Development of a questionnaire to measure physical education teachers' representations on instruction

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ABSTRACT Drawing from the work of Abric (1993, 1996) and Moscovici (1982, 1988) on representations, as well as on the work of Mosston and Ashworth (2002) on teaching styles, a questionnaire was developed to measure physical education teachers' representations in terms of instructional structure. Eighty-four elementary school physical education teachers that were employed in the city of Athens consented to participate in this study. Teachers' years of experience ranged from 3 to 35. Twenty-four of these teachers had done postgraduate studies. Exploratory factor analysis results revealed a four-factor solution with a very good internal consistency as it waw assessed by Cronbach's *alpha* coefficients. Further evidence of construct validity was provided by the fact that the questionnaire revealed identical solutions as displayed in theoretical education models. The results are discussed in terms of the psychometric properties of the questionnaire. To assess teacher differences with regard to the revealed factor structure multivariate analysis of variance (MANOVA) techniques were employed. The results indicated significant differences only for the independent factor of postgraduate studies [Wilk's $\lambda = .596$, $F(3, 24) = 4.07$, $p = .012$], while non significant differences were found for the factors of gender and years of teaching experience. Follow-up univariate analysis (ANOVA) was conducted for the revealed significant independent factor in question.

Key words: Reproduction, Assimilation, Discovery, Production.

Introduction

Physical education (PE) teachers have in the course of time developed their own representations regarding instruction; their own collective, consensual, personal teaching theory (Bromme, 1984), as a structured set of instructional activity schemes that have many similarities to each other (Marland, 1994:178). In this perspective, the similarities are dual, and refer to structure (the organisational principles of representations' central *nucleus*) and to function (the teaching styles of the representations' peripheral system which teachers prefer to use) (Abric, 1993, 1996).

Theory and research suggest that the teaching activity schemes, in terms of structure and function, are of great importance for the PE instruction. Consistently:

(I) PE curricula are aiming at achieving psychomotor, cognitive, affective and social instructional targets, with a view to contribute to overall learners' development (Salvara, 2001a, 2002a, 2002b). In order for this to be achieved, it appears that teaching activity schemes should be extensive, to alternate and to display a degree of equilibrium in their use (Bolhuis, 2002).

(II) Pupils exhibit heterogeneity (Dunn et al., 1989; Willis & Hodson, 1999) and display different learning styles.

There exist several studies suggesting that

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pupils are presenting heterogeneity (Salvara, 2001a:127; Willis & Hodson, 1999:75), meaning that each pupil learns different things in a different manner and for different purposes. In this vein, pupils could be characterised by different thinking patterns and achievement orientations on the subject to be learnt (Papaioannou, 1994; Silverman, 1991). Again, consonant with the work on pupils' learning, Coker (1996) suggested that pupils have their own ways of learning. For the learning process to be as efficient as possible, teachers should recognize their pupils' learning modes and adjust instruction accordingly (Coker, 1996). Four contrasting general learning types have been defined in current literature. Dunn and his colleagues (1989) have distinguished pupils to visual learners, kinaesthetic learners, thinkers and listeners.

Learning styles create different achievement orientations and activate pupils towards learning in a different manner (Papaioannou & Goudas, 1999), without implying that certain groups are culturally superior or inferior. Taking these conceptual findings into account, the present study sought to emphasize the need for instructional pliability, so that all pupils may have equal opportunities for accessing PE.

The present study has focused on questions that were thought of comprising unresolved mechanisms for the examination of teachers' representations on instruction. Specifically, the questions initially raised were: Which are the organisational principles favoured by teachers in Athens? How are they organised? In what extent can these represented realities meet the requirements of the curriculum and contribute to the learners' overall development? Will teachers' representations differ with respect to a vector of factors considered, such as gender, teaching experience and postgraduate studies? It should be noted that the present study involved only the perspective of organisational principles and did not encompass the representations' peripheral system (i.e., the teaching styles investigation in terms of function).

Theoretical framework

Teachers' representations

PE teachers design, apply and evaluate their instruction based on the representations they have in their mind (Abric, 1996). According to Moscovici (1973), representation is a system of values, ideas and practices embracing a dual function. Firstly, representation establishes an order, which enables individuals to orientate themselves and master their material social world. Secondly, it facilitates communication among the members of a community by providing them with a code of the various aspects of their world and their individual history (Sotirakopoulou & Breakwell, 1992).

This multifaceted concept has been strongly supported by Wagner (1993:1). On the one hand, representation is conceived as a social process of communication and discourse in the course of which meanings are generated and elaborated. On the other hand, representation is seen as an individual attribute, as an individual structure of knowledge and affect, which is shared with other people in a group or community. Representation's versatility stems from a particular openness of the theory, which, according to Moscovici (1988) and Farr (1993), encompasses the precondition for further development and elaboration. Farr (1990) concluded that representation indicates a specific form of knowledge (i.e., common-sense knowledge). More generally, it indicates a form of social thought.

In this perspective, Wagner (1993:236) stated that «representations do not account for the behaviour of individuals per se, but only for the behaviour of individuals qua members of social groups». As such, Moscovici (1984:60) holds that representations do not mediate stimuli, but they are stimuli themselves, and therefore independent variables in empirical investigations.

A further explanation on representation is that it contains meanings and icons for all instructional factors (Abric, 1993). It appears

more likely that PE teachers, so as to make their thoughts and ideas applicable in the field, tend to create an image of the actions for their instruction (Abric, 1996). These images are followed by constructed perceptions ready to be applied in practice (Moscovici, 1994; Mosston & Ashworth, 2002) and «obey» more or less to one landmark cluster theory of teaching styles (Mosston & Ashworth, 2002). These constructed perceptions are known as «representations» (Schulman, 1999).

A basis for the configuration of representations is the critical faculty that representation directly depends on the status applied by the educational system. In order to form representations, it is essential to have the embodiment of multiple codification regarding action, visual perceptions and verbal application (Bruner, 1966). In their study Sotirakopoulou and Breakwell (1992:30) mentioned: «The fact that social representations acquire meaning, structure and image through verbal expression and communication creates one more complexity that has to be taken into account in the selection of the methodology».

Furthermore, representations require the intervention of thinking processes such as discerning, grouping, verbal formation, conclusions, explanations and discovery for their formation (Flament, 1994). Additionally, for the formation of thinking processes in the representation models it is required to have specific diagrams of instructional actions, cognitive mapping and chains of phrases (Dick, 1980; Gagné, 1985).

However, representations are, in fact, thinking systems that do not simply represent opinions, pictures and postures; by contrast. they are theories for the organisation of reality (Moscovici, 1994). The term «representation» embraces anything related to PE teachers' collective thought on instruction, given that it is the outcome of cognitive processed, experienced and commonly accepted knowledge base (Moscovici, 1994).

It is suggested (Moscovici, 1988) that the representation system has coherence and balance. It summarizes and categorizes complex teaching situations. It incorporates contradictions. It changes and develops. When a group of teachers expresses its opinion in relation to a teaching style, the system reconstructs the representation involved in such a way so that it could be coherent with the configured conceptions (Moscovici, 1988). There is no a priori objective teaching reality; instead, the teaching reality can be represented, assimilated by the group of teachers and reconstructed in its passage through time.

Theory and research into representations utilize three functions attributed to them: (I) As an interpretative system of the teaching reality that configures a common framework of knowledge (Flament, 1994) which determines the organisational principles. Moreover, PE teachers are provided with the grounds whereupon to support their instructional options (Doise & Mugny, 1979). (II) As a construction system of teaching identity, this differentiates each PE teachers' group (Doise & Mugny, 1979). And (III) as a pre-codification system of teaching reality, which determines the goal to be adopted during instruction (Abric, 1993).

In this vein, the aforementioned teaching reality has got its own structure. The organisational principles of teaching practice are constituents of that structure. The organisational principles work in a generative and stabilizing manner (Abric, 1993; Flament, 1994). They form the element that determines the teaching style schemes in instruction. Any apparent change in the organisational principles involved causes overall alterations in representations, occurring as a subsequent modification in the peripheral system (i.e., the teaching style scheme).

A great deal of research into representations has suggested that the organisational principles of teaching practice are coherent and organised around a central nucleus (Abric, 1993; Flament, 1994), that comprises the centre (Heider, 1958) of instruction. In this respect, organisational principles form a multiple system of contradictory viewpoints regarding learning, teaching work,

communication, performance, evaluation and handling of pupils' mistakes. The identification of the central nucleus allows for comparison between representations at the level of organisational principles regarding teaching practice (Abric, 1993, 1996).

Around the central nucleus the organisation of the representations' peripheral system is found to be salient. The peripheral system is in direct relationship with the central nucleus (i.e., its symmetry, its dynamics and its function are determined by the central nucleus) (Abric, 1996). It appears to constitute the substantial content of representation, the most accessible one. It appears to be of the most vivacious and specific nature. The peripheral system is hierarchically organised in schemes of teaching styles. The constitution of teaching styles plays a prominent part in concretizing the sense and explanation of representation as well as in explicitly stating and justifying representation's sense.

From this perspective, it seems that teaching style schemes mediate between the central nucleus and the teaching situations. Teaching styles assemble three functions: (I) they concretize the representations, (II) they regulate adjustments regarding the teaching circumstances and (III) they constitute a defence shield in the form of «buffers» during representation transformations (Flament, 1994).

Consequently, the organisational principles and the teaching styles schemes function as a totality. The schemes of teaching styles are formed and operate around the organisational principles, which safeguard uniformity in teaching action. Teaching styles schemes are sets of actions with intent; they are product-oriented and institutionalised in relation to roles. Teaching styles function in a more flexible manner, i.e. they allow a certain amount of heterogeneity in the content of teaching actions and their organisation (Abric, 1996; Doise & Mugny, 1979). Thus, representations are experienced peripherally in the form of teaching styles (Abric, 1993).

In support to this, research has indicated (Bergman, 1999; Wagner, 1993) that organisational principles play a part in the stability; coherence, duration and conservation of representations, while the teaching styles depend on the teaching circumstances and the individual characteristics of the PE teachers. As a consequence, teaching styles get adjusted, differentiated and altered (Bergman, 1999). It appears that organisational principles and schemes of teaching styles mutually exist and function as representations' multiple systems. It has been strongly supported that representation accompanies teaching style, while at the same time it precedes and informs it, gives form to it, justifies and rationalizes it (Abric, 1996). It is argued that organisational principles only organise teaching styles. On the contrary, organisational principles construct teaching styles, when these are well constituted and possess the scheme of a product-oriented action base (Flament, 1994).

In short, the literature on representations has proposed two controversial positions: (I) organisational principles are determined by the teaching styles; they are mere reflections of production procedures (Ibanes, 1989; Beauvois et al., 1991), and (II) teaching styles are determined by the organisational principles (Moscovisi, 1988; Abric, 1993; Jodelet, 1989).

The evidence so far supports the existence of a determination relationship between the teaching styles by the instructional organisational principles in instances where the latter consist of representational acts, i.e. a set of habitual teaching styles in a routine form, a product of the collective perception applied with the group consensus within a framework of relative autonomy, which allows for varied and contradictory options. It is supported that as the role played by the organisational principles increases in importance, the more complicated and dilemmatic the situations faced by PE teachers become (Abric, 1996), as in the case with every teaching situation (Pieron, 1994).

Teachers, when facing a teaching situation,

cause the presence of the image of specific teaching styles as an expression of their perceptions of learning, teaching work, communication, evaluation and performance. Consequently, teachers reconstruct the representation they have in mind in order to adjust it to the sequence they have to teach, to the learners' age, to pupils' knowledge level and learning styles.

Teaching styles

Mosston's spectrum of teaching styles is a framework of teaching approaches derived from the chain of decision-making occurring in the teaching-learning interaction. Mosston and Ashworth theorized that specific teaching styles emerge based on whether the teacher or pupils make these decisions (Mosston & Ashworth, 2002). Spectrum theory suggests that there exist two instructional spectrum directions. At one end of the spectrum pupils make all the decisions and at the other end all the decisions are made by the teacher (Curtner-Smith et al., 2001; Mosston & Ashworth, 2002; Salvara, 2001a, 2002a, 2002b). Mosston and his colleague (Mosston & Ashworth, 2002) have identified eleven different teaching styles. Each of these styles is unique, because each has its own decision-making process where teacher and pupils operate under different sets of conditions. «Decisions always influence what happens to people; each style affects the developing learner in unique ways» (Mosston & Ashworth, 2002:6).

Mosston and Ashworth (2002) have distinguished two clusters of landmark styles. The styles in the one cluster are known as reproductive, because within them pupils reproduce information demonstrated by the PE teacher and the aim in these styles is for the pupils to shadow (Curtner-Smith et al., 2001) the pattern shown by the teacher. In contrast, the styles in the second cluster are known as productive, because pupils in these styles produce knowledge that is not known, «knowledge that is new to the learner, new to the teacher and, at times, new to society» (Mosston & Ashworth, 2002:5).

In the present study two more clusters strongly supported in theory, namely the assimilation and the discovery clusters, were included. In the assimilation cluster pupils assimilate the pattern shown by the teacher, while in the discovery (Bandura, 1977) pupils «are involved in problem solving, reasoning and inventing» (Mosston & Ashworth, 2002:6).

Purpose of the study

In particular, this study aimed at investigating the teaching activity schemes in terms of structure, i.e. organisational principles considering the issue of whether PE teachers' representations make up a comprehensive framework attributed to four landmark instructional areas: I) reproduction; II) discovery; III) assimilation and IV) production (Mosston & Ashworth, 2002).

Since individuals are more likely to interact with members of own group, they develop and transmit a particular set of representations that may differ in substance from that of other groups (Bergman, 1999). If «at the collective level representations correspond to culture» (Farr, 1990:58), then we should find variations in the content of representations across cultures (Bergman, 1999:2).

A small but growing number of studies in PE have investigated teachers' employment of teaching styles in terms of function (Goldberger, 1992; Byra & Marks, 1993; Ernst & Byra, 1998; Cai, 1998; Byra & Jenkins, 1998; Curtner-Smith et al., 2001; Salvara, 2001a; Salvara, 2002a) and the effects of cooperative teaching on pupils' motivation (Papaioannou & Goudas, 1999; Ntoumanis, 2001; Hassandra et al., 2002), as well as the effects of different teaching styles on pupils' dispositional and situational goal orientations and perceived motivational climate (Salvara, 2002). However, to date no published research has investigated the Greek PE teachers' re-

Table 1
Representations

Central nucleus	Peripheral system
Organisational principles of teaching practice	Teaching styles
- Organisational principles form a common basis, which is connected with the collective perception and reflects the *homogeneity* of teaching practice. - Organisational principles are stable and coherent, while their role is *regulatory*. - Organisational principles are of generative character and determine the *organisation* of representations.	- Teaching styles are susceptible to trans-individual differences and reflect the *heterogeneity* of teaching practice. - Teaching styles are pliable and flexible, while their role is *functional*. - Teaching styles consist of *representational acts* adjusted to teaching situations.

presentations on instruction in terms of structure.

The main purpose of the present study was to use a more comprehensive measure of teachers' representations on instruction. Moreover, to examine PE teachers' represented importance regarding instruction attributed to four landmark instructional areas: reproduction, assimilation, discovery and production.

Research indicates that teachers' knowledge and beliefs influence the activities selected during instruction (Ennis & Chen, 1995). This study was based upon the perception that PE teachers' representations encounter theories for the organisation of instruction. Representations classification contains four models for the elements of organization, accomplishment and evaluation of teaching performance. These are the reproductive, the assimilative, the discovery and the productive ones (Mosston & Ashworth, 2002; Salvara, 2001a, 2002b). This study is an attempt to facilitate more in depth knowledge about teachers' perceptions regarding their work. Specifically, the purpose was to create a more comprehensive questionnaire that could possibly reveal PE teachers' representations on teaching and learning.

Additionally, it was assumed that possible reasons for teachers' represented importance would comprise the factors of gender, postgraduate studies and teaching experience. For this reason a secondary purpose of the present study was to examine the possible reasons for teachers' revealed represented importance on PE-TRIQ.

Method

Participants and data collection

Eighty-four PE teachers employed in the city of Athens (41 males and 43 females) consented to participate in this study. They all taught mixed gender elementary school classes. Teachers' years of experience ranged from 3 to 35. Twenty-four of these teachers have done postgraduate studies in the field of sport sciences.

This research was based on anonymity of the subjects who participated and a cover letter explaining the procedures and purposes of this research was distributed to each teacher respectively. Permission for this study was granted by the Hellenic Pedagogical Institute.

The return rate of the Physical Education Teachers' Representations on Instruction Questionnaire (PE-TRIQ) was 96%. The questionnaires were self-administered, but not always completed on the spot by the teachers. The authors were

available throughout the process for uprising questions by the respondents. As a consequence, the possibility of missing or misunderstood data was eliminated.

Responses were first examined to determine whether the statements seemed clear and appropriate and then the necessary corrections were made (Borg & Gall, 1989). An independent panel of pedagogy experts (N = 9) in the field reviewed each item's face validity in terms of whether it reflected a reproduction, production, assimilation or discovery model in the physical education context. The panel also provided guidelines and remarks for corrections regarding the clarity of language and meaning. Content validity was established by making all methodological decisions related to data collection and analyses in light of the framework that was theorized for studying representations and teaching styles (Moscovici, 1982; Mosston & Ashworth, 2002).

The issue of the PE-TRIQ statements estimated importance was a matter of mere degree –teachers were asked «how important do they regard each statement»– expressed on a five-point Likert-type scale anchored by *strongly disagree* = 1 to *strongly agree* = 5.

Physical education teachers' representations on instruction questionnaire

The PE-TRIQ consists of 28 items, which are attributed to six main areas of concern accounting for teachers' representations on: learning, teaching, learner's development, communication, evaluation and handling of learners' mistakes. Table 2 presents the six fields of teachers' representations.

Data analyses

Exploratory factor analysis using varimax rotation with principal component analysis (PCA) extraction was conducted to verify the validity of PE-TRIQ. Cronbach's (1951) *alpha* coefficients were calculated for each revealed factor structure respectively: discovery, production, reproduction and assimilation models. Multivariate analysis of variance (MANOVA) was conducted to examine whether any differences in the PE teachers' represented importance on the PE-TRIQ items could be attributed to the characteristics of gender, years of teaching experience and teachers' postgraduate studies. Follow-up univariate analysis of variance (ANOVA) was performed for the effects revealed. Data analyses were performed solely with the Statistical Package for Social Sciences, version 10.1. (SPSS Inc., 1999).

Results

PE-TRIQ internal consistency

The internal consistency of the questionnaires was determined by Cronbach's (1951) *alpha* reliability coefficients for the revealed four-factor-solution. All PE-TRIQ scales demonstrated reliable internal consistency. The reliability of the four factors ranged from .79 to .97. Alpha coefficients are displayed in Table 3.

PE-TRIQ construct validity

An exploratory factor analysis using varimax rotations with PCA examined the structure of the 28 items designed to measure teachers' representations on instruction. Stevens (1996) recommended interpreting only factor loadings with an absolute value greater than .4, which explain around 16% of the variance. Following Stevens suggestions, in the present analysis the minimum loading used to identify items was .40.

A four-factor solution with eigenvalues greater than 1 (Kaiser, 1960) emerged, accounting for 84% of total variance. The Kaiser-Meyer-Olkin (KMO) coefficient was taken into consideration. The results indicated that since KMO coefficients was greater than .5, the present study sample was

Table 2
Six fields of PE teachers' representations on instruction (PE-TRIQ)

Representations for:	Interpersonal expression forms
1. Learning	As display with explanations; as observation and imitation of a model; as questions asked aimed at explanation; as solution through discovery; as multiple-solution creation; as directed or free individual program planning.
2. Teaching	As work with all learners together in a uniform manner; as reciprocal work; as work with self-control; as a work with selection of difficulty level; as work through discovery; as individual planning.
3. Learners' development	When the PE teacher makes all the decisions for the preparation, the conduct and the evaluation; when the PE teacher delegates part of the decisions in respect of the conduct; when the PE teacher delegates part of the decisions regarding appraisal; when the PE teacher delegates part of the decisions regarding preparation; and when the PE teacher delegates all decision-making to the learners.
4. Communication	When the PE teacher suggests, without explaining; agrees with the learners; guides the learners.
5. Evaluation	When the PE teacher estimates the achievement of the objectives with either a mark or a remark; adjusts the subsequent teaching actions; checks the knowledge prerequisites; assists with the recognition and correction of mistakes.
6. Handling of learners' mistakes	When the PE teacher takes the learners' errors as products of carelessness; regards the errors as products of confusion and regards mistakes as display of cognitive gaps and explains the procedure; regards mistakes as inadequate and wrong transformation of previous knowledge and brings them back for reformation.

Note: Parts of the theoretical aspects included in this table were sourced from Mosston and Ashworth (2002).

adequate (Field, 2000:445). Specifically, KMO was found .811, at $p < .001$. The anti-image correlation matrix indicated that most of the off-diagonal elements representing the partial correlations between the variables were small ($p < 0.5$), indicating that the sample was adequate for the given variables examined in each factor (Field, 2000:446).

The criterion of the Bartlett's Test of Sphericity (BTS) was found 1888.450, at $p < .0001$. BTS results showed that the present data were adequate to follow with the factor analyses (Nunnaly, 1978).

Communalities (h^2) displayed in Table 3 are a measure of variance explained by the extracted factors and were all found to be well above .5

Table 3
Principal component analysis (PCA) for PE teachers' representations on instruction (PE-TRIQ) following varimax rotation

Items	F1	F2	F3	F4	h^2
Discovery					
Learning pursued through a series of questions asked, step-by-step.	.87	-	-	-	.84
Learning pursued by placing the learners in front of a problem aiming at having one single solution discovered, checked by the movement.	.80	-	-	-	.79
Learners' development takes place when the teacher makes all decisions on the preparation and delegates decisions with regards to the conduct and the evaluation.	.58	-	-	-	.71
Communication in which the teacher guides learners having them to recall previous knowledge, analyses the main question into subsequent ones, involving all pupils in the discussion.	.58	-	-	-	.91
Evaluation in which the teacher finds out knowledge gaps.	.83	-	-	-	.90
Dealing with mistakes by means of procedure explanation.	.80	-	-	-	.83
Production					
Learning pursued by placing learners in front of a problem, aiming at having multiple solutions generated, checked with movement.	-	.92	-	-	.93
Learning pursued through a directed individual program plan carried out by the learners in cooperation with the teacher.	-	.92	-	-	.94
Learning pursued through a free planning of an individual program carried out by the learners, with the teacher in an auxiliary role, aiming at having multiple solutions generated.	-	.88	-	-	.92
Learners' development takes place when the teacher delegates some decisions on the preparation, while learners make all decisions regarding conduct and evaluation.	-	.61	-	-	.59
Learners' development takes place when the teacher delegates all decisions regarding preparation, conduct and evaluation.	-	.82	-	-	.88
Evaluation in which the teacher checks the prerequisite knowledge necessary for subsequent learning.	-	.42	-	-	.87
Evaluation in which the teacher assists the learners in finding and correcting mistakes.	-	.61	-	-	.84
Dealing with the mistakes by having previous knowledge reshaped; assumed as incomplete modifications.	-	.64	-	-	.90
Reproduction					
Learning pursued through demonstration and explanations aiming at having a pattern reproduced.	-	-	.78	-	.91

Table 3
Principal component analysis (PCA) for PE teachers' representations on instruction (PE-TRIQ) following varimax rotation

Items	F1	F2	F3	F4	h^2
Teaching carried out with the whole class working all together in a uniform and coordinated manner; aiming at having a pattern reproduced.	-	-	.77	-	.93
Learners' development takes place when the teacher makes all the decisions for the preparation, conduct and evaluation.	-	-	.64	-	.87
Communication in which the teacher suggests activities without explaining.	-	-	.58	-	.92
Evaluation in which the teacher assesses by means of a grade or characterization.	-	-	.73	-	.91
Dealing with mistakes by means of exercising; as these are assumed as carelessness and confusion.	-	-	.58	-	.88
Assimilation					
Learning pursued through the observation and imitation of a pattern, aiming at having learners follow the pattern.	-	-	-	.41	.96
Teaching carried out having learners work individually, aiming at having the learners assimilate with the pattern.	-	-	-	.57	.87
Teaching carried out by means of reciprocal work, having pupils exchange the roles of doer and observer.	-	-	-	.78	.78
Teaching carried out by the learners through self-controlled working progress.	-	-	-	.82	.77
Teaching carried out through the selection of a difficulty level.	-	-	-	.65	.62
Learners' development takes place when the teacher makes all decisions for the preparation and evaluation and delegates decisions with regards to evaluation.	-	-	-	.54	.88
Communication in which the teacher agrees with the learners on what is to happen and explains.	-	-	-	.52	.82
Evaluation in which the teacher regulates the subsequent teaching actions.	-	-	-	.66	.71
% of variance	64.8%	9.3%	5.6%	4.5%	
Eigenvalues	18.1	2.6	1.6	1.3	
Cronbach's *alpha* coefficients	.81	.94	.97	.79	

Note: Only factor loadings > 0.4 are presented.

(Field, 2000). Based on MacCallum et al. (1999) indications that as communalities become lower the importance of sample size increases, the present analysis revealed all communalities well above .6, which, according to Guadagnoli and Velicer (1988) relatively small sample sizes (less than 100), may be perfectly adequate.

As displayed in Table 3, which includes the

PCA, the first factor included 6 items indicating an instructional emphasis towards discovery of knowledge. The second factor consisted of 8 items suggesting production of knowledge. The third factor comprised 6 items referring to reproduction of knowledge. Lastly, the fourth factor included 8 items emphasizing knowledge achieved through assimilation.

Teacher differences

A one-way MANOVA applied for the examination of the effects of a vector of factors on the PE-TRIQ revealed a four-factor structure. By means of a general linear model (GLM) multivariate procedure, the dependent variables were the four revealed PE-TRIQ factors, while the variables of years of teaching experience, gender and teachers' postgraduate studies were the independent variables.

Significant multivariate effects emerged for the factors of teachers' postgraduate studies [Wilk's $\lambda = .596$, $F(3, 24) = 4.07$, $p = .012$]. Non-significant effects were found for teachers' years of experience and gender. Interestingly, the interaction of teaching experience in years and the postgraduate studies revealed significant multivariate effects [Wilk's $\lambda = .488$, $F(3, 48) = 2.59$, $p = .019$].

Follow-up ANOVA indicated that teachers with postgraduate studies were significantly different in their represented importance for the third PE-TRIQ factor, which denotes reproduction of knowledge [$F(1, 27) = 7.42$, $p = .011$]. The interaction effect of teaching experience X postgraduate studies was found significantly different for the second PE-TRIQ factor, which implies production of knowledge [$F(2, 27) = 3.75$, $p = .036$]. The post-hoc Bonferroni test for pairwise comparisons revealed no significant differences for the independent factor of teaching experience in years.

Discussion

The purpose of this study was to establish PE-TRIQ as the basis on which to analyse the representations of physical educators, so that subsequent intervention and support of current practices could be bound by quantitative criteria. In this respect, the results of the exploratory factor analyses cast support on the applicability of PE-TRIQ for physical educators in Athens. Exploratory factor analysis of the PE-TRIQ yielded four meaningful and internally consistent factors within the culture examined in this study. Teaching styles theory predict the existence of the four educational models (Mosston & Ashworth, 2002): production, reproduction, assimilation and discovery. The present findings are in line with this prediction. In other words, teachers regard as important, to a greater or lesser extent, all four educational models. With regard to the reliability of the scales, examination of Cronbach's *alpha* coefficient showed that all scales were reliable.

However, with regard to the exploratory analysis, we must take into account Αλεξόπουλος (1998) suggestions that loadings greater than .40 can be considered as significant, as well as Clark and Watson (1995) arguments that the factor analysis should undoubtedly merit attention, though it can only provide us with suggestions as a tool, which by no means can substitute well-defined theoretical frameworks. Parallel to this, Guadagnoli and Velicer (1988) reported that when sample sizes are around 100, then it is sufficient to discuss on loadings of .50 and above. This might not hold true for the given research design, since, if it is to accept reports and suggestions, bigger sample sizes should primarily be regarded in future research on PE-TRIQ.

From the results displayed in Table 3 it appears that all loadings within the present analysis exceeded the value of .40, while several items were lower than .50. In this perspective, given that a four-factor solution was achieved, this supports that PE-TRIQ fully substantiates theory (Mosston & Ashworth, 2002; Moscovici, 1982).

Given that most low-loaded items appeared to be within the production model, as shown in Table 3, this could be partly explained by the small sample sizes acquainted in the present analyses or could be partly due to the fact that the production landmark instructional model have been claimed as «virgin field» (Goldberger, 1992) in sport pedagogy (Rink, 2001), although this claim is not fully substantiated and must be treated very cautiously as a possible cause. This indicates further analysis with the use of observational instruments, so as to clarify the possible existence for such instructional approaches.

Results showed that postgraduate studies seemed to be the main factor influencing teachers' represented importance with regard to the reproduction model. Reproduction model was regarded as not important (*mean* = -.88, *SD* = .28) compared to the other three educational models. Consistent with a study made by Reynolds (2000), the present study authors also believe that well-educated teachers tend to apply more pupil-centred approaches, to include higher order questioning and critical thinking on pupils. No accurate assumption could be made concerning this finding. Further research is required to determine the principal reasons for such approaches.

Interestingly, the interaction of teaching experience and postgraduate studies seemed also to be one of the factors influencing teachers' represented importance with regard to production model. Experienced teachers (26 to 35 years of experience) seemed to favour the production model (*mean* = .774, *SD* = .32) compared to those having 1-5, 6-15 and 16-15 (dummy coded) years of experience respectively. This finding undoubtedly requires further research and analysis, so as pertinent conclusions could be stated.

During the last three decades the developments in national curricula have moved on from teacher-centred approaches (Cobb, 1994) to pupil-centred ones (Jewett & Bain, 1987). The ecological curriculum models stress the need for social change and for the personal search for meaning in PE (Jewett, 1994). Ecological models focus on creating a balance between societal and individual needs as compared to the disciplinary mastery curriculum perspectives with the priority given to the subject matter itself (Jewett, 1994), as is it is found to be the case with the current approaches of Greece (IPEPTH, 1995; Salvara, 2001b).

Having in thought that curriculum objectives are multivariate and learners' individual learning styles are nowadays the focus of pedagogy, a variety of teaching styles is required that stress every aspects of pupils' personality development (i.e., emotional, physical, cognitive and participative ones) (Salvara, 2001a, 2002b), attributed to all the educational areas of reproduction, assimilation, discovery and production. Possible future research could reveal the representations of teachers in Athens in terms of function, having the present results as the basis for further quantitative analysis.

The results of the present study underscore the need for a broader based testing of PE-TRIQ. Acknowledging sample sizes issues, hopefully this study can provide with the opportunity to adapt PE-TRIQ further. However, acknowledging that a questionnaire cannot provide an effective realisation of teachers' current instructional practices, observational instruments should be studied along. McBride (1986), interestingly, asserts that «no single paper-pencil instrument can be totally effective in quantifying all concerns».

This paper provides data on the development of a questionnaire measuring teachers' representations on instruction. In conclusion, this study has provided initial evidence for the structural validity of PE-TRIQ with Greek teachers, although, undoubtedly, further development work is warranted. Future studies should also verify a confirmatory theory testing of PE-TRIQ. Since the factors of PE-TRIQ could also be fixed a priori, it would be of great interest to follow a theory-testing procedure (Stevens, 1996:389). Future pos-

sibilities for studying the representations of physical educators will create a need to conduct more cross culturally determined studies with PE-TRIQ.

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