

Kinesthetic sense, psychomotor ability developed using volleyball-specific methods

Simțul kinestezic, capacitate psihomotrică dezvoltată la studenți cu mijloace specifice jocului de volei

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Abstract

Background. In the current context of medical performance, we consider the development of kinesthetic sense in medical students an educational priority of maximum importance, to achieve their future professional performance, in terms of specialization in general surgery and beyond. Therefore, the development of kinesthetic sense has to start from the first year of study, and continue the following year, reaching the main educational concept within the university of physical education and sport.

Objectives. We consider that by creating and implementing a specific adequate system of action in playing volleyball for the development of kinesthetic sense, we can successfully develop these psychomotor abilities of medical students.

Methods. The research was performed in two groups of the Medical Faculty, 1st year of study, homogeneous in terms of age (19-20 years), sex (female), and general motor skills. In the experimental group 1 (n=44), a special program for the development of kinesthetic sense with volleyball-specific methods was applied, and group 2 (n=51) followed a traditional physical training program, in which other games than volleyball were introduced. The results were processed using SPSS 17.0 mixed ANOVA by calculating means, dispersions and the comparison z test for independent samples greater than 30.

Results. Data on the kinesthetic sense parameters, determined in the experimental group, supported the hypothesis that through the application of a special program for the development of psychomotor skills with volleyball-specific methods, the group subjected to the experiment stood out significantly from the control group that followed traditional teaching activities.

Conclusions. The study on the growth of parameters of kinesthetic sense in the experimental group, compared with the control group, revealed that certain elements and techniques specific to the game of volleyball can be an effective means of developing these psychomotor skills (kinesthetic sense) in relation to using specifically other branches of sports (basketball, handball, football etc). This conclusion was based on the superior results achieved in the post-test compared to the pre-test for group 1, results that were confirmed by the z value of the post-test comparison, which was 1.97, greater than 1.96, and the null hypothesis was refuted and the specific hypothesis was accepted, considering that the difference between the two means was statistically significant at the significance threshold $p < 0.05$. In addition, the test was calculated and compared to the post-test value z between the two groups, which was 2.75, greater than 1.96, also evidencing a statistically significant difference between the two means at the significance threshold $p < 0.05$.

Key words: kinesthetic sense, volleyball, medical students.

Rezumat

Premize. În contextul performanțial actual medical, considerăm dezvoltarea simțului kinestezic la studenții medici ca o prioritate educațională de maximă importanță, în atingerea performanțelor lor profesionale viitoare, în ceea ce privește specializarea de chirurgie generală și nu numai. În acest sens, dezvoltarea simțului kinestezic trebuie începută încă din primul an de studiu și continuată în anul următor, prin atingerea obiectivelor educaționale concepute în acest sens, în cadrul activităților didactice universitare de educație fizică și sport.

Obiective. Considerăm că, prin crearea și implementarea unui sistem de acționare cu mijloace specifice jocului de volei adecvat dezvoltării simțului kinestezic, putem dezvolta cu succes această capacitate psihomotrică la studenții medici.

Metode. Cercetarea s-a efectuat pe două grupe de studenți din cadrul Facultății de Medicină, anul I de studiu, omogen din punct de vedere al vârstei (19-20 ani), sexului (feminin) și al motricității generale. Lotul 1 experimental (n=44), la care s-a aplicat un program special de dezvoltare a simțului kinestezic cu mijloace specifice jocului de volei și lotul 2 de control (n=51), care a urmat un program tradițional de desfășurare a activităților didactice universitare de educație fizică, în care s-au introdus ramuri sportive altele decât voleiul. Prelucrarea rezultatelor s-au făcut prin programul SPSS 17.0 Anova mixt, prin calcularea mediilor, dispersiilor și a testului de comparație z pentru eșantioane independente mai mari de 30.

Rezultate. Datele cu privire la parametrii simțului kinestezic, determinate în grupul experimental susțin ipoteza conform căreia prin aplicarea unui program special de dezvoltare a acestei capacități psihomotrice cu mijloace specifice jocului de volei la lotul supus experimentului, se detașează semnificativ față de lotul de control care a urmat o activitate didactică tradițională.

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Concluzii. Studiul cu privire la creșterea parametrilor simțului kinestezic la lotul experimental în comparație cu lotul de control a scos în evidență faptul că, anumite elemente și procedee tehnice specifice jocului de volei pot reprezenta un mijloc eficient de dezvoltare a acestor capacități psihomotrice (simțul kinestezic) în relație cu folosirea unor mijloace specifice altor ramuri sportive (baschet, handbal, fotbal etc). Această concluzie se bazează pe rezultatele superioare înregistrate în etapa de post-test comparativ cu cea de pre-test pentru lotul 1, rezultate confirmate de valoarea testului de comparație z al post-testului care având valoarea de 1,97 este mai mare decât 1,96 atunci ipoteza nulă se infirmă și se acceptă ipoteza specifică, considerându-se că diferența dintre cele două medii este statistic semnificativă la pragul de semnificație $p < 0,05$. De asemenea, s-a calculat și testul de comparație z între valorile post-testului celor două loturi, care a fost de 2,75 mai mare decât 1,96, rezultând de asemenea că diferența dintre cele două medii este statistic semnificativă la pragul de semnificație $p < 0,05$.

Cuvinte cheie: simțul kinestezic, volei, studenți mediciști.

Introduction

Psychodiagnosis is one of the most important aspects of the motor activity field, with a broad impact on sports orientation, on the preparation and the results of motor activities (Lozincă & Marcu, 2005).

The mind-body training (mind over body) comprises four main areas, all important parts of the athlete's mental training program (Doney, 2008):

- a) Establishing goals;
- b) Mental repetition and visualization;
- c) Use of assertions;
- d) Positive thinking.

The teaching process is a comprehensive instructive-educational activity, carried out systematically and in an organized manner by students and teachers in universities, activity through which students are endowed with a system of knowledge, skills, abilities, capabilities, competences, intellectual and motor acquisitions, based on which they acquire the scientific knowledge of reality, form their worldview, moral beliefs, character traits, and the skills of knowledge, research and creation (Ionescu & Bocoș, 2009).

It is known that psychomotricity is the result of integration of mental and motor functions under the effect of the nervous system maturation, involving the relation between the subject and his body. Psychomotor capabilities include the capacity of the individual to acquire and perform complex motor actions (with a higher difficulty degree), to accurately and economically conduct movements in time and space at the speed and power required in accordance with the situations that arise during the performance of actions (Moisescu, 2008).

Psychomotricity refers to *the motor effects of mental processes* (Drever quoted by Lozincă & Marcu, 2005), and the sensory-motor act is a motor effect of mental processes (English quoted by Lozincă & Marcu, 2005).

In the same idea, Prof. Epuran presents the concept of mental training as *a specific technique of influencing mental processes* (Epuran, 2004). In mental training, Bob Hickey recommends using *cards* that serve for learning the action by mental repetition. The card includes (Hickey, 2009):

- a) The outcome goal;
- b) The thoughts before the action itself.

The literature (Dragnea & Mate-Teodorescu, 2002; Epuran, 2005; Moisescu, 2009) considers 5 fundamental forms of manifestation of psychomotor skills, namely:

a) The capacity of assessment and adjustment of dynamic and spatial-temporal parameters;

- b) The ability to maintain balance;
- c) The sense of rhythm;
- d) The spatial orientation ability;
- e) The ability to coordinate movements.

The descriptive taxonomy of psychomotor skills treated in a synthetic formulation includes (Turcanu & Turcanu, 2009):

- a) Perceptual and perceptual-motor skills;
- b) Coordination - dexterity - aiming (targeting);
- c) Motor skills (qualities);
- d) Non-verbal communication;
- e) Relaxation.

Kinesthesia is a term that is often used interchangeably with proprioception, although the term of *kinesthesia* may place a greater emphasis on motion. Essentially, kinesthesia or kinesthetic sense is a feedback mechanism in which the body or some of its parts move, the information about these movements being returned directly to the brain (Paszta, 2009).

Kinesthesia is a key component of muscle memory. Kinesthetic sense is the ability to reproduce previously performed motor movement, thus requiring segmental coordination.

Movement is the result of the overall action of the kinesthetic sensory organ, consisting of millions of proprioceptive receptors arranged in millions of muscle clusters, tendons, joint surfaces, ligaments.

There are three levels of kinesthesia (Grosu, Popovici, Costinel & Kis, 2010):

- a) High sensitivity (finger, forearm, palm, buccal and lingual muscles, and the vocal tract);
- b) Moderate sensitivity (elbow, knee, pelvis and buttocks);
- c) Low sensitivity (leg muscles).

Objectives

The main objective of the research was the introduction of the volleyball game in teaching activities with medical students as a means to achieve the goals of education, but also as a means to develop psychomotor skills in general and the kinesthetic sense in particular.

Hypothesis

We believe that by implementing a driving system with means specific to the game of volleyball in university physical education teaching, we will be able to develop the kinesthetic sense at superior parameters in the experimental group compared with the control group following a traditional program.

Material and methods

Research protocol

We mention that according to the Helsinki Declaration, Amsterdam Protocol and Directive 86/609/EEC, the approval of the Ethics Commission from the Faculty of Medicine, Department M2 and Discipline of Motricity Sciences from the *University of Medicine and Pharmacy, Tîrgu Mureş* regarding research on human subjects was obtained, and also, the consent of the subjects for their personal participation in the research.

a) Period and place of the research

The study was conducted during the 2011-2012 academic year at the University of Medicine and Pharmacy in Tîrgu-Mureş, for the *Physical Education* subject, with the following subsequent steps:

- T₁ Testing or pre-testing was conducted in October 2011, at the beginning of the first semester;
- T₂ Testing or post-testing was conducted in January 2012, at the end of the first semester, after the implementation of the technical complexes specific to the game of volleyball, in the experimental group.

b) Subjects and groups

The research was based on two groups of 1st year students at the Faculty of Medicine, homogeneous in terms of age (19-20 years) and general motor skills.

- Experimental group E (n = 44);
- Control group C (n = 51).

c) Tests applied

The administration of the *pre-test* (T₁) was intended for the initial verification of the quality level of kinesthetic sense and the collection of start data. Kinesthetic sense was measured with kinesimeters that can schematically be described as follows (Horghidan quoted by Lozincă & Marcu, 2005): Rulers of 120/12 cm, graduated on edges. In the middle of the ruler, a rod is fixed along which a cursor slides. The examined subject performs a motion of a certain amplitude with the slider, with his eyes closed or covered with special blackened lens glasses; 5 seconds later, he reproduces it as close to the original performance as possible. The difference between the two executions will be measured, with the dexterous arm in the direction wanted by the subject.

The driving technology for the experimental group consisted of learning, strengthening and improving elements and techniques specific to the volleyball game:

- The fundamental position of passing the ball with two hands up, focusing on the proper formation of *the cup* and synchronizing the movement of arms and legs;
- The fundamental position of passing the ball with two hands down, focusing on the stressed extension of arms concurrently with the twisting to exterior motion of the forearms and synchronizing the movement of arms and legs;
- The two hands passing from upwards, forwards, sideways and over the head with high, medium or low trajectories with a focus on tracking the ball with the eyes;
- Taking with two hands the ball coming from the partner, downwards, from thrust and from service with an emphasis on leading the ball;
- Organizing the three hits in the field, exclusively by

using top and bottom passing with two hands;

- Service from upward, frontally, hovered, focused on previously established areas of the field;
- Learning individual and collective blocking focusing on the symmetrical action of arms;
- Learning momentum direction attacks.

The *post-test* (T₂) phase was aimed at highlighting the effects of the pedagogical intervention in the experimental group compared to the control group. A second action of comparative measurement of the test subjects resulting from post-testing was performed by comparing the scores obtained by the subjects in the experimental group, namely the global scores in the final evaluation to the scores achieved in the initial evaluation phase. The role of this phase was to determine whether the experimental group stood out significantly from the control group.

d) Statistical processing

The processing of results was performed with the program SPSS 17.0 mixed Anova by calculating means, variances and the comparison z test for independent samples greater than 30 (Bocoş, 2003). Thus, we used the following formula to calculate the comparison z test:

$$z = \frac{m_1 - m_2}{\sqrt{\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2}}}$$

Where:

$$m_1, m_2 \text{ (means)} = \frac{\sum x}{N} = \frac{T}{N}$$

T – the totality of sample values

$\sum x$ - the sum of individual values

N – the number of sample subjects

$$\sigma_{1,2} \text{ (variances)} = \frac{\sum (x-m)^2}{N-1}$$

N₁, N₂ – the number of subjects

Results

The measurements made to determine the kinesthetic sense parameters corresponding to the experimental group (E) for the two tests are as follows (Table I):

Table I

Kinesthetic sense - Group E.		
Difference between performances (cm)	Pre-test frequencies	Post-test frequencies
-5	1	0
-4	1	0
-3	2	1
-2	5	9
-1	3	8
0	2	5
1	10	11
2	7	6
3	6	3
4	4	1
5	3	0
6	0	0

The graphical representation (Fig. 1) shows the ascending route (pre-test - post-test) of kinesthetic sense for the experimental group and highlights the progress of all subjects.

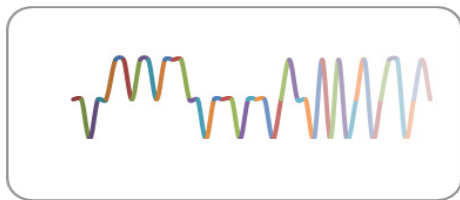


Fig. 1 – Kinesthetic sense, the experimental group.

The measurements made to determine the kinesthetic sense parameters corresponding to the control group (C) for the two tests are as follows (Table II):

Table II
Kinesthetic sense – Group C.

Difference between performances (cm)	Pre-test frequencies	Post-test frequencies
-5	6	7
-4	6	5
-3	5	4
-2	4	5
-1	5	4
0	4	5
1	4	4
2	4	4
3	3	4
4	4	3
5	3	4
6	3	

For the calculation of the comparison *z* test, it was necessary to determine the values of the means and variances for two sources:

- Group E;
- Group E compared to Group C (Table III).

Table III
Comparison *z* test.

Source	pre-test means	pre-test variances	post-test means	post-test variances	Z Test
Group 1	1.02	6.20	0.15	3.02	1.97
Group 1/2	-	-	0.25	11.75	2.75

By studying Table I, we can say that, after the experimental intervention, the kinesthetic sense values increased progressively starting after the pre-test phase performed at the beginning of the first semester of the academic year 2011/2012. This is further supported by the value of the comparison *z* test, the post-test for the experimental group (Table III), which having the value of 1.97, greater than 1.96, the null hypothesis is refuted and the specific hypothesis is accepted, considering that the difference between the two means is statistically significant at the threshold of significance $p < 0.05$ (Bocoş, 2003).

Also, by calculating the comparison *z* test between group E and group C for the post-test frequency, which was 2.75, greater than 1.96, it results (as in the above mentioned case) that the difference between the two means is statistically significant at the threshold of significance $p < 0.05$, and the specific hypothesis is accepted.

Discussions

The gradually ascending developments whereby the

experimental group achieved such values of kinesthetic sense as to differentiate it from the control group have resulted in the subsequent steps that represented the objectives of this research. This supports the correctness of our alleged hypothesis, namely that kinesthetic sense can be developed effectively by using technical elements and procedures specific to the volleyball game in university physical education teaching activities.

The more prepared we are, the more intense sensory and perceptual clarity and the more precise the accuracy of responses will be (Abrams, 2010); if the reaction level is optimal, unaltered and supported by the necessary technical knowledge, the effort will be more easily accepted (Leveque, 2008).

In view of the above context, we may consider that improving the kinesthetic sense of medical students should represent, by the teachers’ contribution, an educational priority in terms of student awareness and determination with respect to the importance of directing the entire teaching act towards a future clear necessity (in our view), namely increasing the overall quality of psychomotor skills and specifically the kinesthetic sense.

The values achieved by the two groups in the pre-test phase were generally close, while in the post-test the gap achieved by the introduction and implementation of the training program in the experimental group, compared to the control group which followed a traditional training program, resulted in increased values of the kinesthetic sense; thus we can affirm that the content sample (technical elements and procedures specific to the volleyball game) represented an educational landmark of a higher quality compared to that of the control group.

Conclusions

1. The use of statistical parameters (mean, variance and comparison *z* test) ensures the reliability of the better results achieved by the experimental group compared to the control group for this kind of evaluation. The research results are not coincidental and are not due to random factors other than those presented in this study.
2. The introduction of technical complexes specific to volleyball in university physical education teaching may guarantee the development of the kinesthetic sense in 1st and 2nd year students, a psychomotor ability that is particularly important for the future medical profession.
3. Extending these concerns of psychomotor skills development to senior students (3rd-6th years) by independent sporting activity may, in our view, lead to superior professional and particularly social results.

Conflicts of interests

No statement.

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