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Influence of the Organizational System on Motor Engagement Time in Physical Education on High School Students

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Abstract

The time students spend practicing physical activities, is one of the most significant variables that affect learning, and predict student's results in Physical Education (PE). This study analyses the influence of three organizational systems on students' Motor Engagement Time (MET). A quasi-experimental intra-group design with repeated measures was used. Participants were 52 Spanish high school students. Results showed that there are significant differences between circuits (higher MET and less student attention time) and consecutive tasks organization. We recommend the use of the circuits organizational system for achieving high levels of motor learning in PE classes.

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Keywords: Academic learning time; Organizational strategies; Effective teaching; Motor learning; Secondary school

1. Introduction

The teaching skills of physical education (PE) teachers have been the subject of numerous studies, mainly in the pre-service stage (Ocaña, 2003; Lozano & Viciana, 2002). The aim of such studies is centered on achieving acceptable levels of specific abilities to ensure adequate teaching efficiency. The cognitive processes supplant this paradigm, focusing the attention on students' conduct, taking decisions and the teachers' thoughts (Xiang, Lee & Williamson, 2001; Kulinna, Silverman & Keating, 2000; Wittrock, 1989). However, there is once again interest in the abilities that a PE teacher must assimilate in initial training, due to the homogenization of studies in the European Higher Education Space.

The control and distribution of class time in PE sessions and how class organization affects them are currently elements of major importance for teachers of this subject since there are curriculum limitations in the number of weekly classes given throughout the world (Pesquie, 1988; Delaunay & Pineau, 1989; Seners, 2001; Viciana, 2002).

Within the management of class time our study concentrates on Motor Engagement Time (MET), defined by Piéron (1993) as the time students spend practising physical activities. MET is one of the most significant variables in studies on PE teaching efficiency (Carreiro da Costa & Piéron, 1990a, 1990b, 1992, 1997; Piéron, 1982). In fact,

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different studies show a positive relationship between MET and students' results in PE classes. These results are positively associated with the process, that is to say, with what happens in class. Moreover, research conclusions consider MET as a variable that enables us to predict students' progress and knowledge acquisition (Graham, 1983; Philips & Carlisle, 1983; Piéron & Piron, 1981; Siedentop, Birdwell & Metzler, 1979).

However, exceptionally, Yerg & Twardy (1982), obtained negative results, showing that motor activity is negatively related to successful learning. This indicates, although it is the object of other research, that other factors influence the relation between MET and learning. Fundamentally, these are feedback (Cuéllar & Carreiro da Costa, 2001), and successful motor practice, or rather, a temporal subset of MET that ensures effective practice for learning (Musgrove, 1988).

Most of the studies that deal with the subject reveal average values for MET of around 30-40% of the total class time (González, 2001). These percentages increase with certain factors, such as the type of content (Thompson, Beauchamp & Darst, 1991), organization (Silverman, Dodds, Placek, Shute & Rife, 1984) or the motivation and expectations of the teacher (Hastie, 1994; Martinek & Harper, 1983), but they can also decline to values of 15-20%.

Thus, frequent interventions by the teachers giving feedback, using space well and avoiding silences and inactive periods foster MET (Hastie, 1994). Furthermore, on seeing their teacher's enthusiasm students are more inclined to learn, attending to and showing greater involvement in the tasks to which they do not normally pay attention (Martinek & Harper, 1983).

Silverman, Dodds, Placek, Shute & Rife (1984) found very significant differences in MET according to the content of the practice, varying from 54% of the time with manipulative skills to 24.3% in team sport practices. As a conclusion to this study, the authors also stated that research in this sphere should be centred on the relation between Academic Learning Time in Physical Education (ALT-PE) (Siedentop, Tousignant & Parker, 1982) and the organization patterns of the students, so as to be able to confirm or reject the idea that the varying ways in which teachers tackle their task affect students' learning time.

Thompson, Beauchamp & Darst (1991) reviewed a wide sample of studies on MET and observed that the students studied employed approximately one-third of class time in activities not directly concerned with achieving the motor learning aims envisaged. After making this review, the authors, concerned at the situation experienced in PE in Canada, sought to reply to the question "What's going on in the Canadian secondary school gym?" To answer it, they put into practice a methodology that included the observation of 199 PE classes, using seven different contents. To analyze the MET of all the students as a whole as well as some of them individually, they used ALT-PE (Siedentop, Tousignant & Parker, 1982). The results proved the existence of significant differences in the global percentages of time spent in MET according to the content imparted; games and sports, aerobics and fitness and dance-jazz being the contents that obtained the highest percentages of MET, in contrast to gymnastics, water activities and activities in the open air. The global percentage of MET, after analyzing all sessions, was 42%, the remaining 58% being shared among: waiting time (21%), time spent in tasks of listening and observation (21%), cognitive engagement time (13%) and time spent in irrelevant behavior (3%). As with other authors, this research concluded, *inter alia*, that the most efficient teachers were those who were aware that the way in which class time is organized is a key factor to optimize students' use of time (Metzler, 1990).

Hould & Brunelle (1981) utilized ALT-PE to observe forty-five ice hockey training sessions. After putting distinct types of organizational systems into practice the results showed: scattered/dispersed organization ensured a motor involvement of 72.7%, organized, 66.5%, in line 35.6%, with change-overs 33.6% and wave 28%. This gives a ratio of 2.5/1 among the different forms of organizing and executing the tasks as maximum and minimum, proving the importance of the teacher or coach's choice of organization when preparing a session.

Another fact that confirms the close relationship between management of class time and organizational activities is provided by Lucke (1989), whose research showed that the percentage of time dedicated to organizational tasks in a PE session varies between 15 and 35% of the total time. The variations in organization time are determined by the type of activity to be carried out. In this sense, Siedentop (1998) stated that the time dedicated to organization, whether of students or materials, is higher when dealing with team sports or gymnastics, and is much less in activities such as dance (Cuéllar & Carreiro da Costa, 2001). These authors identify classroom organization as one of the most important variables that conditions the teaching-learning process, considering it to be fundamental in optimizing the student's MET, facilitating the running of the class and reducing discipline problems.

The aim of this work is to provide an effective organizational strategy that will help in the management of the time available in class, optimizing the work with greater percentages of practice, so bringing with it greater possibilities of learning (Siedentop, 1983a, 1983b). Therefore, the problem posed in this study was to nullify or control the different factors that may influence high school students' MET in PE classes, with the aim of isolating

the class organizational variable and testing how different organizational systems influence MET and other temporal variables. Our hypothesis is that the organizational system influences high school students' MET and that we shall obtain significant differences among the systems used in this research as independent variables.

2. Method

2.1. Participants

The participants in this research were 52 students from a Spanish Educational Centre in Granada in their 2nd year of high school aged between 13-14, of whom 24 were boys and 28 were girls. A graduate PE teacher, with five years' experience, was in charge of planning, designing and putting the sessions into practice. Two observers, PE graduates, analyzed the sessions, and received training in four phases: a) visualization and analysis of three PE sessions independent of this study; b) drawing up a list of problems and doubts that arose during the recording of the temporal variables of the three sessions analyzed; c) drawing up a list of the points of agreement between the observers (Ramírez, Lozano, San-Matias, Zabala & Viciana, 2006); and d) analysis, separately from each other, of three sessions chosen at random from the thirty that made up the study, reaching reliability values of between 85-90% (Anguera, 1999).

2.2. Measures

a) A computerized time management sheet was used to record the time intervals dedicated to each temporal variable. This sheet was designed in the University of Granada and awarded a prize for a teaching innovation project (Viciana, Fernández, Requena, Zabala & Lozano 2003). The main difference as against other time recording instruments in PE, such as ALT-PE, is that the category changes when half plus one of the class students are involved in the new category, rather than an individual record. So, our unit of analysis was the group, not the individual students.
b) University and School Classroom Environment Inventory (CUCEI), translated and validated (Marcelo, 1991) from the original instrument "College and University Classroom Environment Inventory (CUCEI)", designed by Fraser, Treagust & Dennis (1986) in the Western Australian Institute of Technology. It is composed of 49 statements (valued from 0 to 10 according to the degree of agreement) grouped in seven categories: personalization, involvement, cohesion among the students, satisfaction, task orientation, innovation and individualization. This provided control over the possible influence of the classroom environment.
c) Questionnaire on PE as a subject, divided into four categories: consideration of PE as a subject compared with other school subjects, students' level of skill in PE, aspects related to the evaluation of PE, and extra-curricular sport practice outside school hours (Jiménez, 2004).
d) Questionnaire on Attitudes in PE, made up of 19 statements divided between two categories: the type of behavior the pupil presents in PE classes when interacting with classmates, with the teacher, in the treatment of the materials and facilities used; and the pupil's interest in the activities proposed and improvement of the class environment (Jiménez, 2004).
e) Questionnaire on the Evaluation of the session. This indicated the degree of satisfaction with the session just finished in order to check its influence on the results of the temporal variables (Carlier, Radelet & Renard, 1991).

Specific recording and reproduction video and audio materials were used to analyze time spent.

2.3. Design, variables and procedure

The study employed a *quasi-experimental intragroup research design with repeated measures,* applied in fifteen phases, namely, five sessions given in each of the three levels of the independent variables. To eliminate possible errors accumulating during the procedure, the three levels of the independent variables were alternated. Therefore, the research design was presented in the following sequence of application:

Group 1 $X_1 O_1 X_2 O_2 X_3 O_3 X_1 O_4 X_2 O_5 X_3 O_6 X_1 O_7 X_2 O_8 X_3 O_9 X_1 O_{10} X_2 O_{11} X_3 O_{12} X_1 O_{13} X_2 O_{14} X_3 O_{15}$

Note: X_1= circuits, X_2= consecutive tasks for the whole class, X_3= ability level subgroups; and $O_{1\text{-}15}$ = measures of temporal categories in each session from 1 to 15.

The dependent variables were: a) Motor Engagement Time (MET); b) Students' Attention Time (SAT), subdivided into: Time in which the pupil attends to the general information being given by the teacher (TGI), Time in which the pupil attends to task information (TI) and Time when the pupil attends to the Feedback given by the teacher (TF); and c) Organization Time (OT), made up of: the student's Organization Time for the tasks (SOT) y Time student uses in the Organization of the Material (TOM). The Unforeseen Time (UT) was also taken into account as a variable, due to internal or external reasons of the class (UT).

The independent variable was the Organizational system of the tasks and of the students in each session, with the aim of checking their influence on students' MET. This independent variable presented three levels corresponding to the three organizational systems commonly used in PE:

(a) *Circuit (CIR):* an organization by stations where its functioning is first explained and subsequently applied to the whole class under a system of work-rest and pupil rotation. The students work in sub-groups in each circuit station.

(b) *Consecutive tasks for the whole class-group (CTG):* this is the traditional system of explanation, organization and practice time, and each class task following in succession. In this system all the students do the same task during the practice time.

(c) *Ability level subgroups (ALS)*: due to the differences of level normally found at high school, in this system the class is divided into two subgroups who work independently, with their own list of tasks that functions as a massive consecutive organization in each subgroup. The particular feature is that there is a pupil in charge of each subgroup who, in accordance with the teacher's instructions, tells her/his classmates in that subgroup when to change tasks.

The contaminating variables that were controlled in order to be able to compare the organizational systems and ensure that only these could influence the results were the following:

-The content and the materials used (the sessions employed the same PE content and materials in each organizational system).

-The distribution of the temporal variables (on paper, the planning of the sessions provided the same time for MET, Organization Time and Student Attention Time).

-The observers and temporal analysis of the sessions (all were analysed on video by the same observers, following agreed common guidelines). Furthermore, this was always done at the weekend after the practice sessions while the memory was fresh to avoid doubt about codification. The independent variable levels were applied alternately (the application of the design's three organizational systems were alternated in the group so that the pupil did not become accustomed to a specific system, and to foster the organization and distribution of class time).

-Finally, the teacher was the same for all sessions of the study.

3. Results

Before setting out the analysis of the temporal variables, we show the average results of the group in the variables controlled collaterally and with a possible influence on the study: classroom environment, attitude shown in class to classmates and tasks, valuation of PE and valuation of the sessions in which they participated (from 0 to 10 points).

The results extracted from the analysis of the classroom environment indicated that it was a cohesive group ($x=7.45\pm2.47$), interested in carrying out the different tasks ($x=6.18\pm2.32$), motivated by them ($x=6.79\pm3.09$) and oriented to them ($x=6.36\pm3.02$). Equally, the students showed a high degree of involvement in the questionnaire on attitudes. They were cooperative and helped their colleagues ($x=7.10\pm3.20$), used the materials correctly ($x=8.33\pm2.09$), respected classroom rules ($x=8.20\pm3.12$) and showed interest in taking full advantage of the practice time ($x=7.67\pm2.23$), this being an important aspect of the study. The group gave great importance to the practice of physical activity since for a high percentage of class time they were engaged in the activities proposed ($x=8.38$) and to PE as a subject ($x=7.52\pm2.45$). They preferred to be evaluated on their individual progress ($x=8.45\pm3.44$) rather than against an established norm ($x=3.90\pm0.45$). Finally, the group saw itself as sufficiently competent to tackle the content given ($x=7.45\pm2.25$). These data define the sample in the study as a group appropriate to participate in this research, with a medium to high level in the parameters influencing practice time and the other temporal variables of attention and organization.

In table 1 we show the mean and the standard deviation of the dependent variables during the five classes in each organizational system.

Table 1. Descriptive results of the temporal variables (mean of the fifteen classes) in each organizational system

	MET (min.) Mean (SD)	MET (%) Mean (SD)	OT (min.) Mean (SD)	OT (%) Mean (SD)	SAT (min.) Mean (SD)	SAT (%) Mean (SD)	UT (min.) Mean (SD)	UT (%) Mean (SD)
CIR	33.65±3.48	56.08± 5.81	12.95±4.85	21.58±8.08	10.87±2.77	18.10±4.61	2.55±0.75	4.24±1.25
ALS	31.82±3.33	53.04±5.56	12.62±3.17	21.03±5.57	12.92±3.07	21.53±5.12	2.63±0.83	4.40±1.39
CTG	28.82±3.02	48.05±5.01	12.05±3.65	20.07±6.10	16.23±6.48	27.05±10.81	2.88±0.85	4.83±1.50

Note: SD: Standard Deviation; MET: motor engagement time; OT: organization time; SAT: students attention time; UT: unforeseen time; CIR: circuit; ALS: Ability level subgroups; CTG: consecutive tasks for the whole group.

As shown in the table 1, CIR had better MET and less SAT than the ALS, while CTG was the worst of the three organizational systems analyzed.

In table 2 we show the significant effect of intra-group test in MET variable. Therefore organizational system had an influence on students' MET (p= .031). Table 3 shows us the comparison by a pairs test and the significant difference between CIR and CTG (p= .024; effect size η2= .59).

Table 2. Test of intra-group effects for MET with the Huynh-Feldt Penalization

Source		Square addition type III	Fd	Square average	F	Mean
ORGANIZATIONAL SYSTEM	Huynh-Feldt	74.326	1.410	52.708	.448	**.031**

Table 3. Comparison by pairs test of the overall averages of MET in the three organizational systems

(I) ORG. SYSTEM	(J) ORG. SYSTEM	Difference Averages (I-J)	Typical Error	Mean (a)	Confidence Interval at 95 % for difference (a)	
					Límite inf.	Límite sup.
CIR	CTG	4.833(*)	1.854	**.024**	.639	11.823
	ALS	1.833	1.105	.517	-3.013	8.311
CTG	CIR	-4.833(*)	1.854	**.024**	-11.823	-.639
	ALS	-3.000	1.211	.638	-9.244	2.080
ALS	CIR	-1.833	1.105	.517	-8.311	3.013
	CTG	3.000	1.211	.638	-2.080	9.244

Note: CIR: circuit; ALS: Ability level subgroups; CTG: consecutive tasks for the whole group.

In table 4 the significant effect of intra-group test in SAT variable is shown (p= .018). Therefore the organizational system had an influence on SAT. Table 5 shows us the comparison through a pairs test and the significant difference between CIR and CTG (p= .013; effect size η2= .47).

Table 4. Test of intra-group effects for SAT with the Huynh-Feldt Penalization

Source		Square addition type III	Fd	Square average	F	Mean
ORGANIZATIONAL SYSTEM	Huynh-Feldt	493.191	1.410	446.914	4.998	**.018**

Table 5. Comparison by pairs test of the overall averages of SAT in the three organizational systems

(I) ORG. SYSTEM	(J) ORG. SYSTEM	Difference Averages (I-J)	Typical Error	Mean (a)	Confidence Interval at 95 % for difference (a)	
					Límite inf.	Límite sup.
CIR	CTG	-5.366(*)	2.737	**.013**	-17.867	-1.361
	ALS	-2.050	1.907	.607	-8.400	3.102
CTG	CIR	5.366(*)	2.737	**.013**	1.361	17.867
	ALS	3.316	4.299	.432	-6.000	19.930
ALS	CIR	2.050	1.907	.607	-3.102	8.400
	CTG	-3.316	4.299	.432	-19.930	6.000

Note: CIR: circuit; ALS: Ability level subgroups; CTG: consecutive tasks for the whole group.

There were no differences between the three organizational systems in the OT variable (p=0.87).

4. Discussion

In general lines, after analyzing the overall data for MET in any of the organizational systems studied, the average values of this variable in every case are around 50% of the total time of the class. In this way, and bearing in mind the argument of González (2001), who showed that most studies dealing with MET gave values of around 30-40%, we can state that high MET levels have been obtained, independently of the organizational system employed. The study of Mancini, Wuest, Clark & Ridosh (1983) gave percentages for this variable of between 25.7% and 48%, according to the level of enthusiasm and motivation presented by two teachers. In the case of the more motivated teacher, the percentage approached the data in our study, although it was still lower. This serves to confirm the optimization obtained in MET data. On the other hand, the similarity in the results in the organizational systems and the high value of MET is also due to the planning prior to carrying out this research (Byra & Coulon, 1994; Sau-Ching-Ha, Chan-Wan-Ka & Xu, 2002).

In the light of what has been set out above and taking into account the data from other studies such as that of Silverman & Zotos (1987) and Silverman, Devillier & Ramírez (1991) seeking to determine the validity of ALT-PE as an indirect system to measure students' learning and teachers' efficacy, in which ALT reached 45%, we can confirm the validity and the efficacy of our system of measuring temporal variables. Although it is true that students' learning levels have not been measured, what we can confirm is that considerable time was available for MET (around 50% in all three organizational systems), with respect to total class time, and in theory, this fosters learning.

In the study of Borys (1983), it was proved that the increase in MET by the experimental group was a direct consequence of the reduction in time used to give general information to students and the time they spent waiting prior to the activity. In the same way, we have shown in our study that the two organizational systems that required less SAT (Student Attention Time) proved to be the most efficient in achieving overall MET.

In the investigations of Silverman, Dodds, Placek, Shute & Rife (1984) and of Thompson, Beauchamp & Darst (1991) very different percentages of ALT were obtained according to content, going from 24.3% to 54.8%; however, in our work, in contrast with what occurred in the research mentioned, content exercised no noticeable influence on MET, as its values were similar regardless of the content chosen.

Hould & Brunelle (1981) carried out a study based on 45 ice hockey training sessions employing ALT-PE as an instrument to measure temporal variables. The results showed how organizations in dispersed (72.7%) and organized (66.5%) ensured much higher percentages of MET than those in line (35.6%), with change-overs (33.6%) or the wave (28%). The 2.5/1 ratio between the groups with greater or lesser motor involvement showed the importance of the coach's choice of organization. In our study, the overall percentages of MET varied between 48% and 56%. These values can be considered satisfactory, bearing in mind that the tool we used measured the behavior of students as a class, unlike ALT-PE, which is a method measuring individual performance. Achieving these percentages was the determining factor in the design of the activities of the 15 sessions that made up the treatment,

since they were all planned to be executed *simultaneously*, reducing students' waiting time, so that they had much in common with the organizations in change-overs, in line or in wave, where the activities are consecutive.

Therefore, we echo the conclusions of Silverman, Dodds, Placek, Shute & Rife (1984); we coincide in the fact that research in this field should be focused on the relationship between MET and the organizational patterns of the tasks and the students when practicing motor skills in order to confirm or reject the idea that the teachers' different ways of teaching affect the students' learning time. In our case, isolating the organizational aspects, the central axis of the research, even though the exhaustive control of planning and distributing class time, teacher behavior, content and material, have favored significant differences in MET and SAT.

5. Conclusion

Teachers have often had problems achieving high levels of motor learning with their students. This is because of the number of classes they have during the week and for the limited time they have in the academic course to develop all the contents they have to teach. We recommend the use of the circuits organizational system in order to achieve high levels of motor engagement time in PE classes, as well as, increasing levels of motor learning. Even though the circuit had higher levels of OT at the beginning of the class while preparing the tasks, this organizational system reaches the highest levels of MET at the end of class. Also, when the students become accustomed to this way of organizing, the percentages of MET raise even more while those of OT decrease. Consecutive tasks for the whole group (CTG) was the worst organizational system for MET due to the time that the teacher spent explaining each task and answering the children's questions.

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