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Comparative Study of Knowledge Application in the Field after Typical and Constructivist Teaching Interventions in Physical Education

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Abstract

The aim of the present study was the comparison of tactical knowledge application capability in the field, after participation in typical and constructivist teaching interventions -with and without the use of digital environment, for the teaching of volleyball tactics in Physical Education classes. One hundred and ninety one (191) 2nd grade high-school students from public schools of Mytilene-Greece participated in the study (99 boys and 92 girls) in five groups: (1) a control group, without any teaching intervention (2) typical teaching approach, (3) typical teaching approach with the use of digital environment, (4) constructivist approach that takes student preconceptions into consideration to induce cognitive conflict and (5) constructivist approach that takes students' preconceptions into consideration to induce cognitive conflict and the use of digital environment. Two raters evaluated the positioning of each student in the field for each of three iconic offensive attempts from opponent zones 2, 3 and 4. Statistically significant differences were observed between groups, with the two experimental groups in which student preconceptions were taken into consideration displaying the highest scores of appropriate student positioning in the field.

Keywords: preconceptions; game tactics; digital environment; cognitive conflict; physical education

1 Introduction

Throughout the present paper, the term "games" is used in accordance with the definition given by Hopper (2002):

"…the array of activities that use an object and that can develop into the culturally valued games that adults play, such as tennis, basketball and baseball…" (p. 44).

1.1 Technical and Tactical pedagogical approach in Physical Education

Games constitute the backbone of the Physical Education (PE) curricula in western world countries. Even though curricula are often enriched with new activities, games continue to prevail in PE classes (Brooker, Kirk, Braiuka & Bransgrove, 2001; Rink, French & Tseerdsma, 1996), with the time allocated reaching the rate of 65% (Webb & Pearson, 2008). The theory dominating teaching and learning of sports and games in school PE is the behavioral (Light, 2008), which focuses on physical capabilities and the acquisition of technical skills isolated from the context in which they take place, namely the actual game (Brooker, Kirk, Braiuka, & Bransgrove, 2001), prior to the understanding of the game and its tactics (Adam, 2013; Grehaigne & Godbout, 1995). This technical, "coaching" approach (Light, 2008, p. 23) to the teaching of games creates ambiguity as to the purpose of learning isolated skills and presents difficulties of transferring in the

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game (Adam, 2013; Hopper, 2002; Kirk & MacPhail, 2002; Turner, 1996). What is most disquieting, though, is the fact that it has effected reduced student participation, alienation from physical activity (Webb & Pearson, 2008; Graham, 1995), especially on girls (Gorely, Sandford, Duncombe, Musson, Edwardson, Kay, & Jeanes, 2011; Quick, Simon, & Thornton, 2010) and marginalization of low-skilled students of both sexes (Adam, 2013; Ennis, 1999).

Since the late 1980s, there has been a generalized shift in the international research community from behaviorist to constructivist approaches to learning, which has affected PE, transferring the focus toward student-centered pedagogical models that integrate the cognitive dimension of learning, thereby approaching the issue more holistically. The constructivist philosophy's tactical approach to the learning and teaching in PE focuses on the understanding of the game, emphasizing conscious cognitive engagement of students and tactical decision-making (Adam, 2013; Webb & Pearson, 2008; Kirk & MacPhail, 2002; Rink, 2001), without neglecting activities for the development of technique. The integration of those activities into the learning process is implemented after students have realized, through the realistic game situation, the need to develop their technical skills (Griffin, Brooker, & Patton, 2005; Grehaigne, Richard, & Griffin, 2005; Hopper, 2002). Thus, the tactical approach introduces students to the actual game-playing -or in modified/simplified forms of the game depending on student developmental level- right from the beginning (Grehaigne, Richard, & Griffin, 2005; Kirk & MacPhail, 2002; Thorpe, 1990). In doing so, the PE teacher has to assume a more dialectical approach, utilizing pedagogically appropriate questions to guide students (Chatzipanteli & Digelidis, 2012; McNeill, Fry, Wright, Tan, & Rossi, 2008; Forrest, Webb & Pearson, 2007; Mitchell et al., 2006; Griffin & Sheehy, 2004; Bell, 2003) in an authentic learning environment with meaningful activities related to game situations (Pill, Penney, & Swabey, 2012; Forrest, Webb & Pearson, 2007; Dyson, Griffin, & Hasti, 2004). He has to provide students with opportunities to collaboratively investigate and solve tactical and strategic problems, involving the whole class (Light, 2008) and, thus allowing students to construct their own knowledge by helping one another to learn (Dyson, Griffin, & Hasti, 2004). Besides, as argued by Vosniadou and Mason (2012), the involvement of students in a discussion in context is considered a prerequisite for a learning environment conducive to promoting conceptual change, i.e. learning (Vosniadou, 2007; Hatano & Inagaki, 2003; Vosniadou, 2003).

Bunker and Thorpe (1982) were the first to propose the teaching model of TGfU (Teaching Games for Understanding) which embodies the principles and philosophy of the tactical approach to teaching and learning in PE. Since, there followed several variations, encountered in the international literature with such terms as Tactical Games (Griffin, Mitchell, & Oslin, 1997), Game Sense (Australian Sports Commission, 1999), Conceptual-based Games, Game Centred Approach, Tactical Decision Learning Model and more.

1.2 Investigation of Student Preconceptions and the Inducement of Cognitive Conflict

In contrast to the behaviorist consideration of student as tabula rasa, the constructivist approach to learning adopts as one of its basic principles the consideration that students, even before being exposed to formal teaching at school, have acquired experiences and have already formed their own preconceptions or pre-existing conceptions, which in turn affect the way they interpret, organize and process new information (Driver, 1989; Piaget, 1929). The same holds true in a PE class. Students come to school holding to preconceptions, regarding the common cultural forms of games, which have already been shaped through their experience, their exposure to

mass media and teaching in PE classes itself (Kirk & MacPhail, 2002). These preconceptions constitute the supportive framework upon which all future learning is built (Driver, 1989; Millar, 1989; Driver & Scanlon, 1988), hence, their investigation provides teachers with the necessary knowledge to design more effective teaching interventions (Limón, 2001; Kokkotas, 1998).

Cognitive conflict has constituted the basis for the development of constructivist teaching strategies that promote conceptual change, i.e. learning, and according to Scott, Asoko and Driver (1991) has been implemented by many researchers in school setting. Despite its use in science since the 80s and the recognition of its effectiveness (Cakir, 2008; Limon, 2001; Chan, Burtis, & Bereiter, 1997), no noticeable diffusion of the strategy has taken place in the teaching in PE, let alone the development of relevant research.

Knowledge of student preconceptions, on the part of the teacher, is considered to be a prerequisite in order to induce cognitive conflict (Limon, 2001; Scott et al., 1991; Millar, 1989). Based on this knowledge, the teacher is enabled to develop those learning activities that will lead students to the recognition of a contradiction, a problematic situation to which they fail to provide a solution based on their preconceptions (Limon, 2001; Scott et al., 1991; Hewson & Hewson, 1984). When students recognize a cognitive conflict, this recognition itself motivates them to resolve the conflict either by trying to reorganize existing conceptions or by seeking new information (Biggs, 1990; Keller, 1987; Posner, Strike, Hewson, & Gertzog, 1982; Piaget, 1980; Berlyne, 1965; Festinger, 1957).

1.3 Learning and the Use of Activities Based on Digital Environment

According to Driver and Scanlon (1988), conceptual change -i.e. learning- is promoted by activities based on the digital environment because of their capability:

- to encourage students to explicitly express their reasoning,
- to provide students with an object for reflection,
- to provide students with a visualization of the results of their reasoning (also cited in Hokanson & Hooper, 2000; Jonassen, Carr, & Yueh, 1998).

Advances in digital technology have since escalated and so has its capabilities and potential. It is easier than ever to accommodate experimentation in a digital environment. Hypotheses formulated by the students can be assessed for their validity (Kalokyri, Mitzifiris, & Zogopoulou, 2013) and immediate, real-time feedback can be obtained (Mason & Bruning, 2001). It is regarded as a cognitive tool which can “potentially extend and/or enhance students’ cognitive skills … it is associated with the development of high-level cognitive skills” (Komis, 2004, p. 114). Ross, Morrison and Lowther (2010) report on their recent studies indicating increased higher-order learning outcomes.

The new reality of communication in school requires their use as dynamic tools for investigation (Kasimatis, 2008) and critical reflection (Ross et al., 2010; Kasimatis, 2008). This view is supported by an extensive second-order meta-analysis (Tamim, Bernard, Borokhovski, Abrami, & Schmid, 2011), revealing significant -though marginal- positive impact on student achievement by the use of educational computer technology that supports instruction as compared to computer technology that provides direct instruction and, even more so, to technology-free instruction. In PE, the utilization of educational computer technology has mainly been restricted in the acquisition and development of technical skills and relevant knowledge and the learning of the rules of the games, as reported in pertinent reviews (Vernadakis, Antoniou, Zetou, Giannousi, &

Kioumourtzoglou, 2010; Siskos & Antoniou, 2006; McKethan, Everhart, & Stubblefield, 2000), reflecting as expected the dominant technical approach to teaching.

1.4 Definition of the Problem

The domination of the technical approach to teaching and learning in PE and its focus on the acquisition of technical skills isolated from the game itself and prior to the understanding of the game and its tactics, has resulted in difficulties of transferring in the game, let alone student alienation from physical activity. The situation is reflected on the common ascertainments of PE teachers pertaining to the inability to transfer the technique in the game situation. Advances in new pedagogical models, as well as in digital technology, offer new possibilities in the search of more effective teaching approaches. The tactical approach is based on the assumption that the knowledge of tactics will help students make the right decisions during the game play, thereby improving their overall performance in the game (Brooker et al., 2001) and, simultaneously, making the game more interesting and enjoyable (McKeen, Webb & Pearson, 2007), which by itself is motivating to students (Bell, 2005).

1.5 Aim of the Study

The aim of the study was to investigate students' capability to apply newly acquired conceptions in the field, after the initial exploration of their preconceptions and their participation in typical and constructivist teaching interventions for the teaching of volleyball tactics in PE. For each type of approach, it was attempted to further investigate students' application capabilities between groups with and without the use of digital environment.

1.6 Limitations of the Study

Motivational and emotional factors were not taken into consideration, not because they do not affect the learning process, but for focusing reasons on the essence of what learning is, in the context of the conceptual change process and the negotiation between preconceptions and new conceptions. In addition, participants in the study were students from junior high schools of the city of Mytilene, in Lesvos island. A larger sample with wider geographical dispersion could have provided more generalizable conclusions. Lastly, the results from the use of the digital environment refer to the specific digital environment used in the present study. A different environment is likely to produce varied results.

2 Methodology

The present study addressed the topic of volleyball tactics taught in 2nd high-school grade, which refers to the positioning of the players in the volleyball court, when a team is defensively organized against the opponent's offense, with single block, defensive formation with 6 in the front, team formation 4-2 and the setter in zone 3.

2.1 Participants

One hundred and ninety one (191) 14 year old students participated in this study (99 boys and 92 girls) from all public schools of the city of Mytilene in the island of Lesvos in Greece. Students were explicitly informed of the voluntary nature of their participation and written parental approval was granted before the beginning of the research. All pertinent information remained confidential.

2.2 Initial Investigation of Student Preconceptions

Initially, students were subjected to an individual test in a classroom setting, in the presence of the researcher. Each student completed a questionnaire consisting of eight questions that reflect the principles upon which the positioning of the players in the volleyball court, for the topic under examination, relies (Mastrogiannis, Antoniou, & Kasimatis, 2015). In each question, students had the opportunity to further express their pre-existing conceptions verbally and graphically, thus, making their misconceptions explicitly available to the researcher.

2.3 Distribution to Groups and Teaching Interventions

Students were randomly distributed to five (5) groups (Table 1), one control group in which no intervention was applied and four intervention groups in which two 45-minute teaching interventions were implemented:

1. *Control Group:* did not receive any form of teaching intervention and, therefore, it served comparison purposes.
2. *Typical Experimental Group:* was taught using the typical teacher-centered intervention based on demonstration, by placing six students in the appropriate positions in the field for the corresponding iconic offensive attempts from opponent zones 2, 3 and 4. For each iconic offensive attempt, the positioning of each player and the space he defensively covers are reported.
3. *Typical + DE Experimental Group (DE: Digital Environment):* the same typical strategy was applied to teach defensive volleyball tactics for each of the three iconic offensive attempts, with the difference lying in the use of the digital environment.
4. *Experimental PreC Group and (PreC: Preconceptions):* on the other hand, student preconceptions were considered for inducing cognitive conflict to students, thus adopting a constructivist teaching approach strategy.
5. *Experimental PreC + DE Group:* the teaching strategy of inducing cognitive conflict was also employed, using however the digital environment.

Table 1: Descriptive statistics on gender distribution by group

Group	Gender		Total
	Boy	Girl	
Control group	19	23	42
Typical Experimental	24	16	40
Typical Experimental + DE	20	15	35
Experimental PreC	19	18	37
Experimental PreC +DE	17	20	37
Total	**99**	**92**	**191**

In all typical or constructivist teaching interventions -apart from the control group-, students were given the opportunity to apply the newly acquired knowledge from the interventions by practicing in the field or in the digital environment, depending upon the intervention. Figure 1 shows photographic shots, taken in the field during teaching interventions (groups 2 and 4).



Figure 1: Photographs taken from teaching interventions in the field (groups 2 and 4).

2.3 Inducing Cognitive Conflict

The teaching strategy of inducing cognitive conflict to students in groups 4 and 5 (Experimental PreC and Experimental PreC + DE groups), was employed after student preconceptions on the topic were explicitly made available to the researcher from the examination of the completed questionnaires. To facilitate the inducement of cognitive conflict, the researcher took student preconceptions under consideration and formulated appropriate questions that directly challenged their preconceptions. Students, being unable to address the questions based on their preexisting conceptions, were given the opportunity to engage in whole class discussion, expression of conceptions, argumentation and the investigation of their functionality. With the researcher's probing questions, students were expected to voluntarily adopt the accepted conceptions in the scientific field of PE. The researcher's role was restricted in guiding and supporting student initiatives, encouraging discussion and expression of student ideas and conceptions on the issue, without providing answers or solutions.

2.4 The Digital Environment

The teaching interventions in groups 3 and 5 (Typical + DE Experimental group and Experimental PreC + DE group) with the use of activities based on the digital environment, were realized within a classroom setting, with a computer connected to a projector. A digital application was designed for the purposes of the present study. It was developed in the Logo-based, constructivist philosophy programming environment of MicroWorlds Pro (Logo Computer Systems Inc.). The digital application offers a visualization of the real situation under examination (Figure 2), providing an object for reflection and interactive capabilities.

The handling of the application was done by the researcher during both typical and constructivist teaching interventions. Sufficient time was devoted to the application of the acquired knowledge during which students were handling the application, one at a time. They were given the opportunity to experiment by positioning the digital players in the field and receiving feedback as to the appropriateness of their choices. The rest of the students participated by contributing and justifying their choices.

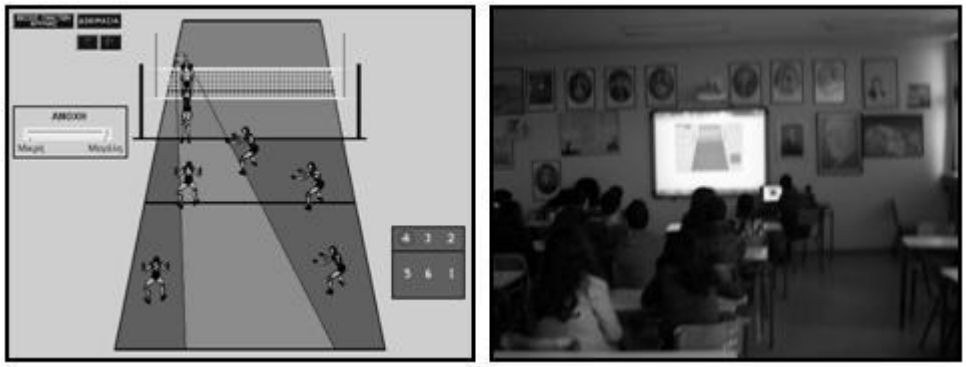


Figure 2: A screenshot of the digital environment (left) and a photograph taken from teaching intervention in the classroom setting (right).

2.5 Application of New Conceptions in the Field

The evaluation of students' capability to apply the newly acquired conceptions in a realistic context was conducted in the school volleyball court, one month after the teaching interventions, with conditions that simulated reality as close as possible. This provided an indication of the functional impact of the conceptions held by the students after the teaching interventions and a means of comparison of the effectiveness of each teaching intervention. Students -including those in the Control Group, who did not receive any teaching intervention- were in turn assuming the positions they considered as appropriate, for each of the following three iconic offensive attempts from the opponent (Figure 3): i) From opponent zone 2ii) from opponent zone 3iii) from opponent zone 4.



Figure 3: Evaluation of students' capability of application of newly acquired conceptions in the field during iconic offensive attempts from the left side, middle and right side of the net.

As shown in the photographic snapshots in Figure 3, to simulate each of the three iconic offensive attempts, a student was standing in the opponents' field with the ball raised over his head, indicating the opponent's attack position, while six students at a time -after they were randomly assigned to zones 1 through 6- assumed the position deemed as appropriate. At this point, students maintained their positions while the researcher and the respective PE teacher of the school unit, independently assessed the appropriateness of the positioning of each of the six students (with the value of 1 or 0 for appropriate or inappropriate positioning respectively). For each rater, the process resulted in a total of three assessments per student, one for every iconic offensive attempt. In addition, three photographic snapshots were taken for reference purposes.

Due to time restrictions imposed by the Greek Ministry of Education for research purposes, it was decided every student to assume one -instead of the six possible- position for every iconic offensive attempt. Besides, in the opposite case, students would be prone to influence by the positioning of their peers in zones that they were to be moved. Between iconic offensive attempts, students were rotated to better serve the following combination of criteria:

- Avoid remaining in the same zone more than once for each student,
- Avoid executing block more than once for each student,
- Maximize the likelihood of a student assuming positions in both back row and front row areas.

For example, if clockwise rotation is realized between iconic offensive attempts, the student who was originally placed in zone 4 would perform a block for three consecutive times and the student who was originally placed in zone 1 would only be assuming positions in the back row area. As could be inferred, investigator triangulation was used to increase the validity and reliability of the measurements (appropriate or inappropriate student positioning in the field), i.e. the "use of several observers to conduct an investigation" (Cohen & Manion, 1994, p. 328).

3 Results

A Kappa test was performed to assess the inter-rater agreement -between the researcher and the respective PE teacher-on the evaluation of the positioning of each student for each of three positions of iconic offensive attempts from opponent zones 2, 3 and 4. Tables 2 and 3 present the respective evaluations made by the researcher and the PE teachers, for each iconic offensive attempt by group.

The results show a high level of agreement between the two raters:

1. Iconic offensive attempt from opponent zone 2: Kappa = 0.804,
2. Iconic offensive attempt from opponent zone 3: Kappa = 0.833,
3. Iconic offensive attempt from opponent zone 4: Kappa = 0.821.

Subsequently, a chi square test of independence estimated the differences between the five experimental groups as to the appropriateness of positioning of students in the field, as recorded by one of the rater's evaluation, namely the researcher. Because of the high level of agreement between the raters reported by the Kappa coefficient, anyone of the raters could have been selected, with no noticeable change in the results. A z test was used to investigate the existence of pairwise differences between the five experimental groups.

The results of the first chi-square test of independence indicated statistically significant differences between the experimental groups, regarding the appropriate student positioning during the iconic offensive attempt from opponent zone 2 ($\chi^2_{(4)}=28.9$, $p<0.001$). The pairwise comparisons revealed that the Experimental PreC +DE group had the highest rate of appropriate positioning (64.9%, 24 of 37) of all groups, followed by the Experimental PreC group (54.1%, 20 of 37) and the Typical Experimental group (45%, 18 of 40). Although no statistically significant differences were found between the three aforementioned groups, all three differed significantly from both the Control group and the Typical Experimental + DE group, with respective rates 14.3% (6 of 42) and 22.9% (8 of 35) (Figure 4).

Table 2: Researcher's evaluations on appropriate and inappropriate student positioning by group

Group	From opponent zone 2		From opponent zone 3		From opponent zone 4		Total instances	
	0	1	0	1	0	1	0	1
Control group	36	6	27	15	38	4	101	25
Typical Experimental	22	18	13	27	29	11	64	56
Typical Experimental + DE	27	8	20	15	30	5	77	28
Experimental PreC	17	20	8	29	17	20	42	69
Experimental PreC +DE	13	24	7	30	9	28	29	82
Total	**115**	**76**	**75**	**116**	**123**	**68**	**313**	**260**

Table 3: Physical Education teachers' evaluations on appropriate and inappropriate student positioning by group

Group	From opponent zone 2		From opponent zone 3		From opponent zone 4		Total instances	
	0	1	0	1	0	1	0	1
Control group	36	6	27	15	36	6	99	27
Typical Experimental	22	18	10	30	28	12	60	60
Typical Experimental + DE	29	6	21	14	29	6	79	26
Experimental PreC	15	22	7	30	16	21	38	73
Experimental PreC +DE	11	26	3	34	8	29	22	89
Total	**113**	**78**	**68**	**123**	**117**	**74**	**298**	**275**

Results of the second chi-square test of independence also indicated statistically significant differences between the experimental groups, regarding the appropriate student positioning during the iconic offensive attempt from opponent zone 3 ($\chi^2_{(4)}$=27.7, p<0.001). As in iconic offensive attempt from opponent zone 2, the pairwise comparisons revealed that the Experimental PreC +DE group had the highest rate of appropriate positioning (81.1%, 30 of 37) of all groups, followed by the Experimental PreC group (78.4%, 29 of 37) and the Typical Experimental group (67.5%, 27 of 40). No statistically significant differences were found between the three aforementioned groups, but all three differed significantly from both the Control group and the Typical Experimental + DE group, with respective rates 35.7% (15 of 42) and 42.9% (15 of 35) (Figure 5).

Lastly, results of the third chi-square test of independence indicated statistically significant differences between the experimental groups, regarding the appropriate student positioning during the iconic offensive attempt from opponent zone 4 ($\chi^2_{(4)}$=51.9, p<0.001).The pairwise comparisons revealed that the highest rates of appropriate positioning were possessed by the two groups in which student preconceptions were taken under consideration -i.e. the Experimental PreC +DE and the Experimental PreC group-reporting percentage rates of 75.7% (28 of 37) and 54.1% (20 of 37) respectively.

No statistically significant differences were found between the two groups, but they differed significantly from all three remaining groups, i.e. the Control group, the Typical Experimental group and the Typical Experimental + DE group, with percentage rates of 9.5% (4 of 42), 27.5% (11 of 40) and 14.3% (5 of 35) respectively (Figure 6).

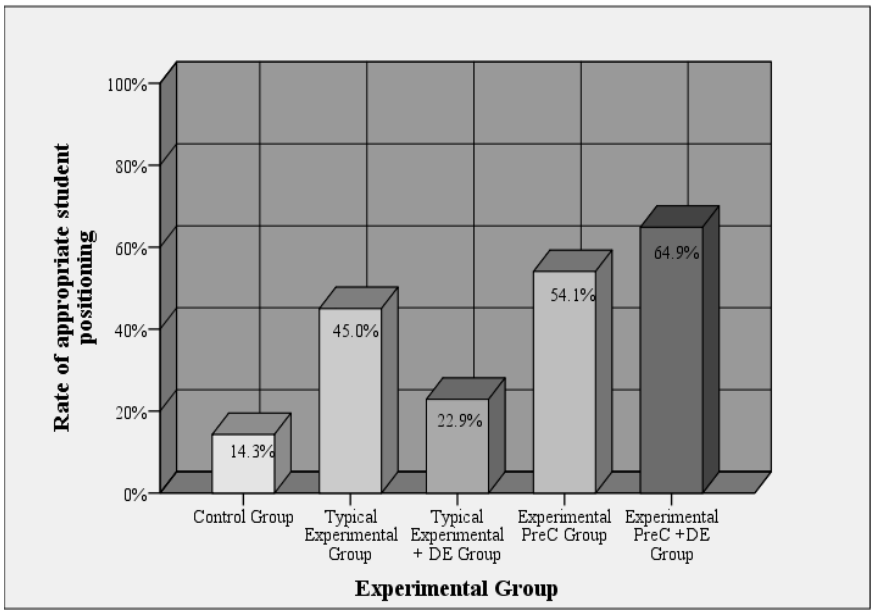


Figure 4: Reported rates of appropriate student positioning in iconic offensive attempt from opponent **zone 2** by group.

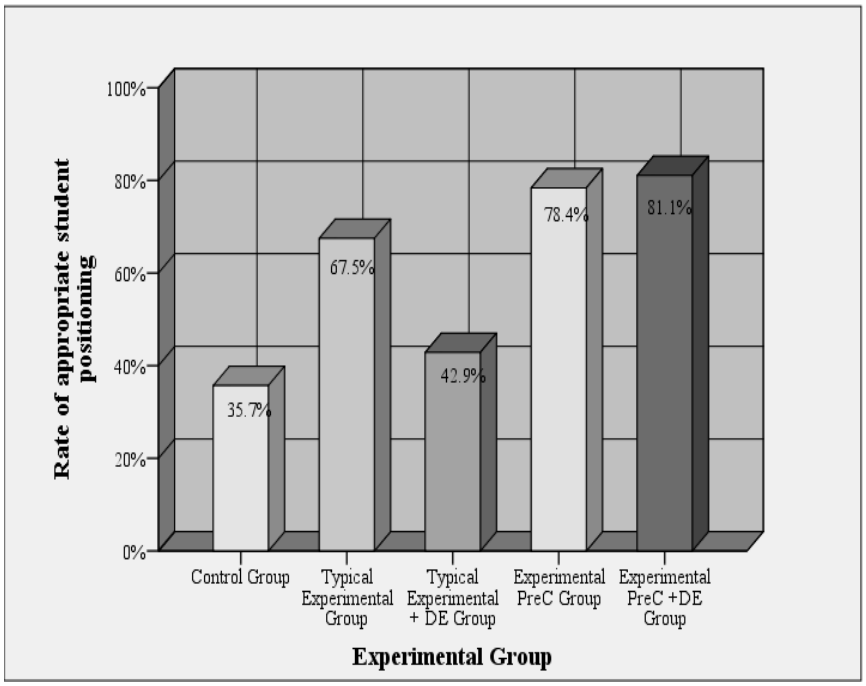


Figure 5: Reported rates of appropriate student positioning in iconic offensive attempt from opponent **zone 3** by group.

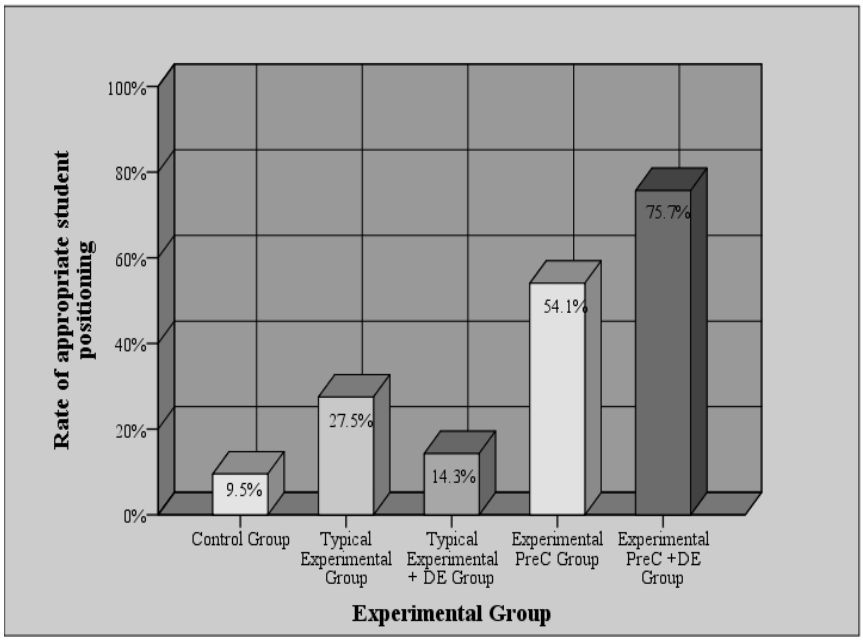


Figure 6: Reported rates of appropriate student positioning in iconic offensive attempt from opponent **zone 4** by group

Let it be noted that the highest rate of appropriate student positioning observed in the iconic offensive attempt from opponent zone 3 (60.7%) -compared to the attempts from zones 2 (39.8%) and 4 (35.6%), i.e. from the center of the net compared to its extreme ends-, are justified by the need for minor movements and the obviousness of the positioning in the appropriate location in the first case.

Finally, in order to investigate gender differences as well as possible interaction between gender and experimental group, a variable was created that represented the overall performance of each student, regarding the appropriateness of positioning based on the researcher's assessment. Its formation was realized by adding the appropriate positioning of each student in all three iconic offensive attempts from opponent zone 2, 3 and 4, resulting in a number from 0 to 3. Subsequently, a two-way analysis of variance was performed, with dependent variable the overall performance of each student in terms of the appropriateness of positioning and independent factors the group and the gender. The results revealed no statistically significant difference based on gender and no interaction between gender and group.

4 Discussion and conclusions

The comparison of the number of appropriate student positioning, during the iconic offensive attempts, between groups, allowed for the assessment of the effectiveness of the teaching interventions regarding the applicability of newly acquired conceptions in the field.

If a new conception -acquired after the interventions-is proved to be fruitful, i.e. helpful to the student, enabling him to tangle with and solve previously unsolved problems (as is the application in the field), the chances of adoption and retention of the new conception are increased (Cakir, 2008; Scott et al., 1991; Hewson & Thorley, 1989; Hewson & Hewson, 1984). The higher to significantly higher rates of appropriate student positioning that were observed in groups where constructivist teaching interventions

were applied, compared to the control group and to groups where typical interventions were applied, demonstrated the effectiveness of adopting teaching approaches of constructivist orientation. In particular, teaching interventions that took student preconceptions under consideration for the inducement of cognitive conflict -which has been applied in science by many researchers in the school setting (Scott et al., 1991) since the early 80s- demonstrated better results compared to typical, teacher-centered teaching interventions that followed the direct teaching approach without considering student preconceptions. The focus on the cognitive level, in the context of the tactical approach to the teaching of sports tactics in PE, was proved to exhibit higher functional impact on knowledge application in the realistic situation of playing the game in the field, as compared to the typical model of teaching. Taking into account the inhibiting factor of student familiarization with direct teaching methodologies and the technical approach that dominate teaching in PE (Digelidis, 2013; Bell, 2005), the results could be regarded as more than encouraging. The lack in gender differences was attributed to the fact that the focus was shifted from the physical capabilities and the teaching of technical skills, that especially affects girls (Gorely et al., 2011; Quick et al., 2010), to the cognitive aspect of tactics and game understanding.

Moreover, since perceived competence declines with age (Papaioannou, Bebetsos, Theodorakis, Christodoulidis, & Kouli, 2006) in junior high-school and even more so in senior high-school (Digelidis & Papaioannou, 1999), it would be interesting if future research should attempt to explore the effect of the findings of the present study on perceived competence. At present, we can only speculate that the higher appropriate positioning of students in the constructivist interventions could positively affect students' perceived competence. Perceived competence is in turn a positive predictor of student enjoyment from their active participation in PE (Cairney, Kwan, Velduizen, Hay, Bray, & Faught, 2012) and of students' future participation in physical activity (Lintunen, Valkonen, Leskinen, & Biddle, 1999; Papaioannou et al., 2006).

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