

Article

Pedagogical Variables and Motor Commitment in the Planning of Invasion Sports in Primary Education

Juan M. García-Ceberino ¹, Sebastián Feu ^{1,2,*}, María G. Gamero ^{1,2} and Sergio J. Ibáñez ^{1,3}

¹ Optimisation of Training and Sports Performance Research Group (GOERD), University of Extremadura, 10003 Cáceres, Spain; jgarciap@alumnos.unex.es (J.M.G.-C.); mgamerob@alumnos.unex.es (M.G.G.); sibanez@unex.es (S.J.I.)

² Faculty of Education, University of Extremadura, 06006 Badajoz, Spain

³ Faculty of Sports Science, University of Extremadura, 10003 Cáceres, Spain

* Correspondence: sfeu@unex.es; Tel.: +34-924-289-501

Abstract: Research on Sports Pedagogy necessitates studying the knowledge possessed by pre-service teachers (PSTs) and its application in the planning of sports in school. The main objectives of this study were to consider if PSTs really apply their beliefs when planning their didactic units, and to analyse time management and its influence on external load in invasion sports. Eighteen PSTs were interviewed and 899 learning tasks were coded using the Integral Analysis System of Training Tasks. Three groups of pedagogical variables (type of task, game phase and game situation), organisational variables related to time and the external load were analysed. A descriptive analysis was made of the contents of the interviews, on the use of the pedagogical variables and on those used in the learning tasks. Application exercises were set by 50.70% of the tasks and 44.30% were without opposition. This did not coincide with teachers' beliefs, as they did not show a clear choice of ideal type of task and indicated that individual game situations with opposition were preferable. A descriptive analysis was also made of the organisational variables according to the planned sport. Inferential analysis using the Kruskal-Wallis H test and pairwise multiple comparisons showed differences in the motor commitment and external load of the task*time depending on the type of invasion sport ($p < 0.05$). Time management conditioned the motor commitment and task load.

Keywords: external load; learning task; organisational variable; pre-service teacher



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1. Introduction

University training provides pre-service teachers (PSTs) of physical education (PE) with knowledge of different instruction, reflection and evaluation methods to prepare them for their teaching role in school [1]. In fact, teaching PSTs, to effectively plan their didactic units, is a challenge for university lecturers [2].

University lecturers should combine content on general pedagogical theory and sports pedagogy with practical sports workshops and seminars, in order to develop specific content knowledge, curricular knowledge and pedagogical knowledge in a holistic manner. To foment the development of this knowledge, it is necessary to provide PSTs with learning experiences (educational practices) in schools which complement their teacher training [1]. Moreover, the socialisation acquired from the experiences in the out of school environment is particularly important with PE teachers, as it is necessary to work on their prior ideas [3], a process in which direct instruction is endowed with great importance.

Educational practice improves the competence and autonomy of PSTs. The absence of learning experiences could make PSTs feel unprepared to teach the subject [4]. These experiences should be associated with knowledge from their university training and help PSTs in the design of more effective didactic units (teaching methodology, strategies, activities, etc.) [2]. For quality educational practice, coordination between these three

components is necessary: PSTs, in-service PE teachers in schools and university lecturers [5]. Work in school influences the learning experiences of the PSTs because they have to face different challenges which will help them forget the predominance of Teacher-Centred Approaches (TCAs) and develop other teaching approaches, e.g., Student-Centred Approaches (SCAs) [6]. Regarding the methodological aspect, different investigations have analysed the benefits of the SCA over the TCA in primary education, both at the psycho-physiological level and in acquired learning [7–12].

Research on teacher training shows the need to study the link between PSTs' knowledge and its subsequent application in the process of sports planning. Examining this interconnection between knowledge and process has significant implications for understanding teaching and the training of teaching staff [13]. The planning of the didactic units will allow the evaluation of PSTs [2].

In this respect, different investigations have examined PSTs' sports planning processes using pedagogical analysis of the learning tasks (the minimum unit of planning process) present in the didactic units for the teaching of invasion sports like basketball [14,15], handball [16] and football [17].

Moreover, the workload levels of the teaching sessions can vary taking into account the use that teachers make of external load variables [18] in learning tasks; and the external load of the learning tasks designed by PSTs have been examined in the teaching of different invasions sports like basketball [19,20], handball [21] and football [22]. External load is defined as the total number of stimuli or efforts that the students are subject to during sports teaching-learning [12].

In the sports planning process, it is also necessary to manage the time devoted to motor practice as efficiently as possible in order to optimise this, as different elements that are involved in a PE session need to be taken into account (e.g., transfer of equipment, personal hygiene . . .) which limit motor commitment time (time for actual/effective practice so that the students develop motor behaviour) [23,24]. This implies efficient time management in the organisation of the PE session on the part of the teacher.

Instruments that make it possible to categorise the learning tasks are available, which analyse the intervention of the PE teachers. A low cost instrument, called the Integral Analysis System of Training Tasks (SIATE, in its Spanish acronym) [18] has been identified in the literature that makes it possible to record and subsequently analyse the planning process of invasion sports, thus aiding in optimisation. This instrument is reliable, valid and adaptable to different contexts and has been used in several investigations [15–17,19–22].

As far as the authors are aware, there are few investigations that analyse PSTs' interventions through the learning tasks that they design in their first professional activities. Studies are necessary to report on how PSTs learn, interpret and apply their knowledge. Thus, this study had three objectives: (1) to ascertain the PSTs' preconception of sports planning in primary schools; (2) to confirm if this preconception is subsequently applied in the design of their didactic units; and (3) to analyse the organisational variables related to time and their influence on external load, according to the invasion sport planned in the didactic units.

2. Materials and Methods

2.1. Study Design

A mixed design was used which combined a qualitative and quantitative approach with a comparative and transversal strategy [25].

2.2. Participants and Sample

Eighteen PSTs ($M \pm SD$, 22.00 \pm 1.17 years) from a University in west central Spain participated voluntarily in the study. They (12 males and 8 females) had received three years' generalist training as primary education teachers and a term of specialisation as PE teachers. During these four months of specialisation, they studied four theoretical-practical subjects in areas like: (1) Motor skills, Physical Activity and Health; (2) Body Image,

perception, expression and communication; (3) Games and Physical-Sports Activities; and (4) Didactics of Primary Physical Education. They were waiting to carry out a period of four months of educational practice in a school. This describes the process of becoming a PE teacher in the Spanish university system.

Each PST replied in writing to an interview and designed a didactic unit on an invasion sport, thus obtaining six didactic units for each sport: basketball, handball and football. Of the PSTs studied, none had a technical sports qualification. Two PSTs (33.30%) who designed their didactic unit on basketball and three PSTs (50.00%) who designed their didactic unit on football had practised these sports with a federation licence.

A total of 899 learning tasks (basketball $n = 280$; handball $n = 312$; and football $n = 307$) were collected from the 18 didactic units selected. In the learning tasks, the teachers define and reflect on their intentions with a view to achieving the teaching objectives according to the curricular content [15].

In this way, the items that made up the interviews and the learning tasks were converted into the units for analysis.

2.3. Variables

Two groups of dependent variables were studied: (1) pedagogical variables (such as type of task, game phase and game situation); and (2) organisational variables related to time (i.e., total time, explanation time, useful time, efficient use of time and external load of the task * time).

The pedagogical variables give information on the characteristics of the learning tasks. Each variable is structured as a categorical-nominal system of different levels [18]:

- Type of task, i.e., teaching means: (1) application exercise (simple and complex); (2) non-specific game (simple and complex); (3) specific game (simple and complex); (4) adapted sport or small-sided game (SSG); and (5) sport.
- Game phase, i.e., game strategic/tactical phase: (1) none; (2) attack; (3) defence; and (4) mixed.
- Game situation: (1) without opposition (e.g., 1 vs. 0, 2 vs. 0 . . .); (2) individual game (e.g., 1 vs. 1); (3) numerical inequality SSG (e.g., 2 vs. 1; 3 vs. 2 . . .); (4) numerical equality SSG (e.g., 2 vs. 2, 3 vs. 3 . . .); and (5) full game (e.g., 5 vs. 5, 6 vs. 6 . . .).

The organisational variables related to time give information on the temporal distribution of the learning tasks. These variables are: (1) total time, from when the teacher requests the attention of the students until the learning task finishes; (2) explanation time, i.e., the time that the teacher takes to explain the learning task and provide corrections during its completion; (3) useful time, i.e., the time in which there is motor commitment (calculated as: total time—explanation time); (4) efficient use of time, percentage of time in which there is motor commitment (calculated as: (useful time/total time) * 100); and (5) external load of the task * time, the value of each of the learning tasks adjusted to the actual practice time (calculated as: external load of the task * useful time). The external load of the task (subjectively) is obtained using the sum of the value chosen, from 1 to 5, in the following variables: opposition degree, task density, percentage of simultaneous performers, competitive load, game space and cognitive implication. These six variables of external load are structured as an ordinal categorical system with five levels [18]. Organisational variables were used because of the importance of discovering motor commitment in the teaching sessions and to analyse its influence on the external load of the task. Both the pedagogical and the organisational variables studied are defined in the SIATE [18].

Two groups of independent variables were used to establish comparisons: (1) instrument used (qualitative interview and SIATE); and (2) invasion sports (basketball, handball and football).

In the analysis of time management, the group known as pedagogical variables was considered as an independent variable.

2.4. Instruments

Qualitative study. A written semi-structured interview was used to discover the PSTs' preconceptions as to sports planning in primary education. The interview comprised six items: (I1) most useful type of task; (I2) priority game phase; (I3) most important game situation; (I4) instructional approach used in the didactic units designed; (I5) most appropriate instructional approach; (I6) reasons for using a different instructional approach (item addressed to PSTs who did not indicate the same approach in items 4 and 5). Furthermore, the interview was validated by a panel of 12 experts and obtained adequate validity values calculated with Aiken's V ($V > 0.70$) [26,27]. This interview referred to the teaching of invasion sports in primary education.

Quantitative study. The SIATE task analysis system was used to code the learning tasks included in the didactic units designed by the PSTs [18], employing the pedagogical and organisational variables recorded in this system. In primary education, the SIATE has also been used to code learning tasks in basketball [28] and football [29], which form didactic units designed with different instructional methods, Direct Instruction and Tactical Games Approach.

2.5. Procedure

A series of chronologically ordered actions were established to implement the two studies: (1) the qualitative study; and (2) the quantitative study.

Qualitative study. When the 18 PSTs had finished the subjects corresponding to the PE speciality and were about to begin their educational practice period in a school, they were requested to answer an interview in writing and send it by e-mail to the researchers. The contents of these interviews on the use of the pedagogical variables of type of task, game phase and game situation were identified and given a meaning.

Quantitative study. Once the interview had been answered, each PST was asked to design a didactic unit of 11–12 sessions on an invasion sport: basketball, handball or football. Each session had to contain between four and five learning tasks and be structured in three parts: warmup, fundamental part and cool down [30]. The PSTs had approximately one month to design the didactic units and had complete freedom to determine the learning tasks that they considered appropriate, although they were asked to indicate the objectives to be worked on in each session. Once the 18 units had been received by e-mail, with the help of the SIATE [18] the learning tasks from each didactic unit were coded, making a total of 899 tasks. This coding was performed by two external coders using the technique of consensual decision-making [31]. Inter-coder reliability of the studied pedagogical variables was also analysed with the Free-Marginal Multirater Kappa ($Multirater_{Kfree}$) programme [32] to ensure the quality control of the data. Three coders took part in this analysis, obtaining substantial agreement [33] in the type of task ($M_{Kfree} = 0.71$) and game phase ($M_{Kfree} = 0.80$) variables, and almost perfect agreement in the game situation variable ($M_{Kfree} = 0.91$). Inter-coder reliability was not calculated for the organisational variables because they were scale variables and the time provided by the PSTs was recorded. These external coders had experience in the field of Sports Pedagogy and the use of this task analysis system, so the learning tasks were not coded by the PSTs themselves.

Finally, the data recorded from the interviews and the learning tasks were analysed independently, to subsequently confirm if the PSTs applied the preconceptions (beliefs) they had manifested when designing their didactic units. An inferential analysis was also performed on the organisational variables (time) according to the invasion sports studied.

2.6. Statistical Analysis

The characteristics of the data led to the use of non-parametric mathematical models to confirm the hypothesis.

Qualitative study. The contents of the interviews were studied by analysing the answers in the paragraphs written by the PSTs as the unit of analysis. Once the replies received from the PSTs for each of the items included in the interview were identified, they were categorised and their frequency and percentage were calculated.

Quantitative study. Thereafter, a descriptive analysis was conducted of the categories of the pedagogical variables using the coding of the learning tasks designed by the PSTs. These descriptive results were compared with the replies of the PSTs in order to confirm if they had really applied the preconceptions previously provided in the interviews in the design of their didactic units.

An inferential analysis was also performed on the organisational variables related to time using the Kruskal-Wallis H test and the pairwise multiple comparisons [34]. The effect size of the Kruskal-Wallis H test was calculated through epsilon squared coefficient (E^2_R) [35].

The statistical analysis was performed using SPSS 21.0 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21, IBM Corp., Armonk, NY, USA).

3. Results

3.1. Qualitative Study

Figure 1 presents the frequencies (percentages) of the replies contributed by the participating PSTs, with the three invasion sports grouped together.

Regarding the PSTs' preconceptions of the planning process for invasion sports in primary education, there was no clear discrimination when indicating which was the most useful type of task for sports teaching. The following are some examples of the replies to item 1:

PST 1: *"I think specific games are the most useful, as increasing the number of rules also increases the difficulty and captures the interest of the students to achieve the proposed objective as well as having fun"*.

PST 12: *"Mini-sport seems to me to be very important because you can work on all the abilities necessary for the sport"*.

PST 16: *"I think that the most useful learning means for teaching-learning sport are exercises because we see the students perform the abilities badly or well, and in this way, we get the whole group to participate because in some games we see students who stand still and don't participate"*.

The PSTs also indicated the attack game phase (83.30%) as the most important, followed by the mixed game (11.10%). Below are some examples of replies to item 2:

PST 4: *"I think it is better to initiate the student with the attack phase. Everyone likes to win and children even more so, at these ages the majority are very competitive and what better way to motivate them than with attack"*.

PST 10: *"I think that the attack phase is the most important when initiating the student in the learning of team sports, as it is the most motivating for the students because there they can score"*.

PST 18: *"If in a sport that has attackers they don't know how to attack or defenders who don't know how to defend, the sport will not develop well. Attack and defence have to be matched for the sport to develop correctly"*.

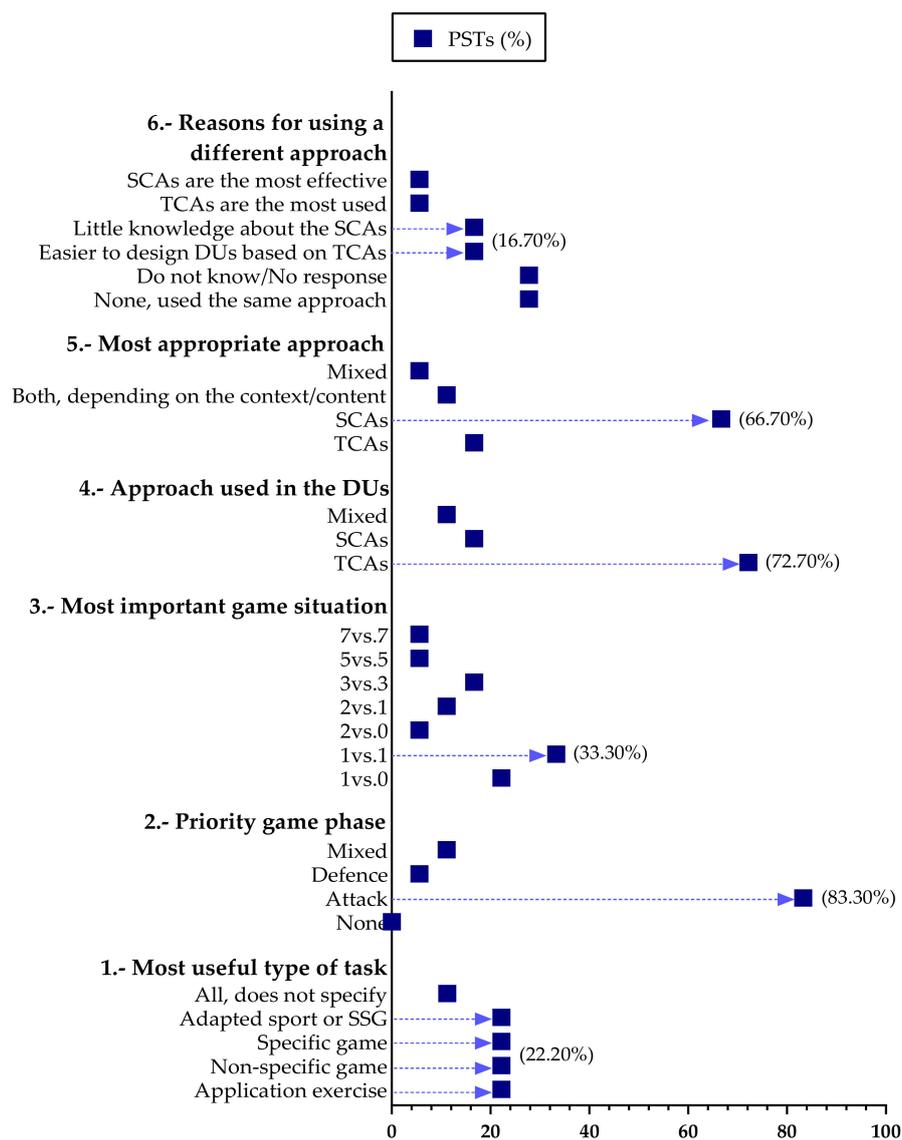


Figure 1. Qualitative results according to invasion sports together. Note: PSTs = Pre-Service Teachers; SCAs = Student Centred-Approaches; TCAs = Teacher Centred-Approaches; DUs = Didactic Units; SSG = Small-Sided Game.

Regarding the game situation, the PSTs indicate the individual game, i.e., the situation of 1 vs. 1 (33.30%) as the most important, followed by the 1 vs. 0 game situation (22.20%). Some examples of answers to item 3 are:

PST 8: “The best game situation is 1 vs. 1 as it is the best situation for the teacher to control the class, correct errors, make all the students participate . . . ”.

PST 9: “The 1 vs. 1 situation, as with this type of tasks all the students work equally and are able to realise by themselves the difficulties of the tasks and thus resolve them individually”.

PST 16: “The 1 vs. 0 is the easiest, as it is a question of attacking and participation would be total”.

Regarding the methodological aspect, the PSTs tend to use TCAs (72.20%) in the design of their didactic units. In spite of this, they consider the SCAs as most suitable (66.70%). Some examples of answers to items 4 and 5 are as follows:

PST 3: “I would place my didactic unit in the TCAs, although I have realised that the SCAs are better”.

PST 5: “My didactic unit relies on TCAs because in all the tasks presented, I explain the guidelines the students should follow to be able to perform the tasks, although SCAs are more appropriate because the teacher doesn’t give any type of rules and the students learn from their knowledge and their mistakes”.

PST 15: “I would place my didactic unit in the TCAs because I teach students they should receive a prior explanation, although SCAs are better for the students to discover and solve the problems as they arise as a group”.

Among the reasons provided by the PSTs, and that lead to this discrepancy, the most important were the greater ease of designing didactic units based on the TCAs (16.70%) and the lack of knowledge about SCAs (16.70%). Below are some replies to item 6:

PST 3: “I chose TCAs because I don’t know enough about SCAs”.

PST 4: “I don’t use SCAs because of lack of knowledge”.

PST 7: “The construction of my didactic unit was based on TCAs due to the fact that proposing tasks based on SCAs seemed very complicated”.

The frequencies of the replies provided by the participating PSTs, separately for each invasion sport, are presented in Table 1.

The quantitative analysis is based on items 1, 2 and 3 of the interviews, with the purpose of comparing the preconceptions of the PSTs and the information collected from their didactic units using the SIATE.

Table 1. Qualitative results according to each invasion sport independently.

Qualitative Interview		Basketball (6 DUs)		Handball (6 DUs)		Football (6 DUs)		Total (18 DUs)	
Item	Response	n	%	n	%	n	%	n	%
1.- Most useful type of task	Application exercise	1	16.70	1	16.70	2	33.30	4	22.20
	Non-specific game	3	50.00	1	16.70	-	-	4	22.20
	Specific game	2	33.30	1	16.70	1	16.70	4	22.20
	Adapted sport or SSG	-	-	3	50.00	1	16.70	4	22.20
	All, does not specify	-	-	-	-	2	33.30	2	11.20
2.- Priority game phase	None	-	-	-	-	-	-	-	0.00
	Attack	5	83.30	6	100.00	4	66.70	15	83.30
	Defence	-	-	-	-	1	16.70	1	5.60
	Mixed	1	16.70	-	-	1	16.70	2	11.10
3.- Most important game situation	1 vs. 0	-	-	2	33.30	2	33.30	4	22.20
	1 vs. 1	2	33.30	2	33.30	2	33.30	6	33.30
	2 vs. 0	1	16.70	-	-	-	-	1	5.60
	2 vs. 1	2	33.30	-	-	-	-	2	11.10
	3 vs. 3	1	16.70	1	16.70	1	16.70	3	16.70
	5 vs. 5	-	-	-	-	1	16.70	1	5.60
	7 vs. 7	-	-	1	16.70	-	-	1	5.60
4.- Approach used in the DUs designed	TCAs	6	100.00	3	50.00	4	66.70	13	72.20
	SCAs	-	-	1	16.70	2	33.30	3	16.70
	Mixed	-	-	2	33.30	-	-	2	11.10
5.- Most appropriate approach	TCAs	-	-	-	-	3	50.00	3	16.70
	SCAs	4	66.70	5	83.30	3	50.00	12	66.70
	Both, depending on the context and/or content	1	16.70	1	16.70	-	-	2	11.10
	Mixed	1	16.70	-	-	-	-	1	5.60

Table 1. Cont.

Qualitative Interview		Basketball (6 DUs)		Handball (6 DUs)		Football (6 DUs)		Total (18 DUs)	
Item	Response	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
6.- Reasons for using a different approach ¹	None, used the same approach	-	-	2	33.30	3	50.00	5	27.80
	Do not know/No response	3	50.00	1	16.70	1	16.70	5	27.80
	Easier to design DUs based on TCAs	-	-	2	33.30	1	16.70	3	16.70
	Little knowledge about the SCAs	2	33.30	1	16.70	-	-	3	16.70
	TCAs are the most used	1	16.70	-	-	-	-	1	5.60
	SCAs are the most effective	-	-	-	-	1	16.70	1	5.60

Note: *n* = Frequency; DUs = Didactic Units; SSG = Small-Sided Game; TCAs = Teacher Centred-Approaches; SCAs = Student Centred-Approaches. ¹ Item addressed to PSTs who do not indicate the same approach in items 4 and 5.

3.2. Quantitative study

The descriptive results of the pedagogical variables studied for each invasion sport are presented in Figure 2. Taking the didactic units as a whole, the PSTs mostly used application exercises as the type of task (50.70%), attack as the game phase (58.20%) and tasks with no opposition as the game situation (44.30%).

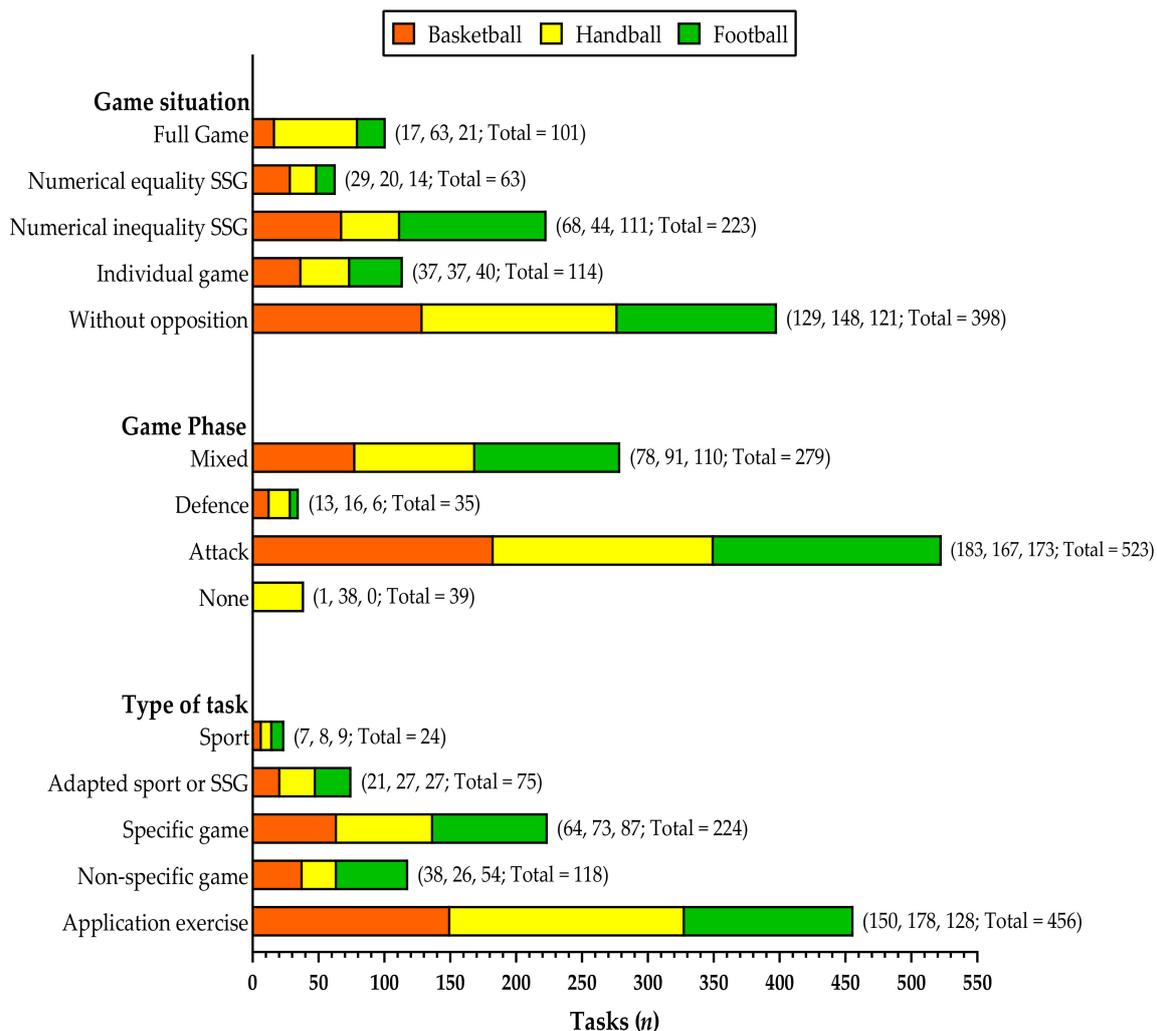


Figure 2. Descriptive analysis of the pedagogical variables studied. Note: *n* = Frequency; SSG = Small-Sided Game.

Time according to the type of task (i.e., teaching means). The PSTs who designed their didactic unit on handball spent less total time in the learning tasks, except for the task type of sport. However, the explanation time was greater in the types of task such as application exercises, non-specific games and specific games, which meant that both useful time and efficient use of time were less in this type of task. Useful time was also less in the adapted sport or SSG type of task in the handball didactic units. In contrast, in the type of task (teaching means) of sport, the PSTs who designed their didactic units on basketball and football spent less total time. However, the explanation time was even longer in the didactic units for football, which meant that the useful time and the efficient use of time were lower in this type of task for football (Table 2).

Table 2. Descriptive results of the organisational variables (time) according to the type of task.

Type of Task (Teaching Means)	Variable (Time, Measured in Seconds)	Basketball		Handball		Football	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Application exercise	Total	720.80	208.77	622.58	192.17	674.06	185.73
	Explanation	146.27	60.96	152.02	59.54	136.41	44.36
	Useful	573.53	175.87	469.55	172.89	537.66	177.29
	Use of time ¹	79.59	5.94	74.89	8.10	78.84	6.98
Non-specific game	Total	707.37	274.48	636.92	83.27	646.67	144.01
	Explanation	140.53	44.72	154.62	38.60	123.33	31.74
	Useful	566.84	256.35	480.00	89.80	521.11	123.25
	Use of time ¹	79.06	6.49	75.07	6.70	80.70	7.71
Specific game	Total	741.56	218.92	611.51	184.84	681.38	164.69
	Explanation	135.00	42.76	143.84	52.67	140.00	37.35
	Useful	606.56	197.16	467.67	179.99	541.38	151.73
	Use of time ¹	81.27	5.64	75.51	9.07	78.94	5.36
Adapted sport or SSG	Total	991.43	324.57	691.11	159.94	833.33	247.57
	Explanation	205.71	95.95	133.33	38.43	142.22	64.77
	Useful	785.71	253.78	557.78	166.26	691.11	258.54
	Use of time ¹	79.83	5.47	79.83	6.88	81.86	7.64
Sport	Total	1028.57	554.72	1207.50	840.27	1046.67	281.60
	Explanation	137.14	75.21	157.50	63.40	206.67	74.16
	Useful	891.43	492.86	1050.00	795.99	840.00	214.24
	Use of time ¹	86.10	4.01	83.40	8.36	80.59	3.08

Note: *M* = Mean; *SD* = Standard Deviation; SSG = Small-Sided Game. ¹ Expressed in %.

Time according to game phase (i.e., game strategic/tactical phase). The PSTs who designed their didactic unit on handball spent less total time in the game phases of attack and defence; however, explanation time was greater. This means that useful time and efficient use of time in both game phases were lower in the didactic units on handball. In addition, in the mixed game phase there was less useful time in the didactic units on football and less efficient use of time in the didactic units on handball (Table 3).

Table 3. Descriptive results of the organisational variables (time) according to the game phase.

Game Phase (Game Strategic/Tactical Phase)	Variable (Time, Measured in Seconds)	Basketball		Handball		Football	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
None ²	Total	600	-	585.79	139.10	-	-
	Explanation	120	-	154.74	47.58	-	-
	Useful	480	-	429.47	118.80	-	-
	Use of time ¹	80	-	73.00	6.55	-	-
Attack	Total	724.26	229.56	612.93	189.98	695.03	175.65
	Explanation	143.72	59.70	147.31	59.53	135.26	40.61
	Useful	580.00	201.11	464.55	173.49	559.08	171.52
	Use of time ¹	79.85	6.29	75.24	8.53	79.77	7.47
Defence	Total	743.08	240.67	581.25	149.75	700.00	154.92
	Explanation	129.23	22.53	157.50	48.37	140.00	30.98
	Useful	617.69	223.31	423.75	124.84	560.00	123.93
	Use of time ¹	82.44	3.24	71.83	8.87	80.00	0.00
Mixed	Total	824.62	300.77	729.89	324.38	726.55	227.33
	Explanation	157.18	67.28	147.69	50.84	145.64	53.58
	Useful	666.15	255.95	582.20	314.13	580.91	204.63
	Use of time ¹	80.60	5.27	78.35	7.75	79.43	5.79

Note: *M* = Mean; *SD* = Standard Deviation. ¹ Expressed in %. ² Learning tasks that do not work on a specific content of the sport studied.

Time according to the game situation. The PSTs who designed their didactic unit on handball spent less total time in the without opposition, individual game and numerical inequality SSG game situations. However, in these game situations, explanation time was greater, leading to less useful time and efficient use of time in the didactic units on handball. The numerical equality SSG and Full Game also recorded less useful time and efficient use of time in this invasion sport (Table 4).

Table 4. Descriptive results of the organisational variables (time) according to the game situation.

Game Situation	Variable (Time, Measured in Seconds)	Basketball		Handball		Football	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>DT</i>	<i>M</i>	<i>M</i>
Without opposition	Total	714.42	214.17	615.41	201.28	677.85	183.90
	Explanation	147.13	64.17	149.59	60.00	137.85	45.59
	Useful	566.90	178.67	464.59	181.57	539.01	176.12
	Use of time ¹	79.42	6.12	74.91	8.25	78.59	7.29
Individual game	Total	713.51	184.81	611.35	139.88	649.50	160.70
	Explanation	135.14	36.64	152.43	52.14	133.50	34.61
	Useful	575.68	162.76	458.92	125.07	516.00	142.37
	Use of time ¹	80.50	4.63	74.40	8.38	79.08	4.57
Numerical inequality SSG	Total	755.29	271.36	623.18	124.26	694.05	199.43
	Explanation	142.94	46.39	152.73	52.49	130.81	36.36
	Useful	612.35	252.34	469.09	117.37	563.24	192.68
	Use of time ¹	79.99	6.72	75.07	7.84	80.50	6.95
Numerical equality SSG	Total	877.24	279.78	672.00	252.77	745.71	144.53
	Explanation	171.72	87.43	144.00	40.83	141.43	29.83
	Useful	705.52	213.73	528.00	245.93	604.29	127.74
	Use of time ¹	81.14	5.40	77.27	7.72	80.83	2.98
Full Game	Total	889.41	431.75	726.67	367.52	891.43	269.86
	Explanation	148.24	73.84	143.81	51.16	180.00	82.70
	Useful	741.18	377.65	582.86	355.85	711.43	223.12
	Use of time ¹	82.81	4.36	78.26	8.54	79.86	6.72

Note: *M* = Mean; *SD* = Standard Deviation; SSG = Small-Sided Games. ¹ Expressed in %.

The variability of time managed by the PSTs in the design of their didactic units for each invasion sport (basketball, handball and football) shows significant differences ($p < 0.05$) in the organisational variables. These differences are reflected in the pairwise multiple comparisons (Figure 3). The theoretical design of the learning tasks was analysed using the SIATE, and no differences were found among them in external load. These tasks are implemented by the PSTs generating an external load which is affected by the motor commitment time on the part of the students, generating the variable external load of the task*time, in which differences can be identified among the sports disciplines.

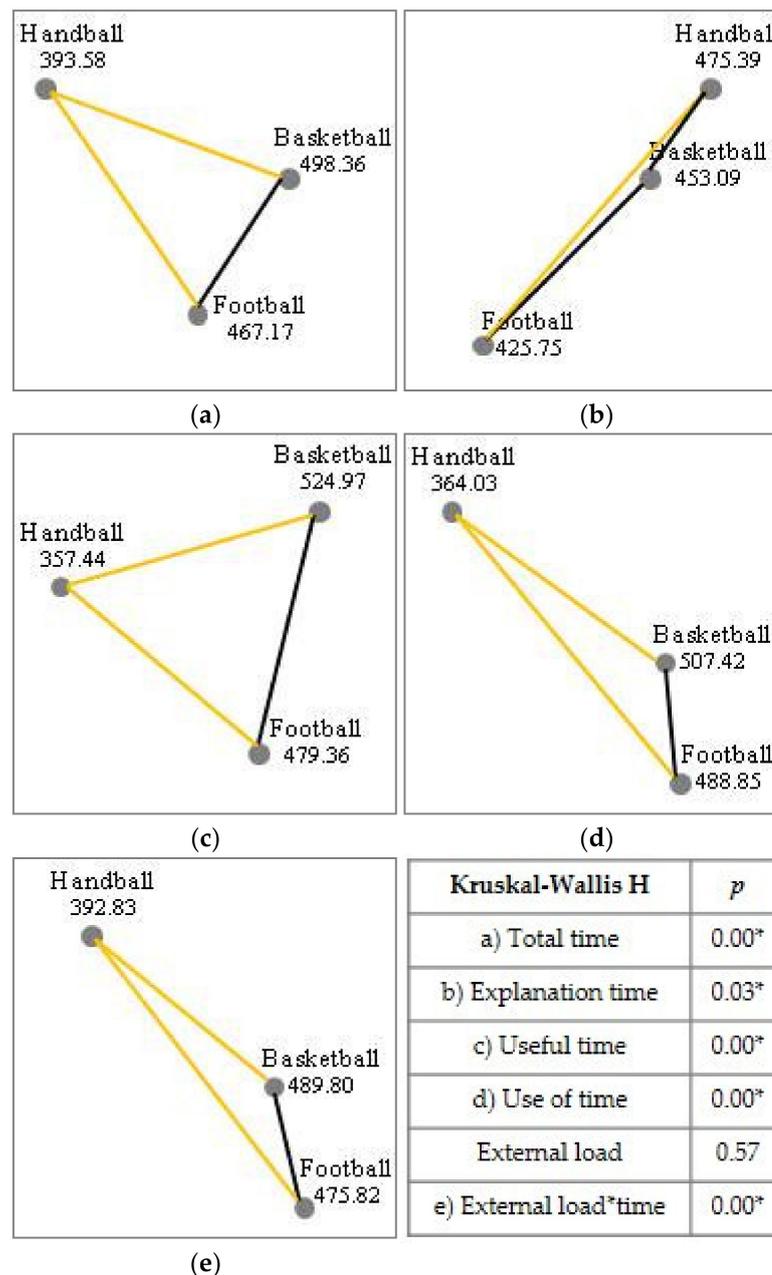


Figure 3. Analysis of differences based on pairwise comparisons (invasion sports). Note: (a) = Total Task Time; (b) = Explanation Time; (c) = Useful Time; (d) = Efficient Use of Time; (e) = External load * Time; Yellow line = Significant differences; Black line = No significant differences. * $p < 0.05$.

The calculation of the effect size shows: no effect on the variable external load of the task ($X^2 = 1.126$; $df = 2$; $E^2_R = 0.00$); a small effect on the variables total time ($X^2 = 30.194$; df

= 2; $E^2_R = 0.03$), explanation time ($X^2 = 7.102$; $df = 2$; $E^2_R = 0.01$), efficient use of time ($X^2 = 62.914$; $df = 2$; $E^2_R = 0.07$) and external load of the task * time ($X^2 = 24.628$; $df = 2$; $E^2_R = 0.03$); and a medium effect on the variable useful time, i.e., motor commitment ($X^2 = 72.012$; $df = 2$; $E^2_R = 0.08$).

4. Discussion

During their initial university training, teachers acquire basic knowledge on the content that they should develop in the subject of PE. This training process is fundamental and imperative for their subsequent teaching interventions [1]. Equally, PSTs need learning experiences for adequate teacher training [2,4,13]. This study aimed to confirm if the PSTs actually apply their preconceptions on the process of sports planning in the design of their didactic units in primary education, as well as to analyse the management of time and its influence on the external load in invasion sports. The results show that PSTs do not apply their preconceptions in the design of their didactic units, with the exception of the pedagogical variable game phase. Furthermore, the management of time conditions motor commitment and the external load of the task.

The PSTs participating in this study did not show a clear preference on the type of task (teaching means) that they found more useful to fulfil their educational objectives. This lack of definition was also generalised independently of the sports discipline planned. There was a majority criterion of working more on attack situations and construction of the game than on defence situations and the deconstruction of the game. The construction of the game's attack phase is identified by the researchers in the processes of sports initiation [36], as it is necessary to endow students with the basic resources to be able to master play in these first learning periods. Similarly, the PSTs prefer more basic player groups and game situations, with opposition between two players. The use of situations of simplified, but complete and actual play, like 1 vs. 1, is frequently indicated by teachers during sports initiation [37], as it offers students a simplified way of playing the game, fomenting their learning [38].

If we group the game together with all its modalities (non-specific, specific...), the teachers underline the value of the game as an educational means for learning which combines two domains (the motor and play aspect) [39]. Equally, the use of the 1 vs. 1 play situation requires contact with companions and problem solving, both characteristics inherent in the game. The greatest difficulty for the PSTs is in setting learning situations that contain problems to be resolved by the students. It is in the process of solving these problems that actual learning is acquired.

In contrast, regarding the design of the learning tasks that made up the didactic units studied, the PSTs tended to use application exercises without the presence of opponents, which implies that tasks working on attack techniques were those most used. The result is that in the relation between knowledge, i.e., what they say, and process, i.e., what they do, the only coincidence was in the pedagogical variable game phase. It is necessary to understand the pedagogical knowledge that the teachers possess that permits them to develop their teaching intervention [40], which is characterised by a decision-making process about the planning and programming of activities and didactic content which determines the pedagogical action.

The structural and formal parameters used by the PSTs in designing their learning tasks for teaching sport in school have been the object of numerous studies. In this vein, the application exercise working on techniques was also the most commonly used type of task by PSTs in the design of their didactic units on basketball [14,15], handball [16] and football [17]. However, based on the formative stage of the students, it is recommended to use play because of its educational potential, through adaptation of rules and motor actions, techniques and tactics [41]. These studies also show the predominance of attack contents over defence. The attack phase should be used as a means to motivate students in the teaching-learning process, as the attack contents, which apply to the construction of the game, are more attractive than the defensive contents [14]. Equally, the PSTs tend to

use tasks without opposition for teaching basketball [19,20], handball [21] and football [22]. The use of tasks without opposition implies the predominance of learning tasks that work on techniques. In-service teachers also plan their pedagogical actions in association with technical abilities [42]. Knowing the structural and formal parameters of the learning tasks will permit a more rigorous design and their adequate sequencing and distribution [43]. In spite of this, the design of learning tasks at present is based on the subjective knowledge of teachers, established from their own personal experiences.

Studying pedagogical variables makes it possible to discover the methodological positioning of the teacher [28,29], and the type of task is the most important variable because it modifies the other variables. Most of the PSTs interviewed showed that their didactic units were based on TCAs and this was confirmed in the analysis of the pedagogical variables they used. However, the SCAs, more than the TCAs, in primary education are more beneficial, both at the psycho-physiological level and in acquired learning [7–12]. For the planning of school basketball [15], handball [16] and football [17] there was also a predominance of technical over tactical learning. PSTs, through their learning experiences, may forget the predominance of TCAs and develop comprehensive approaches, i.e., SCAs [6]. Among the reasons why the PSTs design their didactic units based on the TCAs is the greater facility for designing didactic units based on these approaches, as well as the lack of knowledge about the SCAs [37]. The predominant use of the TCAs may also be due to the fact that the teachers try to repeat and imitate the method with which they were taught, or because this contained little knowledge about new teaching methods [14]. In this study, we observed a discrepancy between the parameters that they considered most important for the teaching of invasion sports in primary education and the approaches that they used. Therefore, a connection is necessary between universities and schools to foment the training and development of knowledge of the PSTs [5], so that the training acquired in the university influences central aspects of the development of knowledge, and the direct impact of the school, through experience, has positive effects on how they learn to teach [1].

Every session of PE should involve two components: the cognitive and the physical; however, teachers do not pay attention to the physical component [19]. Both components should be worked on simultaneously given the small amount of time for motor commitment in teaching sessions. The PSTs who designed their didactic units on basketball and football provoked greater motor commitment and showed more efficient use of time ($p < 0.05$) compared to those who designed their didactic units on handball. The management of motor commitment and the efficient use of time is similar in basketball and football ($p > 0.05$). These differences were found in the variability of the management of time by the PSTs in the design of handball tasks. They tended to use less total time for the tasks; however, they needed more time for explanation and correction. This less efficient time management could be because the teachers had less knowledge about the sport of handball; in fact, none of the PSTs interviewed had a sports qualification or had practised this sport out of school with a federal license. School sport, which seeks the learning of different skills, should contain learning tasks with maximum motor commitment [36]. Following this line of thought, it is recommended to use play (more characteristic of the SCAs) and with the participation of all the students, thus increasing the motor commitment time and the levels of workload. Application exercises (more characteristic of TCAs), where the students are organised in lines, cause motor commitment time and levels of workload to be even lower due to the time spent waiting. It is also necessary to achieve the maximum optimisation of the learning tasks, as other elements that arise in the PE sessions have to be taken into account, e.g., transfer of equipment, personal hygiene, etc., that limit the time for motor commitment. Sometimes this does not surpass 50.00% of the total time of the session and the degree of activation of the student does not reach the necessary threshold for physiological stimulation [23,24].

The management of motor commitment in PE influences the external load of the learning tasks, as shown in this study with a medium effect size. When the external load

of the task is studied without taking time into account, there are no differences; however, when time is taken into account differences exist. In this line of thought, the game plays an essential role in PE as it causes higher levels of workload and improvements in physical fitness [12,44], which are related to health benefits [45,46]. School sports practice should be oriented towards the integral training of the students: i.e., they should develop cognitively, physically, emotionally and socially [47]. Correctly planned teaching sessions are needed for students' integral development [28], as when PE foments psychomotor improvement, progress is also achieved in academic performance, as well as a more favourable attitude to school and a greater awareness of the benefits for health and quality of life.

This study provides objective information about the way in which PSTs conceive and frame the teaching of invasion sports in primary education, and of the use that they make of the different pedagogical and organisational (time) variables. This helps to explore the process of sports planning in school. Thus, the results can be widely applied in the educational and research spheres.

Among the limitations which should be mentioned is the need for a greater number of PSTs to be interviewed. Similarly, this study did not perform an analysis of the implementation of the didactic units in school PE. Korthagen et al. [48] declare that teacher learning should be represented by the interconnection of knowledge, process and context (the three level model). This interconnection will provide a deep understanding of the teachers' actions before and during the implementation of their didactic units [2], so it is proposed that future studies also analyse the context (knowing how to act in concrete situations).

5. Conclusions

Regarding knowledge of the PSTs, there is no clear discrimination of the most useful type of task (teaching means). There is, however, a predominant criterion of working on situations of simplified games that maintain the essence of the sport, and are complete and real, such as 1 vs. 1, and with a predominance of content to teach the attack phase that aims to stimulate play.

The analysis of the learning tasks that make up the didactic units on basketball, handball and football in primary education has shown that PSTs tend to use application exercises without the presence of opponents, which implies that tasks that work on attacking techniques are the most used. These characteristics are representative of the TCAs. There is, therefore, a discrepancy between the preconceptions of the PSTs indicated in the interviews, i.e., what they say, and the information recorded in the learning tasks, i.e., what they do, only coinciding in the game phase pedagogical variable.

There is also a discrepancy between the knowledge declared by the PSTs and their didactic intervention, which reinforces the idea of the importance of modifying implicit theories in new teachers. It is necessary to provide them with striking training experiences to deconstruct their beliefs based on methods nearer to the TCAs and to construct teaching methods that are better adapted to the students' needs, nearer to the SCAs.

The variability of time as managed by the PSTs in the design of their didactic units for each invasion sport determined significant differences in motor commitment. Less knowledge of the content to be taught, i.e., the sports discipline, was associated with an increase in the explanation time needed by the PSTs, reducing motor commitment time. The management of motor commitment conditions the task workload, the greater the motor commitment, the greater the task workload.

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