should be considered. The fact that the intervention targeted a single group and school and was taught by teachers with varying degrees of experience makes it difficult to generalise. Similarly, the duration of the intervention was not consistent with the time recommended by the literature (more than 15 sessions, according to Siedentop, 1994). The sample size of certain group conditions (women or indigenous people) might explain the low impact. Future interventions should consider larger samples.

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