TYPICAL AND CONSTRUCTIVIST TEACHING INTERVENTIONS FOR THE TEACHING OF SPORTS TACTICS IN PHYSICAL EDUCATION AND INVESTIGATION OF STUDENT ENJOYMENT / INTEREST

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Abstract

The aim of this study is the investigation of the level of enjoyment / interest of 2nd grade high-school student 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. The relevant subscale of Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989) was used. One hundred and sixty six (166) 14 year old students participated in the research study (92 boys and 74 girls) in four groups: (1) typical teaching approach, (2) typical teaching approach with the use of digital environment, (3) constructivist approach that takes students' preconceptions into consideration to cause cognitive conflict, (4) constructivist approach that takes students' preconceptions into consideration to cause cognitive conflict and the use of digital environment. High average levels of enjoyment / interest were observed, without statistically significant differences between groups. However, a statistically significant interaction was noted between gender and the use of digital environment, with the girls recording statistically significant higher averages in the absence of digital environment.

Keywords: *enjoyment, interest, constructivism, digital environment, physical education*

1. Introduction

1.1 Technical and Tactical pedagogical approach in Physical Education

The behaviorist learning theory has become the dominant view of learning and teaching for most of the twentieth century and continues its strong influence in shaping the curricula in Physical Education (Light, 2008). In particular, for the teaching of sports and games –for which more than 65% of the time is allocated in physical education classes (Webb & Pearson, 2008)-, the direct teaching approach imposes strictly structured practices, with the segmentation of knowledge to its simplest ingredients and a focus on the acquisition of motor skills and the development of technique (Thorpe & Bunker, 1989; Turner, 1996; Kirk & MacPhail, 2002; Light, 2008), isolated from the context in which they unfold, i.e. the complete participation in the game (Brooker, Kirk, Braiuka, & Bransgrove, 2001). As a result, the use of this teaching approach, apart from the alienation of students from physical activity (Graham, 1995; Webb & Pearson, 2008) and the marginalization of low-skilled students of both sexes (Ennis, 1999; Adam, 2013), has led to a failure to transfer the technical skills in a game situation (Hopper, 2002; Kirk & MacPhail, 2002).

A generalized shift in the international research community from direct to indirect pedagogical approaches has begun since the late 80s and, as expected, it could not leave Physical Education unaffected, with a corresponding increase in researchers' interest for the constructivist theories of learning in the field of Physical Education. In contrast to direct approaches, constructivism advocates a more holistic approach to learning, including and shifting the focus to the conscious cognitive engagement of the student (Rink, 2001) in tactical and decision-making matters (Kirk & MacPhail, 2002; Kirk, 2005; Webb & Pearson, 2008; Adam, 2013). The tactical approach to teaching Physical Education, incorporates learning in the realistic context of playing the game (Clark & Harrelson, 2002), engaging students right from the start in modified forms of games or in the real game, depending on their developmental level (Thorpe, 1990; Kirk & MacPhail, 2002; Grehaigne, Richard, & Griffin, 2005). The learning of technical elements is introduced as the need for improvement arises through the real game situation (Hopper, 2002; Griffin, Brooker, & Patton, 2005; Grehaigne, Richard, & Griffin, 2005). A representative advocate of the tactical approach is the **TGfU** model (Teaching Games for Understanding) of Bunker & Thorpe (1982) and its subsequent variations, encountered with varying terms like **Tactical Games** (Griffin et al ., 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

The behaviorist approach to learning treats students as tabula rasa (Limon, 2001). In contrast, according to the constructivist approach, students, even before receiving the formal school teaching, have acquired experience, have given thought to the world around them and come to class with already shaped preexisting conceptions or preconceptions, which affect the way they interpret, organize and process new information (Piaget, 1929; Driver, 1989). According to Kirk and MacPhail (2002), the same holds true regarding the cultural forms of sports and games which are also taught in school Physical Education. These preconceptions have enormous interpretative power (Posner, Strike, Hewson, & Gertzog, 1982) and therefore are highly resistant to change (Cakir, 2008; Windschitl & Andre, 1998; Driver, 1989). If they are ignored by the teacher, they are simply suppressed, not eliminated (Komis, 2001).

1.3 The teaching strategy of cognitive conflict

The teaching strategy of cognitive conflict has been used since the 1980s in the context of the constructivist conception of learning, mostly in science, and is considered to be the most common teaching strategy which facilitates the reconstruction of student preconceptions. Before any attempted teaching intervention, the elicitation and in-depth knowledge of their preconceptions is considered to be a prerequisite and a decisive factor for the successful inducement of cognitive conflict in students (Scott et al., 1987; Scott et al., 1991; Limon , 2001). Being aware of student preconceptions, the teacher has set the foundation for the design of teaching interventions that form favorable conditions for inducing cognitive conflict. This entails that the teacher needs to design appropriate learning activities, based on their ability to provide opportunities to students to initially activate their (no longer unknown) preconceptions and then directly challenge them (Shuell, 1987; Scott et al., 1991; Limon, 2001). Once the student experiences the contradiction between his preconceptions and the new, scientifically accepted conceptions, i.e. once he realizes the cognitive conflict which he fails to resolve based on his preexisting knowledge and conceptions, the process of conceptual changes is initiated. This recognition motivates the student to resolve the conflict, either by trying to reorganize his existing knowledge or by seeking new information (Festinger, 1957; Berlyne, 1965; Piaget, 1980; Posner, Strike, Hewson, & Gertzog, 1982; Keller, 1987; Biggs , 1990).

1.4 Learning and the use of activities based on digital environment

The role of activities based on the digital environment on learning according to Driver & Scanlon (1988), lies in their capability:

- ✓ to encourage students to explicitly express their reasoning
- ✓ to provide students with a visualization of the results of their reasoning and an object for reflection

An additional value of using digital environment is that it fosters speculations and offers the capability of their evaluation (Kalokiri, Mitzifiris and Zogopoulos, 2013), i.e. their confirmation or refutation, by providing immediate feedback (Mason & Bruning, 2001). It is regarded as a 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).

1.5 Definition of the problem

The discouraging findings regarding the alienation of students from physical activity pose new challenges to educators in Physical Education. Advances in learning theories and new pedagogical approaches as well as in digital technology give rise to new opportunities. New, contemporary, more effective teaching approaches have to be explored to inverse the situation. The absence of enjoyment/ interest as one of the main reasons of students' failure to realize their potential, indicates the high correlation of enjoyment/ interest with learning (Finn, 1989; Shernoff et al., 2003; Goetz et al., 2006).

1.6 Aim of the study

The present study addresses 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. The aim was to investigate the level of student enjoyment / interest from their participation in typical and constructivist approach teaching interventions for the teaching of volleyball tactics in Physical Education. For each of the two approaches, it was attempted to further investigate the level of enjoyment / interest between groups with and without the use of digital environment.

2. Method and Procedure

2.1 Investigation of student preconceptions

One hundred and sixty six 14 year old students participated in the research study (92 boys and 74 girls), from public schools of the city of Mytilene in Greece. Initially, students were subjected to an individual test in order to investigate their preconceptions on the topic, by completing a questionnaire (see Annex: 5.1 Questionnaire for the investigation of student preconceptions), which corresponds to the principles upon which the positioning of the players in the court is based. Students have the opportunity to verbally and graphically express their preconceptions, therefore revealing their misconceptions. Let it be noted that the topic of the aforementioned volleyball defensive tactics is included in 2nd high-school grade Physical Education curriculum in Greece.

2.2 Teaching interventions

The sample was randomly distributed to four groups (see Annex: 5.2 Table 1: Number of students by group and gender), in which two 45-minute teaching interventions were respectively implemented:

1. Typical Experimental Group
2. Typical + DE Experimental Group (DE: Digital Environment)
3. Experimental PreC Group and (PreC: Preconceptions)
4. Experimental PreC + DE Group

(1) The Typical Experimental Group was taught using the typical teacher-centered intervention based on demonstration, by placing six students in the appropriate positions on 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. (2) In the Typical + DE Experimental Group, the same typical strategy was applied to teach defensive team tactics, using however the digital environment. (3) In contrast, in the Experimental PreC Group, the constructivist teaching strategy of inducing cognitive conflict was employed -for each of the three iconic offensive attempts-, taking into consideration student preconceptions, as recorded in the questionnaire. (4) In the Experimental PreC + DE Group, the teaching strategy of inducing cognitive conflict was also employed, using however the digital environment.

Camera snapshots of the teaching interventions in the field (group 1and 3) are shown in Figure 1. In all teaching interventions -typical or constructivist- is given the opportunity to students to practice in the field or in the digital environment, applying the acquired knowledge from the teaching interventions.

Figure 1: Camera snapshots from teaching interventions in the field

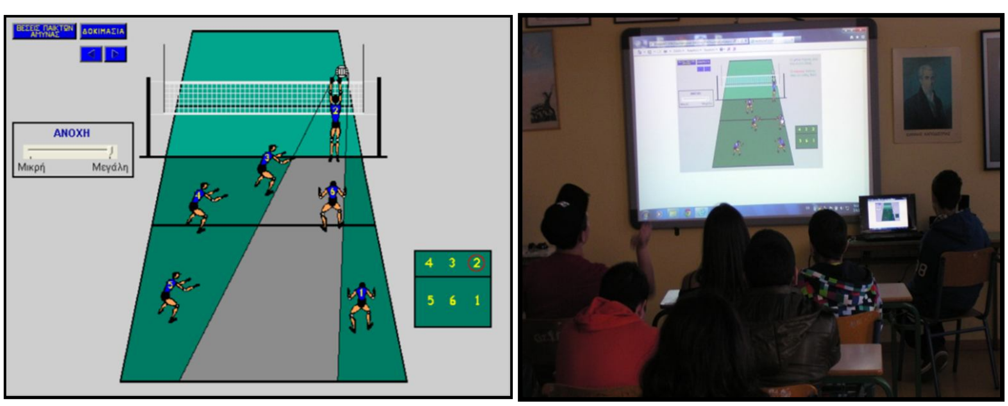
2.3 Inducement of cognitive conflict

After the identification of common erroneous student preconceptions, the objective during the teaching interventions to groups (3) and (4) -in which student preconceptions were taken into consideration- was the inducement of cognitive conflict in order to promote conceptual change and, therefore, learning. The researcher, having acquired the knowledge of student preconceptions on the topic, was able to formulate questions that provided opportunities to induce cognitive conflict, so that students, through discussion, expression of conceptions, argumentation and the investigation of their functionality, are lead to the voluntary adoption of accepted conceptions in the scientific field of Physical Education.

2.4 The digital environment

To serve the aim of this study, a digital application was designed and implemented in the MicroWorlds Pro environment (Logo Computer Systems Inc.). MicroWorlds Pro is a constructivist philosophy programming environment, based on the programming language of Logo, and is addressed to the educational community. It is suitable for creating dynamic, interactive learning environments. The digital application, apart from the visualization and representation of the real situation as well as providing an object for reflection, it offers interactive capabilities. The user may position the digital players in the field, receive feedback as to whether or not the appropriate positioning of players was selected and reflect on his choices (Figure 2, left screenshot).

Figure 2: A screenshot of the digital environment (left) and a camera snapshot in the classroom (right)



The teaching interventions in groups (2) and (4), with the use of activities based on the digital environment, were implemented in a classroom with a computer connected to a projector. During the typical or constructivist teaching intervention, the handling of the application was done by the researcher, whereas during the practice (or application of the acquired knowledge) phase, the handling was done by students on a voluntary basis -one at a time- with the rest of the students contributing and justifying their choices (Figure 2, right camera snapshot).

2.5 Investigation of enjoyment / interest

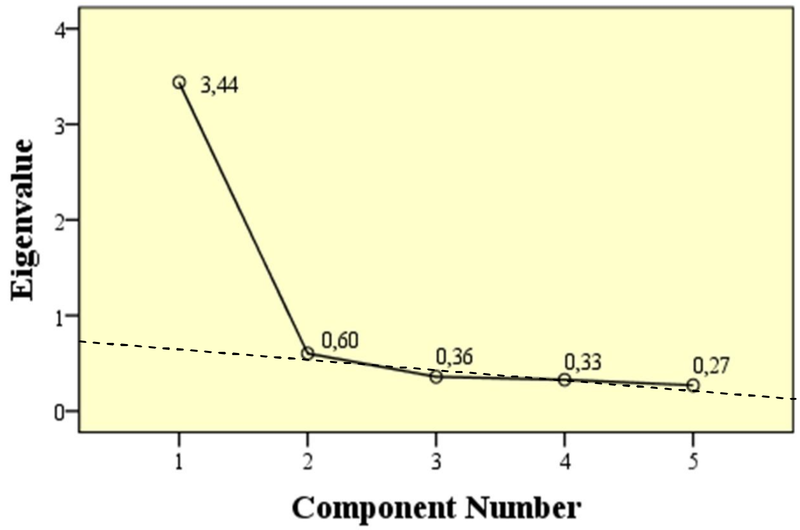
Following the implementation of the teaching interventions, students were asked to complete a questionnaire for the assessment of enjoyment / interest from their participation in the intervention activities. The relevant subscale of the Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989) was used (see Annex: 5.3 Intrinsic Motivation Inventory subscale for the investigation of student enjoyment / interest from their participation in the teaching interventions). It consists of five items on a Likert scale from strongly disagree (1) to strongly agree (7). Each item is formed by a sentence of agreement-disagreement associated with the variable of enjoyment / interest from student participation in each teaching intervention. The questionnaire was completed by students of all four groups in the classroom setting, in the presence of the researcher. The results of a previous study on 674 10 -17 year old students in Greece, who participated in Physical Education classes, supported the validity and reliability of the subscale (Digelidis & Papaioannou, 1999). Prior to data analysis, codes 1-7 of student responses to negatively worded item 5 (5th item: “This activity did not hold my attention at all”) were rescaled by reversion, to the direction of positively worded sentences.

3. Results

The investigation of student enjoyment / interest was conducted on the sample of one hundred and sixty six (166) students that constitute the four groups. After a series of analyses of variance, with dependent variables the five items of *enjoyment / interest* and independent variable the experimental *group*, no statistically significant differences were found between groups in terms of student enjoyment / interest from their participation in the activities of the respective teaching interventions (1st item: $F(3, 162) = 0.3$, $p = 0.828$; 2nd item: $F(3, 162) = 2.8$, $p = 0.043$; 3rd item: $F(3, 162) = 0.29$, $p = 0.835$; 4th item: $F(3, 162) = 1.8$, $p = 0.157$; 5th item: $F(3, 162) = 1.1$, $p = 0.372$).

The factorial analysis performed, using the principal component analysis method with input variables the five items of student *enjoyment / interest*, revealed the single-factor structure of the questionnaire (Figure 3). Only one eigenvalue was greater than 1 (3.44) explaining 69% of the total variance, followed by the second highest value being no greater than 0.60.

Figure 3: Scree Plot



All five items noted strong loadings on the factor of *enjoyment / interest* (> 0.74, see Table 2) and the reliability of the factor was found to be sufficiently high (Cronbach's a = 0.88). The present study is in line with a previous study by Digelidis and Papaioannou (1999), supporting the validity and reliability of the subscale of the Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989) for the assessment of student enjoyment / interest from their participation in learning activities.

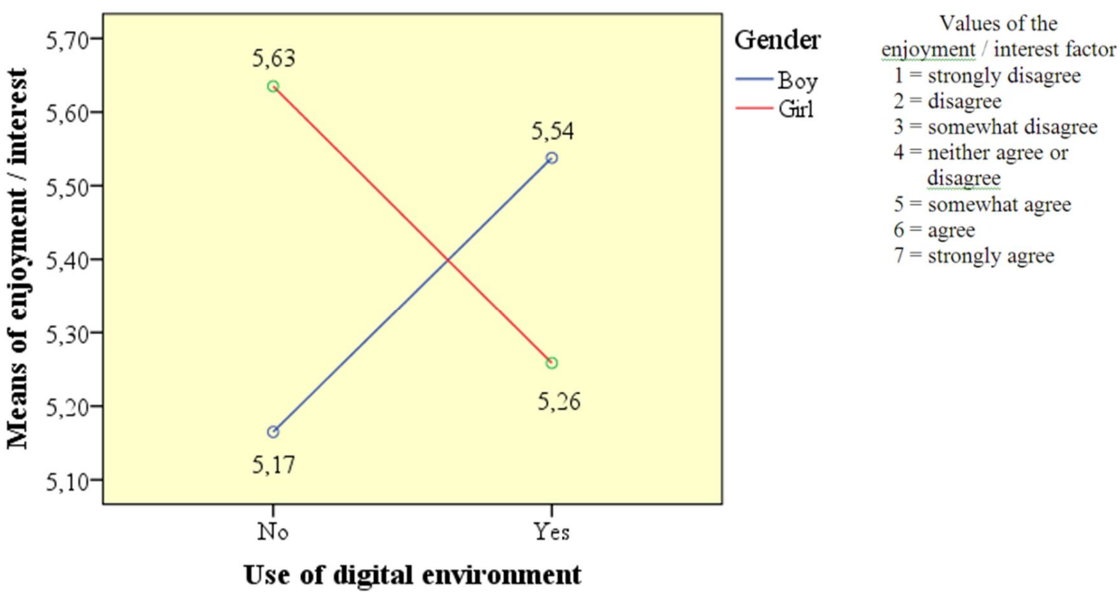
Table 2: Factor analysis loadings on the 5 items of enjoyment / interest of IMI

	Factor
Items of enjoyment / interest subscale of IMI	**1**
1st item: I enjoyed doing this activity very much	0,878
3rd item: I would describe this activity as very interesting	0,872
2nd item: This activity was fun to do	0,850
5th item: This activity did not hold my attention at all	0,799
4th item: While I was doing this activity, I was thinking about how much I enjoyed it	0,740
Total Variance Explained	68,8%

Extraction Method: Principal Component Analysis.

Subsequently, as a result of the factor analysis, an overall factor of enjoyment / interest was created by using the method of averaging the student responses, to investigate the existence of differences in the *overall enjoyment / interest* factor between *groups* and between *gender*. To this end, a 3-way analysis of variance was performed, with dependent variable the *overall enjoyment / interest* and independent factors the *gender*, the *exploitation of student preconceptions* and the *use of digital environment*. The results of the analysis did not indicate a statistically significant main effect (neither of *gender* nor of the *exploitation of student preconceptions* on the topic nor of the *use of the digital environment*). However, a statistically significant interaction between *gender* and the *use of digital environment* was found (F (1,158) = 4.23, p = 0.041). An examination of the graph in Figure 4, reveals that in the case of the absence of the digital environment -i.e. in the teaching interventions in the Typical Experimental Group and the Experimental PreC Group-, girls recorded higher scores on the *overall enjoyment / interest* factor than boys (Boys: M = 5.17, SD = 1.34; Girls: M = 5.63, SD = 0.84). In contrast, in the case of the presence of the digital environment -i.e. in the teaching interventions in Typical + DE Experimental Group and the Experimental PreC + DE Group-, girls recorded lower scores on the *overall enjoyment / interest* factor than boys (Boys: M = 5.54, SD = 1.25; Girls: M = 5.26, SD = 1.02).

Figure 4: Estimated marginal means of overall enjoyment / interest in teaching interventions with the use of digital environment by gender



All four groups recorded high scores on the *overall enjoyment / interest* factor (> 5.17). Let it be noted that, in the teaching interventions in which student preconceptions were taken into consideration -namely in the Experimental PreC Group and the Experimental PreC + DE Group-, higher scores were recorded on the *overall enjoyment / interest* factor, as compared to the scores of the other two groups, although no statistically significant differences were found (Experimental PreC Group: M= 5.40, SD = 1.18; Experimental PreC + DE Group: M = 5.46, SD = 1.11; Typical Experimental Group: M = 5.35, SD = 1.18; Typical + DE Experimental Group: M = 5.36, SD = 1.19) (Figure 5). In the same groups, although no statistically significant interaction between *gender* and the *exploitation of student preconceptions* was recorded, girls noted higher scores on the *overall enjoyment / interest* factor (Boys: M = 5.29, SD = 1.33; Girls: M = 5.58, TA = 0.89) (Figure 6).

Figure 5: Estimated marginal means of overall enjoyment / interest by group

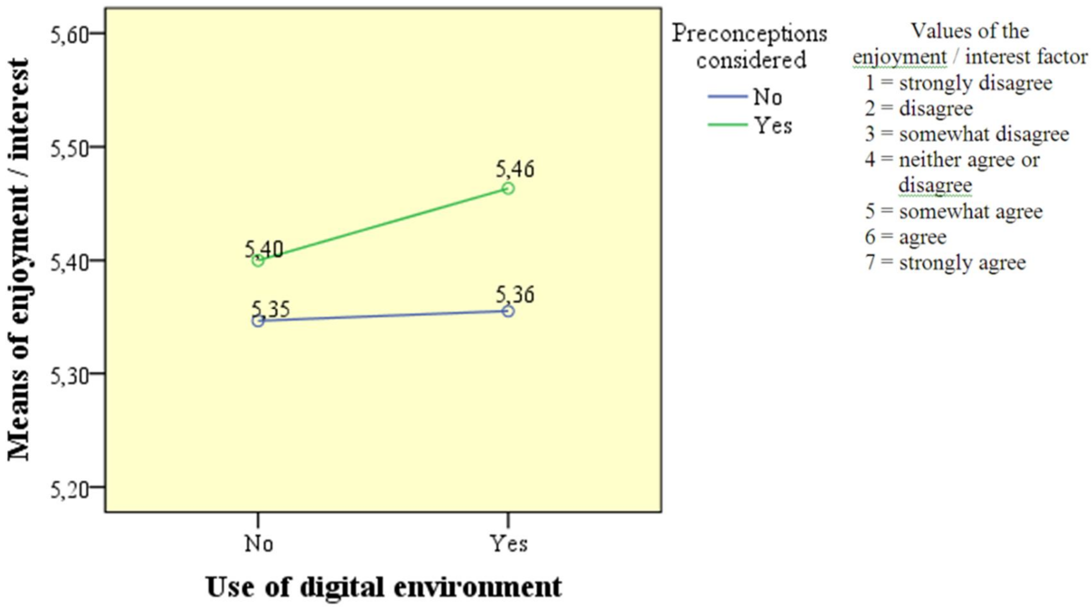
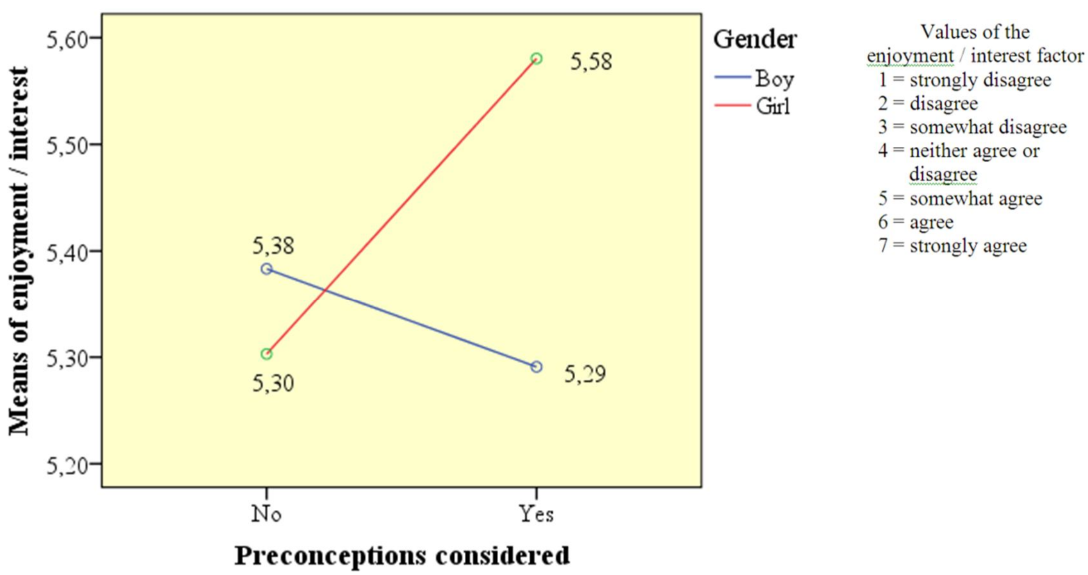


Figure 6: Estimated marginal means of overall enjoyment / interest in teaching interventions with the exploitation of student preconceptions by gender



4. Conclusions

Although no statistically significant differences were found between groups or between sexes, the higher average values of student enjoyment / interest in the constructivist approach groups as compared to the typical approach groups (Figure 5) indicate that, regarding the enjoyment / interest factor, constructivist approaches for the teaching of volleyball tactics do not fall short as compared to typical approaches. And that, despite the fact that school Physical Education follows the technical model of teaching, focusing on the development of the technique (Bell, 2005;

Digelidis, 2013) and, therefore, students are familiarized with the methodological approach of typical teaching.

In a previous study on volleyball teaching to 12 year old students by Griffin et al. (1995), students who were taught following the tactical approach showed more interest and derived more pleasure than students following the technical approach. More contemporary studies have indicated increased level of enjoyment in college students (McKeen, Webb & Pearson, 2007) and students 11 to 14 years old (Jones, Marshall & Peters, 2010) exposed to the tactical approach of TGfU, compared to students exposed to the technical teaching approach to games.

The statistically significant higher average of enjoyment / interest recorded by the boys in the groups that used the digital environment, is in line with a research conducted by Lightbody et al. (1996), on 1068 secondary education students. Even though digital technology has since advanced, statistically significant differences between the sexes were recorded even 20 years ago, with the boys deriving greater enjoyment than girls in Physical Education and Information Technology courses, conforming to traditional gender stereotypes. In more recent studies, Christensen et al. (2005), in a large-scale study on 2nd grade high-school students and Sáinz and López-Sáez (2010) on high-school students, came to similar conclusions, with the girls recording statistically significant lower level of enjoyment from using computers than boys.

In conclusion, the cognitive dimension in the teaching of Physical Education -as is the teaching of volleyball tactics- can be supported by constructivist approach, cognitive orientation teaching interventions, with increased level of student enjoyment / interest, as professed by the modern pedagogical model of the tactical approach (Bell, 2005, McKeen, Webb & Pearson, 2007) to the teaching and learning in Physical Education.

5. Annex

5.1 Questionnaire for the investigation of student preconceptions

Boy ☐ Girl ☐ Student code ☐

Are you enrolled in a volleyball team? Yes ☐ No ☐

If so, do you participate regularly in the training sessions? Yes ☐ No ☐

1. In each of the following pictures, circle the player that performs the **block**:

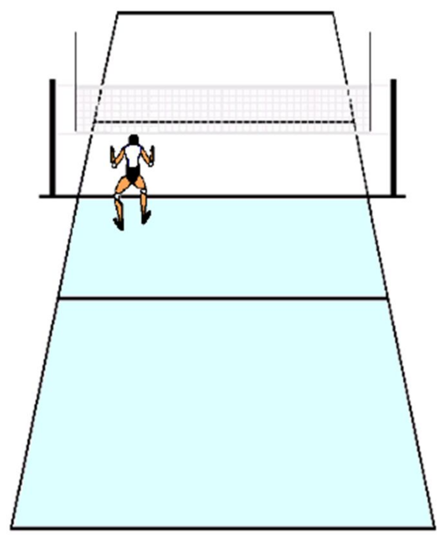
2. In each of the following pictures, circle the player that performs the **spike**:

The opponent team is in the white field and is trying to land the ball into the light blue field where our team is on defense.
Our team plays with the setter always in the center, at the front court close to the net. Only one player at a time performs block (single block).

3. ***A player from the opponent team (white field) attacks the ball close to the net:***

What does our teammate opposite to him do?

I. Moves away from the net ☐
II. Performs a block ☐
III. Stays put ☐
IV. I do not know ☐



Justify your answer:

4. ***A teammate of ours that is <u>not</u> the setter, contacts the ball first (any ball touching our teammate that performs the block is not considered a contact).***

To whom of our teammates will he attempt to pass the ball?

I. To his closest teammate ☐
II. To the best offensive teammate of his ☐
III. To the tallest teammate of his ☐
IV. To the setter ☐
V. Other ☐

VI. I do not know ☐

Justify your answer:

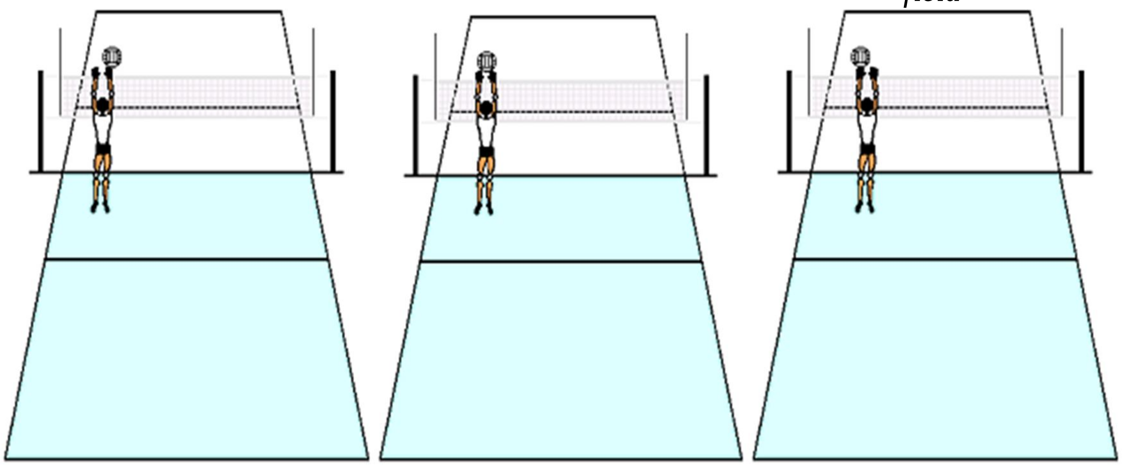
2 of 5

5. ***A teammate of ours performs a block.*** In which of the following figures has he taken the best position in regard to the ball and our field?

a. Figure 1 ☐ *toward the side of the field*

b. Figure 2 ☐ *exactly in front of the ball*

c. Figure 3 ☐ *toward the center of the field*

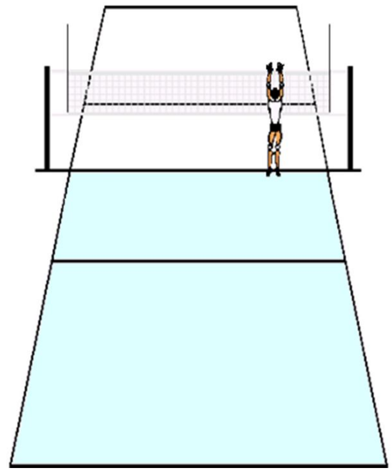


d. I do not know ☐

Justify your answer:

6. ***A player from the opponent team (white field) attacks the ball and a teammate of ours (light blue field) performs a block opposite to him.***

The probability of the ball reaching at any part in our field (light blue field):



I. Is the same for every part of the field ☐

II. Is not the same for every part of the field ☐

III. I do not know ☐

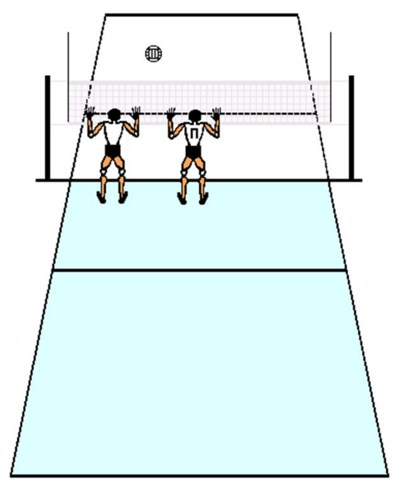
Justify your answer:

Draw and illustrate (the same, higher or lower probability) on the figure.

3 of 5

7. ***A player from the opponent team (white field) attacks the ball between and at an equal distance from our setter (II) and another teammate of ours.***

Which one of our teammates will position himself opposite the opponent in order to perform a block?



I. Our setter ☐

II. The other teammate of ours ☐

III. I does not matter which one ☐

IV. I do not know ☐

Justify your answer:

8. ***The ball is passed to our field by the opponent team and it first reaches a teammate of ours that is not the setter:***

What does our setter do?

I. Makes a run to the net in order to receive the ball And perform a spike ☐

II. Is in readiness to receive the first pass ☐

III. Moves towards our teammate that received the ball ☐

IV. Turns towards the net facing the opponents' field ☐

V. Other ☐

VI. I do not know ☐

Justify your answer:

4 of 5

9. Besides the player that performs a block, most of the players should defend:

I. in our field's region behind the player that performs the block ☐

II. equally dispersed throughout our entire field ☐

III. in our field's region to the right and to the left of the player that performs the block ☐

IV. Other ☐

V. I do not know ☐

Justify your answer:

10. Whenever our setter does **<u>not</u>** perform a block, is he involved in our team's defense? In other words, is he responsible for defending a region in our field?

I. Yes ☐

II. No ☐

III. I do not know ☐

Justify your answer:

If you answered Yes, which is that region in our field:

-- THE END --

5 of 5

5.2 Table 1: Number of students by group and gender

	Gender		
Experimental group	Boys	Girls	Total
Typical	25	16	41
Typical με χρήση ψηφιακού περιβάλλοντος	23	17	40
Με αξιοποίηση των προαντιλήψεων	24	20	44
Με αξιοποίηση των προαντιλήψεων και χρήση ψηφιακού περιβάλλοντος	20	21	41
Total	92	74	166

5.3 Intrinsic Motivation Inventory subscale for the investigation of student enjoyment / interest from their participation in the teaching interventions

Select whether you agree or disagree with each of the following sentences, by marking with a √ the appropriate column for each sentence:

	strongly agree	disagree	somewhat disagree	neither agree or disagree	somewhat agree	agree	strongly agree
I enjoyed doing this activity very much							
This activity was fun to do							
I would describe this activity as very interesting							
While I was doing this activity, I was thinking about how much I enjoyed it							
This activity did not hold my attention at all							

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