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The Role of Information Technology in Optimizing and Increasing the Efficiency of the Teaching of Motor Habits and Skills

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Author's contribution

This whole work was carried out authors CP.

Review Article

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ABSTRACT

Aims: To investigate the role of information technology in optimizing and increasing the efficiency of the teaching of motor habits and skills.
Study design: A controlled educational experiment.
Place and Duration of Study: Longitudinal research took place during the period 2009-2011 in 6 urban schools, all of which had the possibility of using modern technology to transmit information.
Methodology: This research included two categories of subjects: 12 teachers, two from each school out of the 6, and 158 pupils, girls and boys, aged 11/12 and 12/13 respectively. They were divided into two groups, an experimental group and a control group, each of which containing 79 subjects. In addition to this, when presenting the tasks entrusted to the subjects in the experimental group, modern technology - video and PowerPoint projections were used.
Results: In terms of training and acquisition of specific technical elements of the game of basketball, athletics and gymnastics it was found that the final results obtained by the subjects in the control group are lower than those made by their counterparts in the experimental group. The progress recorded by the latter were due to the increase in motivation, interest and mobilization of the subjects following the use of the audio-visual technique, an approach that led to a positive transfer in the shaping of the respective habits, based on intuitive information.

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Conclusion: The use of audiovisual means is part of the didactic strategy contributing to the diminution of the efforts made by the students and teachers of physical education in shaping the skills, abilities and specific attitudes.

Keywords: Information technology development; motor skills; physical education; didactic; abilitties.

1. INTRODUCTION

The knowledge lying at the basis of society at present is focused on the distribution of information based mainly on textual criterion. During school and afterward, especially during professional training, higher education or lifelong learning, the education and self-education processes continue through writing and reading [1].

According to H. Gardner's multiple intelligences theory [2], a human individual is capable of 8 different styles of learning and processing information: using words, questions, images, watching films, holding discussions, intrapersonal studying, and through direct contact with nature.

The progressive development of technological means, their possibilities of implementation, and with accessible costs, have determined, among others, the influence of this accessibility in the domain of bodily activities-see the new types of equipment designed for physical effort, especially for people with different deficiencies and the elderly, which may be used at home to improve their living conditions [3].

New motor coordination is based on previous practice and any 'alternation' of this is determined either by the absence of specific stimuli, or by the absence of continuity in the steps of cognitive, associative or autonomous learning [4], or of the consolidation of certain positive attitudes meant to replace other negative ones [5].

The present study is dedicated to the optimization of specific didactic motor activities, beginning with the role and importance of bringing back the use of images of the skills and abilities about to be learned or strengthened using modern information technology.

2. PROBLEM FORMULATION

Learning motor activities includes, besides the learning of gestures, a physical acquisition accomplished within the sphere of motor skills, habits, or uses, forms of intelligent learning consisting in the acquisition of notions and concepts, which has to do with creative learning. It is, therefore, a combination between the intellectual and the motor factor, aimed at harmonizing them in order to obtain optimal learning [3]. As far as the domain of physical education and sports is concerned, the possibilities of processing the information may be analyzed by making use of information processing models, which are considered the mechanisms involved in the human brain when they are approached from the perspective of a diagram, of a succession of events expressed by visual means [4]. One of these information processing models, adaptable to sports activities, is the Welford Model [6], the series of events being presented in Fig. 1.

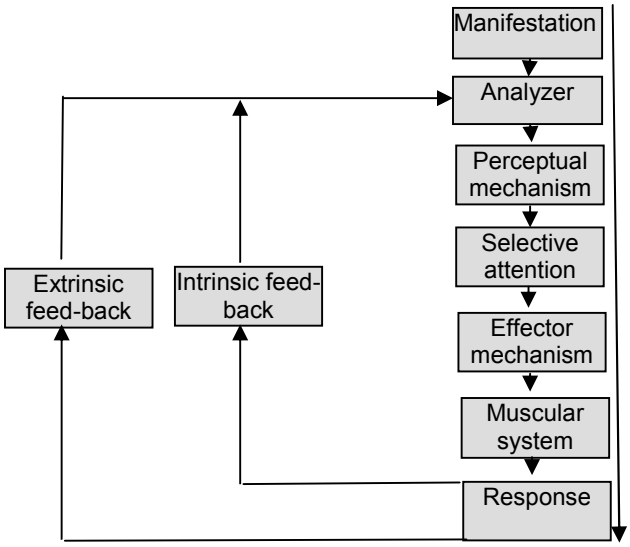

Fig. 1. Welford model (inspired by Altherton et al. [4])

In specialized literature, the perceptive motor process is presented as having five stages: sensory input-receiving different types of stimuli and transmitting them to the central nervous system; sensory integration-processing of the information received and storing them in a codified form in the memory; motor interpretation - adopting motor decisions based on the balancing of the present sensory information and the information stocked in the long-term memory; producing movement-carrying out observable movements; feedback-evaluating movement using different sensory ways [6].

From the perspective of perceptive learning, the systematic modifications of the homonymous reactions consist of structural changes, on the level of the receivers - for instance, a reduction of the sensitivity threshold, an accurate perception of the details or of different aspects of the whole, the recognition or identification of the structures under different conditions of difficulty, reducing the illusions corresponding to this type of learning, etc. [3].

The use of audiovisual means is part of the didactic strategy which has to be adopted unanimously in the training system, completing the standard teaching-learning methods and contributing to the diminution of the efforts made by the specialized teacher in the shaping of the specific competencies and abilities, along with the implementation of positive attitudes concerning the role of physical exercise in individual development [7].

Updating of information can be done relatively easy when you break it down into its componential segments, a process called chunking [4], alongside the use of mental repetition to store images, which when used correctly can become a strong ally, due to the diveristy of the situations at hand, being determined either by sensory stimulations, or by motor stimulations [8].

Nonetheless, it is possible that the use of images can present some disadvantages, these being caused by the fact that it is not always possible to differentiate between the positive and negative character of the proposed objectives, and the premeditation of mental

repetition shouldn't be likened to that seen and unsustained, because it can be falsified by some speculative results.

At the same time, some problems can also appear in using this method, in a retrospective mode instead of a prospective one (for example, the playback of a mistake in a game), except in the situation where, from these mistakes, the inaccuracies of individual execution can be corrected [9].

Table 1. Advantages and disadvantages of the use of audiovisual means in physical education lesson-prelucrare după R. Renard, J. Cureau [10,11]

Advantages	Disadvantages
• The pupil finds it easier to adapt to learning and exercise situations;	• The visual information, related to the execution, relies only on exact data, corresponding to the storage of similar events;
• Different executions are put in direct relation to each other, along with a paired central and peripheral vision of the events;	• The information is processed from a central perspective, expressed by means of a global vision of the action;
• The presentation is anticipated, the subject turning his eyes to the place where the action is sure to take place, which makes it possible to analyze the important elements;	• The presentation of the different types of executions and mistakes in relation to the motor action respects the chronology of their appearance, which does not allow their in-depth analysis;
• It is possible to analyze and consult each action over a longer period of time, with the information being complete, it becomes easier to analyze the strong points and the weak points of the execution in general or to make an analysis of sequences, unlike in the situation when the teacher serves as an example;	• In order to clarify the problem, a large number of examples and demonstrations is used;
• There may appear answers and, based on them, solutions for solving the task, even during the situation;	• The time dedicated to the analysis of the act or of the action becomes insufficient, the information being also incomplete, which supposes the repetition of the problem, sometimes for an undetermined period;
• So, the duration of the analysis of the problem decreases, and the action may become immediate;	• So, the period of time between the moment when the information is supplied and the moment when the correct answer is triggered becomes longer;
• Motor answers become efficient and match the action pursued.	• The motor actions become, more often than not, inefficient and inadequate for the action pursued.

Without aiming to make a complete presentation, in the table below we have presented several of the advantages and disadvantages of the use of modern Information Technology in physical education teaching in schools.

3. MATERIALS AND METHODS

3.1 Work Hypotheses

For the presentation of the motor tasks that need to be approached in the physical education class or sports training class, we shall make use of audiovisual means, and through the promotion and use of these:

a. We shall favor the memorization of the information needed to acquire the motor abilities and habits and skills, compared to the traditional teaching-learning manner.
b. We shall optimize the teaching approach specific to physical education and sports training, through the implementation of new ways of approaching the contents in order to shape the competencies, abilities and attitudes specific to this domain and to increase the interest in the practice of physical exercise, effect of which shall be visible in a better motor and functional capacity of the organism.

3.2 Research Portfolio

This longitudinal research took place during the period 2009-2011 in 6 urban schools (Targoviste city, Dambovita county, Romania), which had the possibility of using modern technology to transmit information, and included two categories of subjects:

a. 12 teachers, two from each school out of the 6. They awarded points on a scale from 0 to 10, at the beginning and at the end of each lesson cycle, for each habit and/or skill, programmed for training, shaping and development, taking into account the structure of each. The principle behind the choosing of these 12 teachers was homogeneity-all possess a didactic level 1 qualification, with teaching experience of over 20 years in physical education and sport in schools.
b. 158 pupils, girls and boys, aged 11/12 and 12/13 respectively, their ages corresponding to point of curriculum to the 5^{th} and 6^{th} grades, namely to lower secondary education. They were divided into two groups, an experimental one and a control group, each of which including 79 subjects. The subjects were chosen randomly, the heterogeneous character of class structure in Romanian education being well known. The control group worked using the traditional program, while the experimental group followed a special program described in the pedagogical experiment.

3.3 Methods

In order to attain the aim and objectives of our research, we used the following methods: bibliographical study, pedagogical observations, pedagogical experiment and graphical representation.

Within the pedagogical observation, protocols were used to determine the motor density of a lesson [MD=(actual time a subject works / time allocated to the lesson)x100] and the

pedagogical density [PD=(time consumed by necessary didactic measures / time allocated to the lesson) x 100], both for the control group and the experimental group.

The statistic processing and interpretation of the indicators used in our research have been realized by means of standard statistical-mathematical methods, looking at the following values:

a. Parameters of the central tendencies, namely arithmetic mean characterizing the tendency of central clustering, which is an indicator of position and represents the most probable value of the group;
b. Parameters of the variability tendency, namely: standard deviation or type deviation, (S)dispersion indicator; mean value standard amplitude, or mean error (Em); the variability coefficient (Cv) is expressed in percentages, giving the homogeneity degree of a group.
c. The Student Test (t) as a method for determining the differences between groups (the differences are considered insignificant if $t<1.96$, significance level 5%)

The pedagogical experiment - for the control group, involved the demonstration of the motor tasks followed by the verbal presentation of the elements that make them up. However, when presenting the tasks to the subjects in the experimental group, modern technology-video and PowerPoint projections were used. Concomitantly, using comments, the subjects' attention was drawn to the important moments of execution of each element included in the respective motor structure. In order to obtain objective solutions, consulting and discussions among the subjects of the experimental group about the components or methods of execution were avoided, the presentation being made to each of them individually.

Each subject, regardless of his belonging to one group or the other, benefited of three presentations for each structure or task that was to be solved, and later was invited to put down in writing the components he had memorized, all these being followed by the practical execution of the proposed exercises.

The motor tasks were directed towards:

a. acquiring, shaping and developing certain procedures specific to basketball – throwing the ball to the basket while standing and running, respectively; dribbling the ball, catching and passing it, jump stop.
b. acquiring, shaping and developing certain motor habits specific to acrobatic gymnastics–vaulting over the horse, with the legs straddled (gymnastics): momentum, punch on the springboard, support on one's hands, flight, landing;
c. acquiring, shaping and developing the start from a low position and the throw of the ball specific for athletics–the long jump with 1 1/2 steps (athletics): momentum, punch, launch, flight (steps in the air), and landing;

3. RESULTS

As we have shown before, in order to highlight the value of modern IT in the teaching and learning of the physical education contents, and of the means used in order to shape motor habits and skills specific for basketball, athletics and gymnastics included in the school curricula, a number of 12 teachers, from 6 schools, 2 for each school, awarded points on a scale from 0 to 10, at the beginning and at the end of each class system, for each habit and/or skill, considering their respective structure.

In Fig. 2 we have presented the average values of the scores obtained by the control group and the experimental group, during the initial testing and final testing, following the evaluation by the teachers of the progress recorded by the subjects for each of the three abilities under analysis.

So, in relation to the shaping and the acquisition of the technical elements specific for the basketball game, it was observed that the results of the appreciations concerning the level of the subjects in the experimental group were on average of 5.421 points at the beginning of the research, attaining the level of 8.662 points at the end of the evaluation, the progress being of 3.241 points, while the control subjects started with an average of 5.314 points, and in the end obtained 7.587 points, the difference being of 2.273 points. The superior result recorded by the experimental group is obvious, the initial average values being quite similar in both groups. This highlights the efficiency of the approach proposed ($P<0.001$).

Concerning the shaping of the habit of the long jump with 1 1/2 steps (athletics), for the experimental group, the average values were 3.654 points during the initial test and 8.254 points at the final test, while the control group scored 3.453 points and 7.478 points, the growth rate being in favor of the experimental group, which proves once again the efficiency of the application of the methods proposed ($P<0.001$). As far as the start from a low position is concerned, the initial values of the average score obtained were 2.412 points for the control group and 2.720 points for the experimental group. In the end, the same indicator reached respectively 7.496 points and 8.560 points, the progress being of 4.084 points and 5.840 points, with a difference of 1.836 in favor of those to whom the proposed work methodology was applied, which highlighted its efficacy ($P<0.001$).

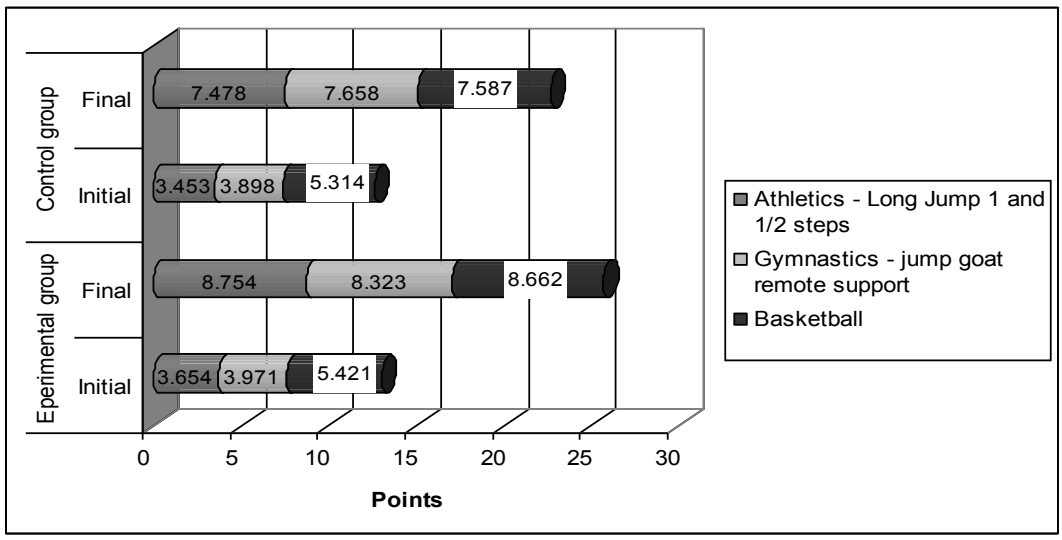

Fig. 2. Average results obtained by the subjects, according to the specialists' evaluation

At the same time, as far as the average of the initial score obtained for *vaulting* in the domain of gymnastics by each of the two groups is concerned, it was low and close in value (3.898 points for the control group and 3.971 for the experimental group); nevertheless, at the end of the experiment, this average was 8.323 points and 7.658 points respectively, with

an obvious progress of 4.352 points in favor of the experimental group compared to 3.760 points for the control group.

The progress recorded highlights the positive role of the use of audio-visual means in the teaching of material specific to gymnastics, the statistical-mathematical calculations demonstrating the significant character of this progress ($P<0.001$).

Another objective of our research was to establish motor and pedagogical density, in order to determine, from this point of view, the effect of using audio-visual means with the expermental group, in the 3 types of lessons (athletics, basketball, and gymnastics), in comparison with the control group which worked in a more traditional manner.

Thus, based on the results registered regarding the density protocols, which were the same for both groups, it was found that in the lessons aimed at developing athletics skills, the subjects from the experimental group recorded higher values in terms of pedagogical density, 32.68%, compared to 29.10% for the control group. This result led us to affirm that the use of audio-visual technology with the experimental group resulted in an increase in pedagogical density, without affecting motor density, the time allocated to the development of motor skills being 30.17% in the experimental group, compared to 27.64% in the control group, from the total 50 minutes destined for each lesson. At the same time, the reduced amount of breaks with a passive character recorded in the experimental group (37.15%), compared to that of the control group (43.26%) confirms once again the efficiency of using audio-visual means in physical education lessons with themes from athletics (Fig. 3).

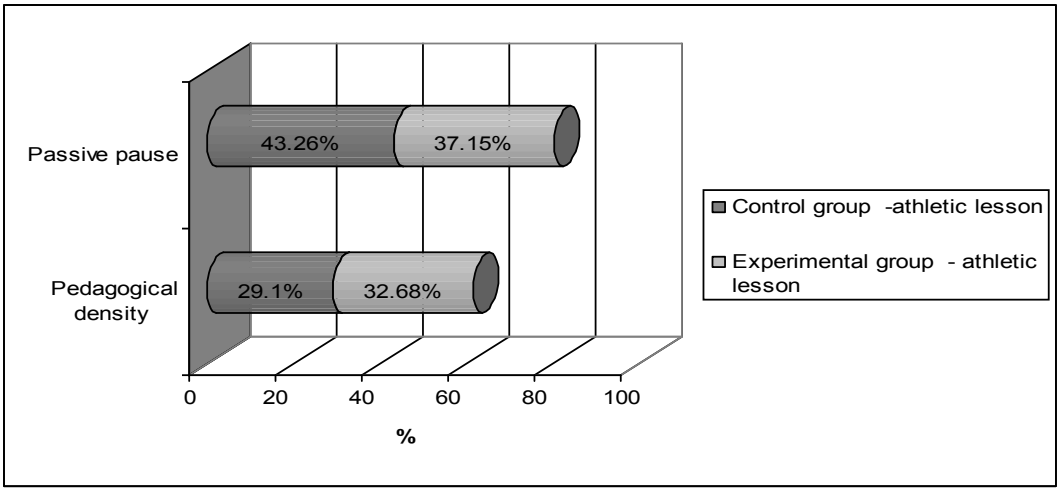

Fig. 3. Recorded results for pedagogical density and passive breaks during the athletics themed lessons

As far as the second category of lessons is concerned (basketball), as in the case of athletics, the recordings related to density showed increased values related to pedagogical density, 26.26% for the experimental group, compared to 24.6% for the control group, the conclusion being the same: the use of audio-visual technology resulted in an increase in pedagogical density without affecting, however, motor density, the value of which was 21.67% for control group and 25.98% for the experimental group, from the total 50 minutes allocated for each lesson.

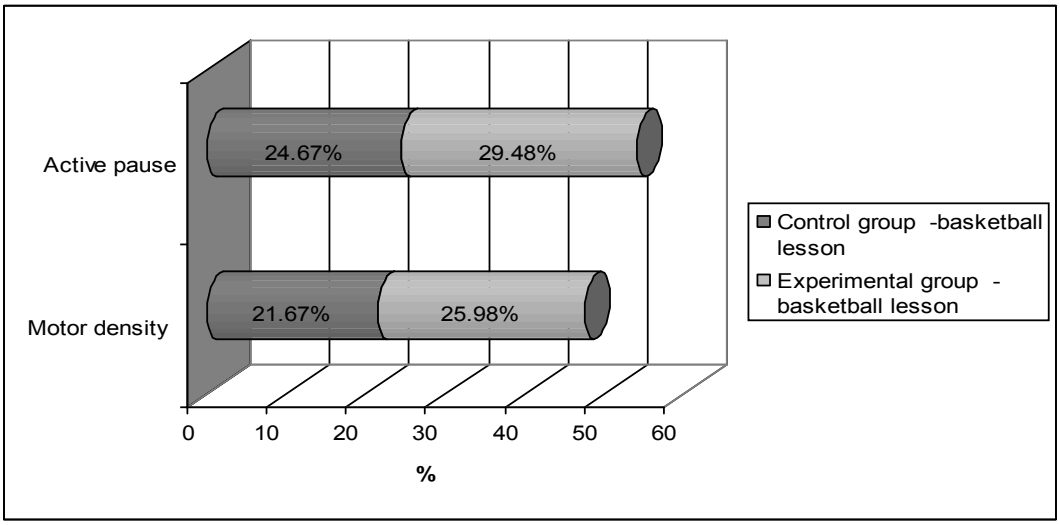

Fig. 4. Recorded values for motor density and active breaks during the basketball themed lessons

We must also mention that the time set aside for active breaks was 24.67% for the control group and 29.48% for the experiemental one. The decreased values of passive breaks recorded in the experimental group (47.76%), compared to that of the control group (53.73%), demonstrates in this case also the positive influence of audio-visual technology in lessons aimed at the formation and strengthening of motor skills specific to `team sports, in our case, basketball.

In connection with the third category of lesson, those in which themes from gymnastics were approached, we once again observed increased values in pedagogical density for the experimental group, 28.87% of the time allocated to the lessn, compared to the lower value of 23.77% for the control group. As in the previous cases, this did not have a negative effect on motor density, the values of which were decreased for the control group, 29.10% of the time allocated for the lesson, compared to 30.73% registered for the members of the experimental group. With regard to the time used for active breaks, this retained its decreased value for the control group, 13.86%, in comparison to 17.67% for the experimental group.

4. DISCUSSION

The motor tasks which were to be resolved by the subjects involved in the research corresponded to the level of motor expression of each, being based on the principle of accessibility and representation formation [3]. On the other hand, the motor skills in question are included in the school's physical education curriculum for the respective age groups. As well as this, it is well known that between the competencies and abilities of beginners, compared to those who are already involved in sport activities, there are significant differences related to the cognitive factors associated with coding, storing and processing information [3,12], an aspect confirmed by the subjects throughout the research through their heterogeneity from the point of view of motor capacity manifestation.

The large number of the analyzers participating to the identification of the stimuli determining the realization of a motor act or action that is part of a task reduces the risk that the person involved might respond in an erroneous way to the respective task. In this way, while the attention-related and execution-related mechanisms are influenced by an efficient feed-back, the latter becomes a main information source in the motor learning process [4, Fig.1]. Previous studies have demonstrated that experienced sportsmen rely in certain situations even on a negative feedback in order to eliminate the execution mistakes [17]. However, this is not valid in our case, namely in the case of beginners. The lower the level of development of the motor habits and skills specific to a sports branch or task is, the less developed the perception of a correct execution is. At the same time, the erroneous prior acquisition of a motor habit or skill and its application, at the respective moment, in a motor action may trigger a series of subsequent errors [18].

Concerning the differences and the gaps that may appear following the use of audio-visual means in the educational approach, the specialized literature speaks about two categories of beneficiaries: students whose practice relies on a frequent use of these means in the process of learning and students with limited or no access to such information-transmitting technology. The frequent use of audiovisual technology in the physical education lesson determines the student's adequate adaptation to the learning and practice situations, as the prior presentation permits a lengthy and pertinent analysis of the action, and positive answers may appear even during this process, which can finally assure an efficient motor answer, adequate for the action being carried out [10,11]. This has been demonstrated as well in the case of our research, an aspect exemplified by the results presented above, but also by the subsequent ones.

At the same time, between the anatomical performances of the visual system, there are not significant differences between the subjects of the same age group, in our case 10/11 years and 12/13 years respectively, these differences appearing only if some of them are attempting the motor skills for the first time while the others have continuity in this respect [13,14,15]. As far as we are concerned, all of the subjects have continuity in the selected sports, only that the use of audio-visual technology, together with the other methodological measures taken, facilitated the evolution of the subjects in the experimental group, their progress showing in the strengthening of the selected motor skills, in comparison to the control group, something confirmed by the appreciations of the 12 teachers involved in the research (3.241 points, compared to 2.273 points in basketball, 5.1 and 4.025 points respectively for athletics, and 4.32 points in comparison to 3.76 points in the sport of gymnastics). However, the significant evolution of the experimental group, between the two evaluation periods, in comparison to that of the control group, cannot be attributed solely to our intervention protocol, but in combination with the process of repetition and memorizing the motor tasks to be resolved, an aspect which was confirmed by the increase in motor density in favor of the experimental group (Fig. 4). Another important aspect is to do with the fact that the connection between the process of task representation and the explication of the task channeled the process of their perception, the explication bringing the plus needed by the subjects of the experimental group in the approach taken, not being able to benefit from this solely by calling upon sensory means [16].

5. CONCLUSION

We can state that our hypotheses have been confirmed, the final results obtained by the control subjects being lower, compared to those realized by their peers from the experimental group; the progress recorded by the latter were due to the increase in

motivation, interest and mobilization of the subjects following the use of the audio-visual technique, an approach that led to a positive transfer in the shaping of the respective habits, based on intuitive information.

As well, we can remember that presenting the motor tasks to the subjects through images favourizes retention of this information, in comparison to the use of traditional teaching methods, even though no significant differences appear between the time allocated to the actual execution, compared to the time required for the execution of the demonstrations.

Consequently, it is evident that the use of audio-visual technology does not contribute to a decrease in value of the different types of lesson density, on the contrary, in some cases, as in the case of the pedagogical density recorded in the experimental group for all lesson types, this kind of resource leads to an increase in lesson density, and ultimately, for the same group, important increases in motor density.

As a result, we can confirm that the progress of the subjects in the experiemental group was significant, and that this was the result of choosing, alongside the traditional teaching methods, video means inorder to present the motor tasks which were to be strengthened of perfected.

The inferior results recorded by the subjects in the control group are the consequence of using solely traditional methods of teaching, learning, and consolidating the physical education content, a fact which suggests need of a new approach in the process of transmitting and retaining information and in which the use of modern technology cannot be overlooked.

CONSENT

It is not necessary as the subjects are not patients.

ETHICAL APPROVAL

We mention that according to the Helsinki Declaration, Amsterdam Protocol and the Directive 86/609/EEC, Ethical Commission has been approved by the Departement of Physical Education and Sport from the Valahia University of Targovişte, Dambovita county, Romania regarding the research on human subjects and their agreement on personal participation in the research.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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