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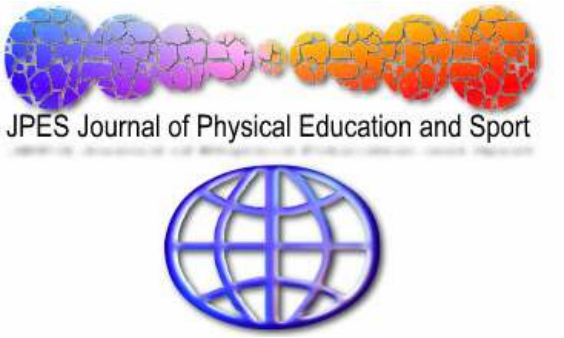

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ORIGINAL RESEARCH

THE FORECAST OF VALUES FOR EVALUATION IN COORDINATIVE CAPACITY AT ALPINE SKIERS BEGINNERS

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Summary

The paper proposes itself to present some methods of forecasting the values of coordinative capacities, evaluated through equilibrium and motor memory tests, during training programs of alpine skiers in the beginner class. These studies have lead to new methods and techniques of mathematical approximation of data using polynomial functions of result apportionment for the analyzed groups.

Key words: alpine ski, coordinative capacity, forecasting methods

Introduction

The forecast of the sports result for a certain training period supposes knowing the level of the sportsman's capacities, the results obtained during training and controlled repetition. In each training step the physical component has a well determined place and a volume of hours of preparation concordant with the established performance objectives.

Identifying the characteristics specific to each alpine skier may have an important contribution in the development of an efficient activity and in obtaining a physical condition through which the sportsmen may face the demands from today's alpine skiing.

The sportsman is an unique entity and has to consider the morphologic particularities, the physical capacities and it's own technical and tactical potential, to create a favorable climate to obtain performances.

The endowment of the sportsman with skills and aptitudes, complex or of keenness, with psycho-motor capacities well developed and educated, for precise purposes, measurable, through a training program well planned and organized, represents just a few of the directions to which the specialists action should be focused, in order to specialize the sports training.

Considering the targets in the sports training, the multilateral physical development, the specific physical development, the technical, tactical and psychological factors, the team spirit, the health factors, preventing accidents, the theoretical and specialty knowledge, etc., an important aspect in starting the specific actions consists of the preliminary ascertainment of the training goal and the forecasting of these factors.

The presentation of the experiment and of the tests results

Hypothesis: in our research it is supposed that implementing the mathematical model based on informational technology will contribute to the forecasting of the psycho-motor parameters that influence the physical training of alpine skiers in the beginners class.

Research methods used:

- Observation method;
- Experimental method;
- Mathematical model method;
- Graphical and table method.

The purpose of the research consists of perfecting the training process and the intuitive evaluation of the potential sportsmen, capable to obtain high performance with the help of informational technology based on sports forecasting methods. Concomitantly the permanent evaluation of the results obtained by the sportsmen during the training periods and comparing these with the medium results obtained by other similar groups permits adapting the training program, in order to obtain positive results in the end.

The structure and methodology of research

The experimental study was made on a number of 25 sportsmen of 9-10 years of age from the Vatra Dornei Winter Sports Club, Suceava County.

The research has consisted in organizing a base experiment, in the period of April 1st – October 1st 2008 at the Vatra Dornei Winter Sports Club, and the mathematical model and data processing were done in the in the Modeling and Simulation Laboratory of the Electrical Engineering and Computer Science Faculty from Suceava.

The sportsmen had they're physical training off the sport track, outdoors and indoors.

Concerning the processing of the conditional, coordinative and intermediate capacities, force in speed condition (fast force) will contribute to regulating and adapting the muscular coordination, as the good functioning of the guiding nervous system.

In our research we have applied a number of four tests available to the test group, selected from reference materials, which have been proven to be authentic and valid:

- Test 1 – static equilibrium (Romberg method);
- Test 2- Equilibrium and spatial orientation (5 rotations in a delimited circle, followed by walking in equilibrium on a marked space, 20 cm wide and 3 m. Long);
- Test 3- Dynamic equilibrium (walking in equilibrium on the gymnastics bench followed by 180^0 turns);
- Test 4- Operative-motor memory (8 point exercise).

The testing was realized in three months intervals, existing an initial evaluation, (Ti), an intermediate evaluation, three months after the first one (Tm) and a final evaluation, three months later (Tf). The results are presented in Table 1.

The tests have been chosen by the coordinative point of view, because at the age of 9-10 years, major development changes are recorded, and the maximum values are at the age of 16-20 years.

Table 1. *The evolution of the development parameters of coordinative capacities at the alpine skiing beginners class*

Crt. Nr.	Name	Age	Test 1			Test 2 [cm]			Test 3			Test 4		
			Ti	Tm	Tf	Ti	Tm	Tf	Ti	Tm	Tf	Ti	Tm	Tf
1.	A.D.	10	3	4	5	25	28	28	6	7	9	2	1	1
2.	D.F.	9	2	2	3	20	20	25	15	15	17	1	0	1
3.	F.G.	10	3	4	5	15	17	17	3	5	6	0	1	0
4.	D.R.	10	4	6	6	25	26	26	11	13	13	2	2	1
5.	T.U.	10	5	6	6	35	35	34	9	9	9	3	2	2
6.	D.G.	10	5	6	6	40	40	40	18	19	18	4	3	3
7.	A.N.	9	3	4	6	15	18	18	13	16	17	1	0	1
8.	D.C.	9	2	3	3	20	22	22	12	13	14	1	1	1
9.	V.L.	9	3	5	5	25	25	27	5	7	7	5	4	4
10.	L.M.	10	4	4	4	35	35	35	12	13	16	0	0	0
11.	B.N.	9	4	4	5	40	40	41	12	11	13	3	3	2
12.	V.F.	10	5	6	7	30	32	32	10	16	14	2	2	2
13.	H.L.	10	6	8	8	35	36	36	7	8	10	1	1	1
14.	L.C.	9	3	6	6	25	25	28	11	12	12	1	0	0
15.	C.A.	9	2	4	5	15	19	19	14	13	8	2	1	1
16.	S.D.	9	3	3	6	10	10	15	15	16	12	3	2	2
17.	D.F.	10	4	5	5	20	24	24	6	11	15	1	1	1
18.	R.T.	9	3	4	6	25	26	26	3	5	6	1	1	1
19.	R.S.	9	4	4	6	25	25	26	13	15	15	2	1	1
20.	R.A.	9	5	5	6	35	36	36	8	8	10	3	3	2
21.	R.E.	10	3	3	4	20	22	22	18	14	16	3	2	2
22.	F.H.	9	3	4	5	25	25	27	7	8	9	4	2	3
23.	P.H.	10	4	5	6	20	27	27	6	6	8	4	3	3
24.	C.E.	10	5	6	7	30	28	28	13	11	15	2	1	1
25.	D.F.	10	6	7	7	20	20	25	11	13	12	1	1	1

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To process the information were illustrated tests number two and four.

During the data processing the graphical information representation was emphasised as the most intuitive in identifying the results global characteristics. Starting from this, diagrams were made, representing the frequency with which it appeared in the tested group, for the results obtained in each evaluation.

In the following representations we may observe the performance's evolution in the tested group.

Sportsmen

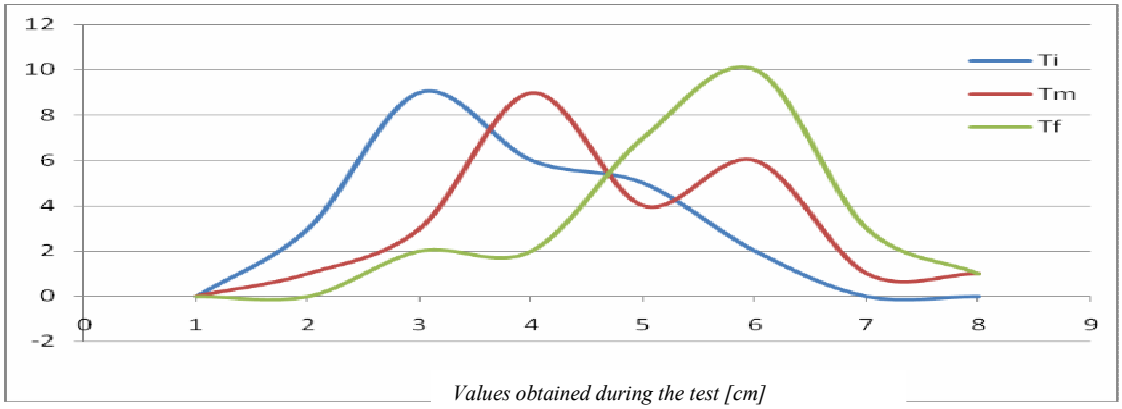

Diagram 1. *Representation of data obtained during test numbrer 2, of equilibrium and spacial orientation*

In the case of diagram number one, the equilibrium and special orientation test, we observe the maximal values displacing to the right, to the maximal performance area. For the initial testing there is an absolute maximum, around the value of 3, and for the final testing the absolute maximum is around the value of 6. Also for the final testing we observe a secondary maximum, at the value of three, this being represented by the individuals in the group that didn't responded with the corresponding evolution to the training program and which may be directed to the mass sports.

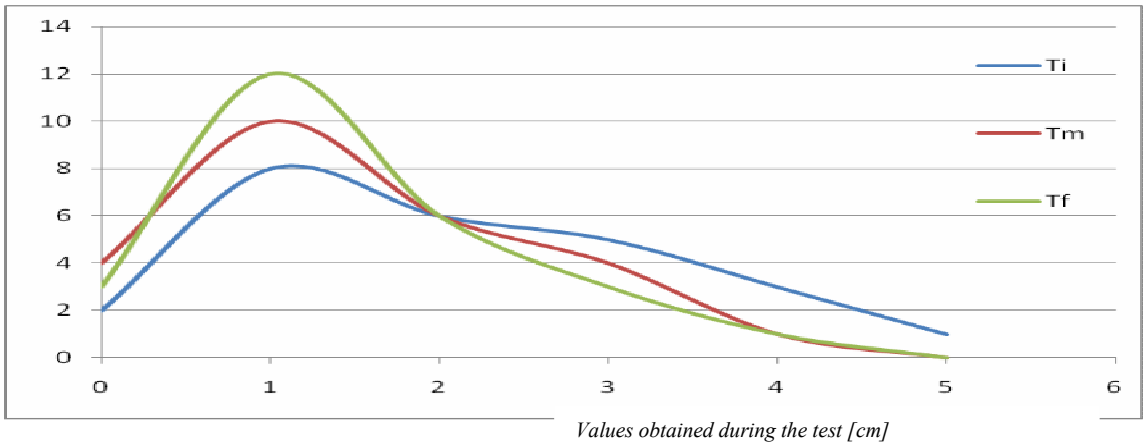

Diagram 2. Representation of the data obtained during test number 4, for the mothrical operative memory

In the case of diagram number two, we observe the changes in the graphical gradient between tests and an increase in the extreme values at once with the training program. It is very interesting the graphical intersection at the value of 2, resulting a constant number of sportsmen that make the same number of mistakes, regardless of the testing period.

In the previous cases, having for each test only the first two rows of values (Ti and Tm), we can approximate the values from the final training period (Tf) in the purpose of an earlier evaluation of the programs efficiency.

For this we must search for functions that would permit the extrapolation of data from the first two periods and generating a set of values which would overlap the actual final results. We can evaluate the programs results and eventually change' it in the final period in order to maximize the results.

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In many practical applications appears the necessity of function approximation through a relatively simple function, so that for any value of *x,* the value of the approximation function should be "sufficiently close" to the value of the real result.

There are especially two cases in which the approximation of such a function is imposed. The first is the one in which the function has an intricate expression or hard to evaluate or handle in the gravel. In the second case in which the approximation is imposed is the one in which the function is given through a table of values obtained, for example, from some measurements. In this situation we approximate the function given in the table by an analytic expression that would permit the interpolation or extrapolation in the values table.

Very frequently in the process of approximation we get polynomial functions as linear independent functions. In this case, the approximation polynomial will be an algebraic one. The polynomials are easy to evaluate and the sum, difference and product of two polynomials lead to other polynomials. Also, the polynomials can be derived and easily integrated. The polynomial approximation is based on Weierstass'es theory of approximation that shows that if a function is continued in a close interval, than for each value in that interval there will be a polynomial of *n* degree, so that:

$$|f(x) - p_n(x)| < \varepsilon, \quad a \le x \le b$$

Where *f(x)* is the approximated function, $p_n(x)$ is the approximation polynomial and the values of *a* and *b* are the terminals of the interval in which the approximation is made.

Sadly, the existing criteria to generate the approximation polynomial do not guarantee in no way that the found polynomial is the one distinguished by the theory of Weierstras.

From graphic number one and two result that the functions of approximation used must have a polynomial figure, because only this overlaps with minimal errors over the real diagrams earlier presented.

In diagram number three a 4th degree polynomial function is presented, made to approximate the final values of the motor operative memory test and the real values obtained during the testing. The extrapolation was based on the values from the test at the beginning of the training period and the test done three months later. The approximation polynomial found is : $y = -0{,}38x^4 + 4{,}4x^3 - 17{,}3x^2 + 21{,}7x + 3{,}1$. As we see in the diagram, it leads to a medium error value of zero, but we get greater errors in the last part of the interval, so the sportsmen group with training results is well approximated.

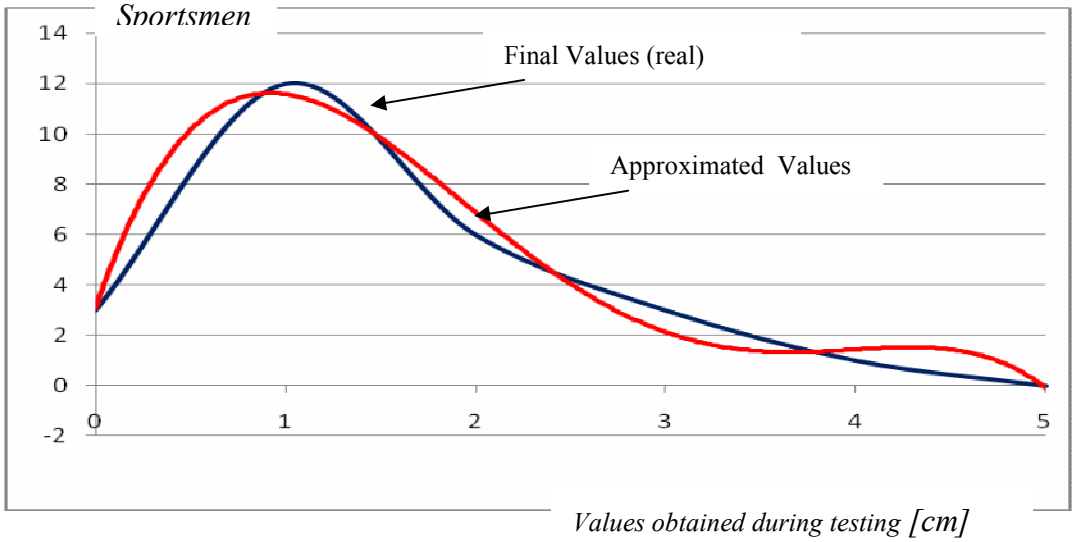

Diagram 3. *Representation of data obtained at the end of test number 4 and in the case of polynomial approximation of this data*

Conclusions:

1. The general and specific physical training off track for beginners class skiers in alpine skiing must have a multilateral character, viewing the optimization of all physical features, of coordination and motor capacities for skiers 9-10 years of age.
2. The role and importance of coordinative capacity in the physical training of skiers 9-10 years of age insures the base for the specific training and is the starting point in realising the process of selection for performance.
3. It is recommended to make this tests using other methods and processes in order to reduce errors, at least in the case of the static equilibrium. There are known systems realised at the National Sports Research

Institute by professors Piere de Hillerin's staff. The testing methods used are general methods, but through an innovating activity that is based on the experience as a trainer we can develop tests specific to any event.

4. The prediction algorithm used in research proves to be necessary and useful for the planning of the training in order to select the potential performance sportsmen.

5. The diversity of the human nature leads to groups of athletes with different availability to performance. From this motive the coefficient of the approximation functions will vary from one group to another even if the members have the same age and training program. So the approximation function can be used in the same way for two large groups of athletes where we can obtain an average performance in some approximated limits.

6. An exact gravel of the extrapolation functions can be very useful to identify the athletes with the greatest potential for performance sports even if the determination algorithm of the polynomial coefficients is laborious. A software application is possible, to automatically calculate these functions, in order to extract rapidly the information needed by the trainer.

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