Kinesics and proxemics communication of expert and novice PE teachers

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Abstract The aim of the study is to analyse the sequential paraverbal communication used while teaching by expert and novice PE teachers. Four expert and four novice teachers were observed using a coding scheme of paraverbal behavior. The detection of temporal patterns using Theme v.5 enabled sequential analyses of paraverbal behaviour. The results indicate that compared to expert teachers, novice teachers used a greater number of gestures and did not always make effective use of the teaching space. Their gestures were also less qualitative in nature as they did not take full advantage of the communicative possibilities offered by some of the gestures analysed.

Keywords Paraverbal communication · PE teachers · Observational instrument · Sequential analysis · Temporal patterns

1 Introduction

An intrinsic part of all teaching activity is a constant flow of communicational, in which the spontaneous nature of communication is considered to be a habitual feature. The primary focus of this paper is on the analysis of paraverbal communication, specifically on how teachers, when teaching, approach the *twin aspects* of gesture (i.e. kinesic behaviour) and the use of space (i.e. proxemic behaviour). This interest in studying the paraverbal communication

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of teachers derives directly from the fact that such communication has either been overlooked or studied only superficially within the educational context. However, teaching behaviour is shaped by numerous kinesic and proxemic actions within the communicative process that takes place in the classroom. Despite the considerable emphasis that educational institutions place on verbal language, one is obliged to take note of other forms of communication which, far from being of secondary importance, determine to a large extent the pedagogical relationship.

In order to improve the scenarios to be managed by teachers it is important to identify the essential aspects of communication, such as gestures and the use of teaching time and space, which are associated with the teaching discourse. The processes of teaching are complex and multidimensional, and teaching behaviours and actions are shaped by numerous cognitive decisions made by the teacher during all types of educative situation. Given that one of these teaching actions is communicational in nature, then one of the keys to optimising teaching tasks lies in paying close attention to the communication and teaching style that each teacher may develop and rework over time.

Research on effective teaching has highlighted the importance of communication in instruction (Mottet et al. 2006; Rosenshine and Stevens 1986). Furthermore, several authors have noted that specific references to actual communicative behaviour are required to develop a model of communicational competency (Wiemann and Backlund 1980; Mulholland and Wallace 2001; Pence and Macgillivray 2008). We believe that optimising the communicational skills of teachers can help to boost not only their competence but also their confidence, or as Berliner puts it "the development of teacher expertise is seen as an increase in agency over time" (Berliner 2001). Indeed, this is a key aspect in the various models of how teacher expertise progresses (Dreyfus and Dreyfus 1986; Genberg 1992). In light of the above the present study aims to: (1) identify the kinesic and proxemic behaviours of physical education (PE) teachers related to instructional tasks; and (2) compare the communicative teaching styles of expert and novice teachers.

1.1 Paraverbal communication: the gestural discourse envelops the verbal discourse

The communicative reality in which humans live can be understood in terms of the linearity and sequential nature of verbal language, which depends upon our sole speech organ: the oral cavity and vocal cords. Alongside this there is a dimension of discourse that is not strictly verbal and which is characterised by simultaneity, one that is also referred to as analogical language, as opposed to verbal language which is regarded as digital (McNeill 2000). The diverse and—at the same time—bilateral structure of our corporeality enables us to generate *postures* (related to the statics of the body), *gestures* (related to the dynamic nature of the body), and bodily *attitudes* (which give meaning to gestures and postures) (Castañer et al. 2009).

If we accept that each gesture and each bodily attitude is motivated by our socio-affective sphere then we are obliged to ask whether our bodily expression may seek to be arbitrary in the way that our verbal language is. However, any comparison of verbal and body language is a thorny issue, since even though we may be able to see some kind of concordance and interdependence between them, their material and expressive basis is essentially very different. Research conducted since the 1970s by several prestigious authors in the field of communication theory (Hall 1968; Birdwhistell 1970; Efron 1972; Ekman 1976; Poyatos 1983; Argyle 1988) has left an exhaustive legacy regarding the kinesic and proxemic dimensions of human paraverbal communication. In contrast, however, very little educational research has been concerned with the role of gestures in teaching and learning (Roth 2001). Furthermore, while gestural kinesics constitutes one feature of paraverbal communication, the teaching

task involves many other communicative aspects (McNeill 2005). In this regard, many studies have focused on how effective teachers communicate, but little research has explored why teachers communicate as they do (Webster 2008).

The paraverbal structure of communication will be addressed here according to two dimensions: *kinesics*, which centres on the gestural language of the body; and *proxemics*, which centres on the use of space (in this case, the teaching space). These dimensions of analysis have been considered for many years by key authors in the field, and in the context of teaching discourse they can be clearly and concisely defined as follows:*kinesics:* the study of patterns in gesture and posture that are used by the teacher; and *proxemics:* the study of how the teacher uses the space in which teaching takes place.

The processes of teaching and learning are, above all, communicative processes. In our view it is clear that high communicative competency in the teacher will result in higher quality of interaction for the student. If, as educators, we agree with this one could argue that the two of the main pillars of education are, firstly, to recognise and, secondly, to optimise the paraverbal registers (Castañer 2009) on which the teacher's discourse rests. Paraverbal teaching style refers to the ways in which a teacher conveys his or her educational discourse, and this is why it is sometimes associated with the idea of expressive movement (Gallaher 1992). De Vries et al. (2009) also define communicative style as the characteristic way a person sends verbal, paraverbal, and non-verbal signals in social interactions.

Might we therefore consider that pedagogical semiotics, when properly employed, could become a kind of Socratic maieutics, one that is action-oriented and highly personalised (Barbat 2008)? This is linked to the concept of persuasive discourse (Lischinsky 2008), since it suggests a way of conducting a semiotic analysis of the personal tools used by the teacher, tools which serve to revitalise, to motivate, to arouse or even to provoke. Thus there is a continuous interchange between two basic elements: the technical/didactic and the linguistic/communicational. Socratic maieutics places greater emphasis on retrieving what is already known rather than the transmission of knowledge from the outside in.

1.2 Communication in expert and novice teachers

In the teaching context, experiential knowledge and self-awareness form the basis of the 'know thyself' that is essential for teachers. The word *expertise* has several connotations, suggesting something that is done 'correctly', 'with dexterity' or 'resourcefully', but it always implies that the person concerned has the competency required by the task in hand (Loughran and Berry 2005). Mastery of a domain involves many skills, such as class control and management or the development of effective strategies (Genberg 1992), but a key aspect is optimising and adapting the techniques and skills of the paraverbal communication (both kinesic and proxemic) that accompanies the teaching discourse. As Kinchin, Cabot, and Hay put it, "the visualisation of expertise is a necessary step in the development of a pedagogy in which expertise is the currency of exchange between teachers and students" (Kinchin et al. 2008, p. 324). In this regard, Allen and Casbergue (1997) noted that studies of teacher expertise reveal that experts recall more meaningful classroom events occurring in a complex, dynamic classroom than do inexperienced teachers (Carter et al. 1987; Clartidge and Berliner 1991; Peterson and Comeaux 1987; Sabers et al. 1991).

Furthermore, recent research indicates that an understanding of what constitutes successful communication in teaching may best be derived from comparisons of expert and non-expert teachers (Webster 2008). Tochon and Munby (1993) suggested that novices and experts understand and process time differently, and a recent study by our group also found differences in their use of kinesic and proxemic behaviour (Castañer et al. 2010). If communication

is to be effective it is necessary to ensure that all the paraverbal dimensions are congruent, i.e. that they seek to transmit the same message, strengthening and confirming it in accordance with the educational circumstances (Jones and LeBaron 2002). Thus, regardless of a teacher's experience it is always worth questioning the forms and style of verbal and non-verbal communication used in everyday teaching practice, as well as the quality of the messages transmitted (Cloes et al. 1995).

Hayes et al. (2008) note that in the extensive literature regarding the training of PE teachers, much research has focused on beginner and expert teachers who face different concerns (Wendt and Bain 1989; Behets 1990, 1997; Meek 1996; Meek and Behets 1999; Rossi et al. 2008). For example, Behets (1990) found several significant differences with respect to the instructional variables, all indicating that the most effective teachers spent significantly less time and attention on providing information to pupils. According to Castañer (1996) and Rossi et al. (2008), the 'putting into practice' employed by PE teachers bears a certain resemblance to the presentation of self that was described by Goffman (1959) in relation to our behaviour in space and time, and which in our view is associated with the kinesic and proxemic behaviours that form the object of the present study.

2 Methods

Observational methodology was used due to the habitual nature of teachers' behaviour and the fact that the context is a naturalistic one. The flexibility and rigour of this methodology make it fully consistent with the characteristics of the study and it has become a standard approach to observational research (Anguera 1979, 2003; Hernández-Mendo and Anguera 2002), especially in the field of sport (Jonsson et al. 2006). and when addressing motor skills or kinesic behaviour (Castañer et al. 2009). Moreover, this methodology allow us to combine qualitative and quantitative sides (Camerino et al. 2012; Castañer et al. 2012) of nonverbal behaviour.

2.1 Participants

Eight PE teachers, four novices (in their first year of teaching) and four experts (with a mean teaching experience of 12 years), volunteered to participate in the study and were observed for both kinesic and proxemic communication. All the teachers were free to choose four classes from among their regular timetable, thus ensuring that the observational methodology was always applied to naturalistic contexts and spontaneous behaviours that we can percept. The pupils were aged between 10 and 12 years and attended a co-educational primary school, with an average of 21 pupils per class. A total of 32 classes with a mean duration of 50 min were recorded and analysed, which entailed the analysis of 8,960 observation frames (=280 frames/session). The procedure was conducted according to APA ethical guidelines, was approved by the university departments involved, and met the requirements of The Belmont Report (1979) in order to assure that subjects' rights were protected.

2.2 Instruments

The observational instruments used were SOCIN and SOPROX (Castañer et al. 2010; Castañer 2009) which enables the different levels of kinesic and proxemic response to be systematically observed. Kinesic responses were recorded by means of the system for the Observation of Kinesic Gestures (SOCIN; see Table 1), while proxemic gestures were recorded by means of the system for the Observation of Proxemics (SOPROX; see Table 2). Both sys-

Table 1 SOCIN: system of observation for kinesic communication (Castañer et al. 2010)

Dimension	Analytical categorisation	Code	Description
Function	Regulatory	RE	Action by the teacher whose objective is to obtain an immediate response from receivers
Dimension that refers to the intention of the spoken discourse that the gesture accompanies			It comprises imperative, interrogative, and instructive phrases with the aim of exemplifying, giving orders or formulating questions and answers
	Illustrative	IL	Action that does not aim to obtain an immediate response from the receiver (although possibly at some future point). It comprises narrative, descriptive and expository phrases with the aim of getting receivers to listen
Morphology	Emblem	EMB	Gesture with its own pre-established iconic meaning
Dimension that refers to the iconic and biomechanical form of gestures	Deictic	DEI	Gesture that indicates or points at people, places or objects
	Pictographic	PIC	Gesture that draws figures or forms in space
	Kinetographic	KIN	Gesture that draws actions or movements in space
	Beats	BEA	Iconically undefined gesture used exclusively by the sender and which usually only accompanies the logic of spoken discourse
Situational	Demonstrate	DE	When the teacher performs in gestures that which he or she wishes the students to do
Dimension that refers to a wide range of bodily actions which usually coincide with parts of the teaching process that cover a certain period of time	Help	HE	When the teacher performs actions with the intention of supporting or improving the contributions of students
	Participate	PA	When the teacher participates alongside students

Table 1 continued

Dimension	Analytical categorisation	Code	Description
	Observe	OB	Period of time during which the teacher shows an interest in what is happening in the classroom with the students
	Provide material	PM	When the teacher handles, distributes or uses teaching material in accordance with the educational setting
	Show of affect	AF	When the teacher uses an emotionally-charged gesture with respect to the students
Adaptation	Object adaptor	OBJ	When the teacher maintains contact with objects but without any communicative purpose
Dimension that refers to gestures without communicative intentionality in which the teacher makes contact with different parts of his/her body, or with objects or other people	Self-adaptor	SA	When the teacher maintains contact with other parts of his/her body but without any communicative purpose
	Hetero-adaptor	HA	When the teacher maintains bodily contact with other people but without any communicative purpose
	Multi-adaptor	MUL	When several of these adaptor gestures are combined

tems have been successfully used in previous research to observe the behaviour of teachers in interaction with their students. Each criterion gives rise to a system of categories that are both exhaustive and mutually exclusive.

As record instruments, we have used ThemeCoder software, in order to record the non-verbal behaviours that are included in SOCIN and SOPROX.

In order to control the quality of data, we have used SDIS-GSEQ software (Bakeman and Quera 1992).

The data analysis has been made with THEME (Magnusson 2000, 2005) and SDIS-GSEQ (Bakeman and Quera 1992) software.

2.3 Procedures

Sessions were digitised to make them available for frame-to-frame analysis and to enable them to be coded in ThemeCoder software. The behaviour of teachers was observed uninterruptedly across all the sessions. Two different observers analysed all the recordings from observation sessions. In order to control the quality of data with respect to inter-observer reliability

Table 2 SOPROX: system of observation for proxemic communication (Castañer et al. 2010)

Dimension	Analytical categorisation	Code	Description
Group	Macro-group	MAC	When the teacher speaks to the whole class/group
Dimension that refers to the number of students to whom the teacher speaks	Micro-group	MIC	When the teacher speaks to a specific sub-group of students
	Dyad	DYA	When the teacher speaks to a single student
Topology	Peripheral	P	The teacher is located at one end or side of the classroom
Dimension that refers to the spatial location of the teacher in the classroom	Central	C	The teacher is situated in the central area of the classroom
Interaction	At a distance	DIS	Bodily attitude that reveals the teacher to be absent from what is happening in the classroom, or which indicates a separation, whether physical or in terms of gaze or attitude, with respect to the students
Dimension that refers to the bodily attitude which indicates the teacher's degree of involvement with the students	Integrated	INT	Bodily attitude that reveals the teacher to be highly involved in what is happening in the classroom, and in a relation of complicity with the students
	Tactile contact	TC	When the teacher makes bodily contact with a student
Orientation	Facing	FAC	The teacher is located facing the students, in line with their field of view
Dimension that refers to the spatial location of the teacher with respect to the students	Behind	BEH	The teacher is located behind the students, outside their field of view
	Among	AMO	The teacher is located inside the space occupied by the students
	To the right	RIG	The teacher is located in an area to the right of the classroom and of the students, with respect to what is considered to be the facing orientation of the teaching space

Table 2 continued

Dimension	Analytical categorisation	Code	Description
	To the left	LEF	The teacher is located in an area to the left of the classroom and of the students, with respect to what is considered to be the facing orientation of the teaching space
Transitions: dimension	Fixed bipedal posture	FB	The teacher remains standing without moving
that refers to the body posture adopted by the teacher in space	Fixed seated posture	FS	The teacher remains in a seated position
	Locomotion	LOC	The teacher moves around the classroom
	Support	SU	The teacher maintains a support posture by leaning against or on a structure, material or person

(Jansen et al. 2003) the kappa coefficient was obtained by means of SDIS-GSEQ (Bakeman and Quera 1992). The value obtained (0.92 for all sessions) provided a satisfactory guarantee of data quality.

The data were then imported into SDIS-GSEQ to enable sequential analyses. Temporal patterns (T-patterns) were detected and analysed with the *Theme* v.5 software (Magnusson 2005). *Theme* not only detects temporal patterns but also indicates the relevance and configuration of recorded events. The approach is based on a sequential and real-time pattern type, known as T-patterns, which, in conjunction with detection algorithms, can describe and detect behavioural structure in terms of repeated patterns (Magnusson 2000, 2005). It has been shown that such patterns, while common in behaviour, are typically invisible to observers, even when aided by standard statistical and behaviour analysis methods.

3 Results

The analyses revealed key trends in paraverbal communicative behaviour that were related to the expertise of teachers. In regards to the sequential analysis (SDIS-GSEQ) the results indicate that novices use more kinesic behaviours than do expert teachers. Furthermore, the adjusted residuals at lag 0 are more significant and, therefore, more balanced. The most relevant data correspond to the following SOCIN criteria: regulatory and illustrative functions; emblem morphology; situational and adaptation.

3.1 Sequential analysis

In novice teachers the SDIS-GSEQ program revealed (see Table 3) a highly significant co-occurrence of Adaptors and Situationals (=348), of Emblems and Adaptors (=112), Adaptors and Regulators (181), of Adaptors and Illustrators (=108), and of Regulators and

Table 3 Combination of kinesic behaviours of novice teachers

Given	Determined					
	Emblem	Adapter	Regulat	Illustra	Situati	Total
Emblem	0	112	0	1	1	114
Adapter	0	0	181	108	348	637
Regulat	0	0	0	0	102	102
Illustra	0	0	0	0	1	1
Situati	0	0	0	0	0	0
Total	0	112	181	109	452	854

Table 4 Combination of kinesic behaviours of expert teachers

Given	Determined					
	Emblem	Adapter	Regulat	Illustra	Situati	Total
Emblem	0	22	0	0	6	28
Adapter	0	0	29	47	70	146
Regulat	0	0	0	0	22	22
Illustra	0	0	0	0	16	16
Situati	0	0	0	0	0	0
Total	0	22	29	47	114	212

Situational markers (=102). For expert teachers (see Table 4) the same program showed significant co-occurrences of Adaptors and Situationals (=70), of Adaptors and Illustrators (=47), of Adaptors and Regulators (=29), of Emblems and Adaptors (=22), and of Regulators and Situational gestures (=22). These results reveal that novice teachers tend to make more gestures and kinesic demonstrations when teaching than do expert teachers. Specifically, many Adapters were observed and it is precisely this kind of gesture (i.e. object adaptor, multi-adaptor, hetero-adaptor and, especially, self-adaptor) that has no communicative purpose; indeed, their use often reflects a degree of insecurity, which is much more typical of novice teachers. Expert teachers use so many adaptors also but in a low range. The most interesting finding concerns the co-occurrences between regulators and situational gestures, which implies that when a teacher changes his/her spatial position he/she makes gestures to regulate the group. This occurs in both cases but, once again, is more common among novice teachers.

Tables 5 and 6 show the significant adjusted residuals ($p < 0.05$) for novice and expert teachers, respectively, in the first sequence analysed as lag 0. The significant adjusted residuals for novice teachers (Table 5) are highlighted and show a strong association between Emblems

Table 5 Adjusted residuals for the combination of kinesic behaviours at lag 0 for novice teachers

Given	Determined				
	Emblem	Adapter	Regulat	Illustra	Situati
Emblem	0.00	28.93	−5.95	−4.09	−11.96
Adapter	0.00	−19.45	8.85	6.29	1.14
Regulat	0.00	−4.18	−5.58	−4.12	10.15
Illustra	0.00	−0.39	−0.52	−0.38	0.94
Situati	0.00	0.00	0.00	0.00	0.00

Table 6 Adjusted residuals for the combination of kinesic behaviours at lag 0 for expert teachers

Given	Determined				
	Emblem	Adapter	Regulat	Illustra	Situati
Emblem	0.00	12.70	−2.26	−3.03	−3.68
Adapter	0.00	−7.37	3.90	5.22	−2.53
Regulat	0.00	−1.69	−1.97	−2.64	4.59
Illustra	0.00	−1.42	−1.66	−2.22	3.86
Situati	0.00	0.00	0.00	0.00	0.00

and Adaptors ($r_{adj} = 28.93$), Regulators and Situational gestures ($r_{adj} = 10.15$), Adapters and Regulators ($r_{adj} = 8.85$) and between Adaptors and Illustrators ($r_{adj} = 6.29$). The significant adjusted residuals ($p < 0.05$) for expert teachers (Table 6) are also highlighted and show a strong association between Emblems and Adaptors ($r_{adj} = 12.70$), Adapters and Illustrators ($r_{adj} = 5.22$), Regulators and Situational ($r_{adj} = 4.59$), and between Adaptors and Regulators gestures ($r_{adj} = 3.90$) and similarly between Illustrators and Situationals ($r_{adj} = 3.86$). Once again it can be seen that novice teachers generate more kinesic behaviours than do experts. The data regarding sequentiality between emblem and adaptor gestures is fairly significant in both cases, suggesting that a highly-defined emblem gesture is followed by adaptor gestures as a way of finalising or providing a gestural anchor for the segments of the teacher's body.

This method of sequential analysis also shows that the same occurs when we cross the kinesic behaviours with the proxemic ones (Tables 7, 8). The codes refer to the following: 1C: the teacher is situated in the centre of the teaching space with respect to the group as a

Table 7 Adjusted residuals for the combination of kinesic and proxemic behaviours at lag 0 (co-occurrence of both behaviours) for novice teachers

The significant adjusted residuals are highlighted ($p < 0.05$), both the excitatory (positive values) and negative ones (negative values)

Given	Determined			
	1C	1P	3C	3P
E7	−2.01	−1.32	2.80	0.11
E8	−1.07	−0.70	2.22	1.48
E10	−0.94	−0.62	5.24	−0.46
E11	−2.94	−1.92	−1.58	−1.43
A2	3.06	−0.40	−0.60	−0.30
A6	−1.13	−0.74	−0.07	−0.55
A8	−0.83	−1.03	6.77	2.01
A9	3.03	3.15	−0.85	−0.42
R8	−1.07	−0.70	2.22	1.48
R9	−1.79	−0.52	6.50	−0.39
R10	−1.13	−0.74	2.00	1.35
R12	−2.01	−1.32	−0.77	1.21
R13	−1.13	−0.74	2.00	1.35
I2	−3.89	−2.55	−0.70	−1.89
I3	−1.52	−1.00	2.39	3.53
I5	−1.29	−0.84	2.38	−0.63

Table 8 Adjusted residuals for the combination of kinesic and proxemic behaviours at lag 0 (co-occurrence of both behaviours) for expert teachers

Given	Determined			
	1C	1P	3C	3P
E7	0.87	−1.81	4.36	1.84
E10	−0.86	−3.08	4.52	−0.57
E11	−1.44	−5.15	−0.50	−0.95
E12	−0.39	−1.40	4.24	−0.26
A2	3.49	−0.99	−0.67	−0.18
A6	−0.20	−0.70	−0.47	7.75
A7	−0.20	−0.70	2.11	−0.13
A8	−0.59	−2.10	2.91	2.25
A9	−0.29	5.90	−2.47	1.89
R4	−0.48	−1.71	−0.10	2.91
R5	−0.62	−2.22	−1.51	−4.41
R7	−0.95	−3.39	−1.76	−0.63
R12	−1.31	−4.70	−0.35	0.36
R13	−1.14	−4.09	−1.40	−0.76
R15	−0.62	−2.22	2.61	−0.41
I1	−0.88	−3.16	8.40	1.20
I2	−1.99	−7.11	9.79	0.43
I3	−0.71	−2.53	4.79	1.73
I5	−0.81	−2.91	1.20	1.39

The significant adjusted residuals are highlighted ($p < 0.05$), both the excitatory (positive values) and the negative ones (negative values)

whole (macro-group); 1P: the teacher is situated at the periphery of the teaching space with respect to the group as a whole (macro-group); 3C: the teacher is situated in the centre of the teaching space with respect to a sub-group of students (micro-group); and 3P: the teacher is situated at the periphery of the teaching space with respect to a sub-group of students (micro-group).

In general the two tables show that novice teachers use the central teaching space more than the periphery, while the latter is used more by expert teachers who, in turn, relate more to small (micro-) groups. Novice teachers use more adapter gestures, mainly self-adapters, when they are located centrally with respect to the group, and as noted above, this illustrates a degree of insecurity on their part. In contrast, expert teachers use such gestures when they are at the periphery of the teaching space, which avoids any interference with the quality of their communication, since the gestures are made when they are not communicating directly with pupils. Novice teachers use more regulatory and illustrative gestures in any type of group format, whereas expert teachers only do so when they are situated peripherally to the large group or with specific subgroups.

3.2 Detection of T-patterns

The observation of a natural context requires the use of the above-mentioned observational instrument. In-depth analysis is then possible with the detection and analysis of temporal patterns (T-patterns) in the transcribed actions. Based on the above sequential analyses, Fig. 1a and b shows two T-patterns derived from a similar teaching situation with a macro-group (MAC), in which the abovementioned differences are revealed. Both pattern tree
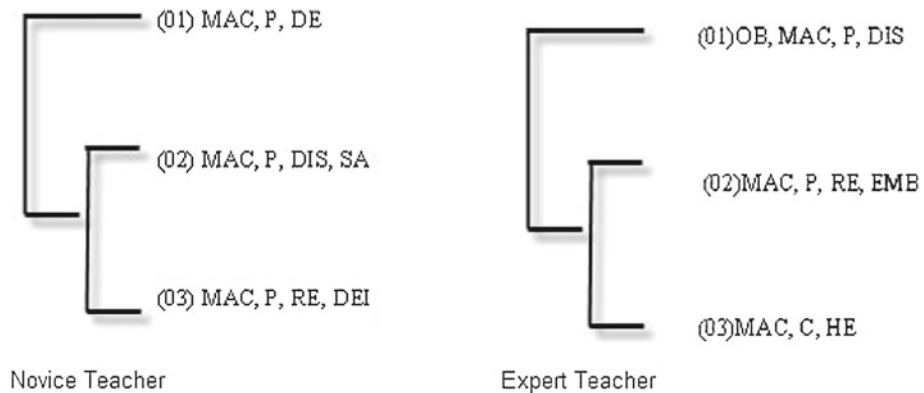
Fig. 1 a Tree graph demonstrating a detected pattern with a novice teacher doing demonstration (DE), followed by self-adapters without a communicative purpose (SA) while he observes (OB) and makes regulatory gestures (RE) in the form of deictics (DEI). **b** Tree graph demonstrating a detected pattern with an expert teacher showing how he doesn't need to demonstrate, only observe (OB), before moving on to regulate (RE), with the quality of his emblematic gesture (EMB), but without the need for a self-adapter. He later moves into the central area of the room in order to help (HE)

graphs/dendograms[1] show three levels of concurrence of paraverbal communicative behaviours. Figure 1a corresponds to a novice teacher and it can be seen that he uses more demonstration (DE) and self-adapters without a communicative purpose (SA) while he observes (OB) and makes regulatory gestures (RE) in the form of deictics (DEI), whose function is to indicate. Figure 1b corresponds to an expert teacher and shows how he doesn't need to demonstrate, only observe (OB), before moving on to regulate (RE) by means of the quality of his emblematic gesture (EMB), but without the need for a self-adapter. He later moves into the central area of the room in order to help (HE).

The T-pattern of Fig. 2 shows an interesting relationship between the criteria *Function* and *Transitions* for both types of teachers. The *Theme* program allows grouping all the recordings of each teacher and derived frequencies and T-patterns that reveal the trends in kinesic and proxemic paraverbal communication from an ideographic perspective between experts and novice teachers.

In particular it reveals a common association between the regulatory (RE) function and static bipedal (FB) postures, whereas the illustrative (IL) function is combined with locomotion (LOC) or movement around the teaching area.

4 Discussion

The present study sought to offer a way of optimising teaching styles by using the *Theme* software to perform sequential analyses and obtain T-patterns based on the kinesic and proxemic behaviours observed in teachers. As reported in our previous research that aimed to optimise the observation of kinesics and motor skills (Castañer et al. 2009), the observation of a natural context (Anguera 2003) requires the use of ad hoc observation instruments, such as those used here, as well as the detection of sequential and temporal behavioural patterns

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[1] **How to read the pattern tree graph**: The tree graph shows the events occurring within the pattern, listed in the order in which they occur within the pattern. The first event in the pattern appears at the top and the last at the bottom. The pattern diagram (the lines connecting the dots) shows the connection between events.
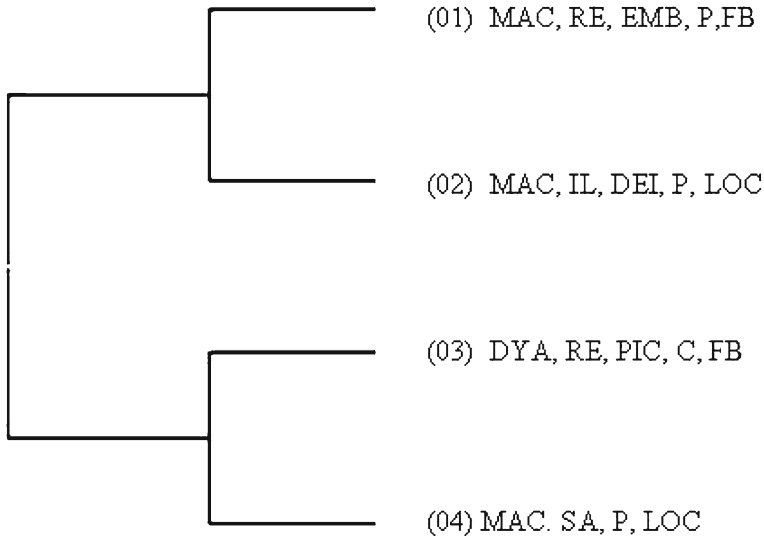
(01) MAC, RE, EMB, P, FB

(02) MAC, IL, DEI, P, LOC

(03) DYA, RE, PIC, C, FB

(04) MAC. SA, P, LOC

Fig. 2 Tree graph demonstrating the relationship between the criteria *Function* and *Transitions* for both types of teachers

in the transcribed actions. The *Theme* program allowed grouping together all the recordings of each teacher (nomothetic view) enabling the search for temporal patterning occurring across observation periods. The results revealed number of T-patterns that corresponding to trends in kinesic and proxemic paraverbal communication from a pedagogical perspective (see Figs. 1a, b, 2).

With respect to the criteria of the observation instruments (SOCIN and SOPROX) the relevant T-patterns obtained and described in Sect. 3 invite a more detailed discussion of the following sequences in the communicative styles of the PE teachers:

(1) Teaching situations involving *regulation* are those in which the teacher requires an immediate response from pupils (for example, orders, questions, etc.). In this kind of situation, regulatory gestures (RE) are morphologically coded predominantly by means of Emblems (EMB), for example, in situations in which pupils are asked to move closer through emblematic gestures involving one or both arms in a beckoning movement, without the need to speak. It was observed that expert teachers make use of this communicative strategy which, to an extent, enables them to 'save their voice' in noisy situations or when there is some distance between teacher and pupils, their voice being substituted by iconically agreed gestures (emblems). Clear—and even coded—examples of this strategy have also been found in the gestural codes of basketball and scuba diving. It is also worth noting the co-occurrences between regulators and situational gestures (Tables 3, 4), which implies that when the teacher changes his/her spatial position (in order to Demonstrate, Help, Participate, Observe, Show Affect or Provide Material) he/she makes specific regulatory gestures toward the group. This occurs in both cases but, once again, is more common among novice teachers.

(2) Teaching situations involving *illustration* are those in which the teacher does not require an immediate response from pupils. They may, however, invite a delayed response, for example, after the teacher has explained a given activity and told pupils how they should distribute themselves the latter will then follow these instructions. As such, most expla-

nations made by a teacher regarding situations, or the feedback provided about a situation already performed, are examples of illustrative behaviour. In this kind of situation, illustrative gestures (IL) are coded through Beats (BEA), which are gestures without any specific iconic definition. Rather, they are highly indicative of the individual in question: for example, some people move their hands in unison, others only move one hand at a time, some do not move their hands but their whole body a little, or perhaps just their head. In sum, these gestures accompany the logic and rhythm of spoken discourse, but we can do without them entirely. The results show that novice teachers make greater use of this kind of gesture, at times excessively so, whereas expert teachers use them in a way that is more adequately tailored to their own communicative style.

(3) Adaptor gestures, as shown in Tables 1 and 2. Many adapters were observed (for example, object adaptor, multi-adaptor, hetero-adaptor and, especially, self-adaptor), although these gestures have no communicative purpose and are often a sign of insecurity, which is common among novice teachers. The data regarding sequentiality (Tables 5, 6) between emblem and adaptor gestures is fairly significant in both cases, suggesting that a highly-defined emblem gesture is followed by adaptor gestures as a way of finalising or providing a gestural anchor for the segments of the teacher's body. This anchor was much more noticeable in novice teachers, which again can be related to possible insecurity. Another interesting aspect is shown in Tables 7 and 8, which indicate that novice teachers use more adapter gestures, mainly self-adapters, when they are located centrally with respect to the group; as noted above, this illustrates a degree of insecurity on their part. In contrast, expert teachers use such gestures when they are at the periphery of the teaching space, which avoids any interference with the quality of their communication, since the gestures are made when they are not communicating directly with pupils.

(4) Deictic forms (DEI) of gestures have a special meaning since, anthropologically speaking, they are perhaps the first communicative gesture whose function was to indicate or point at something. The enormous range of our body language rests on the deictic gestures derived from *deixis* (from the Greek δ ε ῖ ξ ι ς). Each gesture can be performed biomechanically in several ways (with one or two arms, extended, semi-extended, pointing with one or more fingers, or even using our leg, foot or head to indicate something). Therefore, above and beyond the individual style of each teacher in using one deictic gesture or another, the important aspect is which one is used and how. The sequential analyses conducted here show that such gestures are usually associated with regulatory behaviours, although they may also appear when the teacher illustrates as part of an explanation.

(5) Pictographs (PIC) and Kinetographs (KIN) are of interest in relation to the effectiveness and discursive clarity of teachers. These gestures, without reaching the status of emblems, accompany verbal discourse and lend it a descriptive quality. Pictographs 'draw' in space the qualities and properties of what is being explained; for example, using both hands to draw a circle in the transverse plane so as to illustrate, for instance, that pupils should form a circle in the room. Similarly, forming a pincer with the thumb and index finger of each hand, bringing them together and separating them progressively while drawing a line in space, might illustrate that something is long and thin. Kinetographs have the same purpose as pictographs but with the added value of 'drawing' movement, i.e. action. For example, a hand can show the action of bouncing a ball, even though there is no ball there. As such, pupils can easily imagine the ball through the bouncing movement indicated by the hand movement. The analyses showed that expert teachers make adequate use of this type of illustrative gesture, whereas their usage varies considerably among novice teachers. Specifically, novices tend to make excessive use

not only of beats (as noted earlier) but also of pictographs and kinetographs. Overall, they resort to a greater number of gestures and kinesic demonstrations than do expert teachers when teaching.

(6) With respect to the combination of proxemic and kinesic behaviours the results of the sequential analyses reveal two relevant aspects:

(6a) It can be seen in Tables 7 and 8 that when the activity is performed by the macro-group, novice teachers are likely to be situated at the centre, whereas expert teachers prefer to locate themselves at the periphery. We interpret this as demonstrating that experts seek to promote more self-management in the group, rather than always taking up a more central or integrated role themselves. When the activity is done by a micro-group a similar trend is observed, although expert teachers also relate to the micro-group when they are in the centre of the teaching area.

(6b) The dendograms of the sequential T-patterns depicted in Fig. 2 reveal an interesting relationship between the criteria *Function* and *Transitions* for both types of teachers. In particular they show a common association between the regulatory (RE) function and static bipedal (FB) postures, whereas the illustrative (IL) function is combined with locomotion (LOC) or movement around the teaching area. It appears that when giving an illustration, which does not require a gesture of interaction, the teacher feels freer to move around. In contrast, the regulatory function, which does call for gestures that indicate interaction, seems to require greater concentration on the part of teachers and leads them to fix their posture and thus focus their vision on a single point while asking questions, making comments or giving orders, etc.

5 Conclusions

Having discussed the results in detail it would seem helpful to end by offering some general and concise conclusions regarding what this study has contributed. The results support the conclusion that in comparison with expert teachers, novice teachers make not only a more quantitative use of gestures and various uses of space, but also that their paraverbal behaviours are less qualitative, in that they fail to take full advantage of certain gestures, such as emblems and kinetographs, or certain uses of space, such as their position with respect to the group. For all teachers, having an optimum paraverbal communicative style (both kinesic and proxemic) in combination with effective verbal communication is important in terms of the efficacy of instruction. The most morphologically defined kinesic behaviour corresponds to Emblems, Deictics, Pictographs and Kinetographs, all of which are of considerable value in terms of illustrating and regulating verbal discourse provided they are used adequately (McNeill 2005). However, their excessive use, as tends to be the case among novice teachers, is something that needs to be gradually rectified as teachers gain in expertise. The same could be said for the frequent use of Adaptors which, as noted in the discussion, reflects anchors (Roth 1999) of insecurity among novice teachers.

Regardless of a teacher's experience it is always worth questioning the forms, style and quality of the messages that are communicated both verbally and para-verbally in everyday teaching practice. We firmly believe that the optimisation of these communicative styles can have a direct positive effect on teaching processes for all teachers, although especially for PE teachers, whose own body is the protagonist of this subject and curricular area.

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