PROGRAMMING, CONTROL AND EVALUATION OF EDUCATIONAL TRAINING EFFECTS AND CHANGES

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Original scientific paper

Abstract
The aim of this paper is to present a model for managing effects and changes as well as the methodology for creating educational training programs. According to the aim the management model, algorithmic methodological steps of educational training programs, models and methods that will be used in their creation and control, calculation and analysis of their effects and changes in sport will be presented. The model of management of educational training effects and changes and its mathematical formulation has been described first. Then, the algorithmic methodological steps of creating educational training programs are fundamentally described. Since the proposed methodology requires complex operations with a large number of variables, as well as the application of relatively complex mathematical and statistical procedures, it was also necessary to describe information technology support as a hardware and software system for automatic data collection and processing. In some steps of making educational training programs, the model of consistency, difference, residue, linear stochastic model, component, taxonomic, canonical and regression model would be used. In doing so, quantitative and qualitative methods for analyzing, programming and controlling training effects and changes would be used.

***Key words:** motor control, algorithm, programming methodology, training effects, training changes.*

Introduction

The main aim of this paper is to present modern knowledge and to answer the question of management i.e. the organizing, programming and conducting of training process in order to achieve the best possible education training effects and to generate planned changes in the domain of the provided knowledge, abilities and skills of sportspeople (Amanović, Baić, Nikač, Ljubisavljevic. 2015; Bonacin, 2012; Bonacin, Bonacin, Lozovina, 2013;Lozovina, Lozovina, Bonacin, 2011; Lozovina & Lozovina 2012; Momirović, Prot, Dugić, et al., 1987; Milošević, Mudrić, Mudrić, Milošević, 2012; Milosevic& Milosevic 2013a; Milosevic & Milosevic 2014; Milošević, Nemec, Nemec, Milošević, 2018). Based on the latest experimental research results and contemporary education training theories, mathematical models of education and training of sportspeople have been defined, and the latest methodology of education and training has been programmed and examined in practice. Its application significantly accelerates learning processes as well as the adaptation and transformation processes of athletes in the field of education and training(Bonacin 2012, Bonacin et al., 2013; Lozovina, et al., 2011; Lozovina & Lozovin, 2012; Momirović, et al., 1987; Milošević, et al., 2012; Milosevic & Milosevic 2013a,b; Milosevic, Nemec, Zivotic, Milosevic, Rajovic, 2014a; Milošević, Milošević, Nemec, Životic, Radjo, 2014b; Milošević, Džoljić, Milošević, Yourkesh, Behm, 2014c; Milosevic & Milosevic 2014; Nemec, Milošević, Nemec, Milošević, 2016; Milosevic, Nemec, Jourkesh, Nemec, Milosevic, Behm, 2016; Milošević, Nemec, Nemec, Milošević, 2017; Milošević, et al., 2018). Special attention has been dedicated to exact planning and programming education training programmes, education training processes and methods, as the methods for data gathering and feedback analysis on the general output from education training effects and changes managing system (Bonacin, 2012; Bonacin et al., 2013; Lozovina, et al., 2011; Lozovina &Lozovin2012; Momirović, et al., 1987; Milošević, et al., 2012; Milosevic & Milosevic 2013a,b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic& Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016; Milošević, et al., 2018). Accordingly, the authors have provided an opportunity to individuals to plan, programme, and manage education training while all effects and changes of their work are measurable and manageable by applying stated methodology. A part of the aforementioned methodology is technical support in managing education training effects and changes (Bonacin, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2014). It provides quick and simple data acquisition, storing it to specialized databases, and their complex structure analysis by stochastic and deterministic mathematical methods and procedures (Bonacin, 2012; Momirović, et al., 1987; Milosevic & Milosevic 2014) Likewise, it provides determining equations which depict various specific movements of athletes, force production, education training effects and changes in knowledge, force, aerobic and anaerobic, the dynamics of athlete’s progress, their energy reserves and energy processes, the pace of their recovery while training and intermissions, the speed, time and level of supercompensation in various managing fields (Bonacin, 2012; Bonacin et al., 2013; Lozovina, et al., 2011; Lozovina & Lozovina 2012;Momirović, et al., 1987; Milosevic& Milosevic 2013a,b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic& Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016; Milošević, et al., 2018; Pyne, Mujika, Reilly.2009; Yue, Broich, Seifriz, Mester. 2008). Finally, it provides graphic presentation, printing the analysis results and reports, comparison of athletes, classes, and groups to the results of European and world athletes, and sequential search for the best possible training for an individual, class, group or sports team (Bonacin, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2014).

In addition, programming support provides direct managing of education and training sessions, and managing and directing programmed current and cumulative training effects and changes (Bonacin, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2014). This methodological concept provides the coaches, professors and athletes with the knowledge regarding exactly what to do and why at all times as well as what not do to and what is the outcome of the conducted training (Milošević, et al., 2012). Thus, things like good external usability of output data, hardware and software support and generation of data which can but also which can't be provided with in vivo experiments are, among other characteristics, the most important reason for recommending the presented model for further use in practice on a daily basis (Milosevic& Milosevic 2013a,b; Milosevic& Milosevic 2014).

The model for managing education training effects and changes

Athletes' performance is evaluated through the effects, quantitative and qualitative changes, and specific skills and processes which influence the quality and speed realisation of their motion in sports. The desired effects are generated by applying education training effects (operator) in accordance with the set goals (Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic& Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016; Pyne, et al. 2009; Yue,et al. 2008). The state model is used as the basis (Milosevic& Milosevic 2014) for rational managing of effects and changes. Consequently, the state of the system presents the smallest set of factors which at a particular time frame enables (Bonacin, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2013a ; Milosevic& Milosevic 2014) the following:

- A thorough explanation of athletes' functioning and characteristics as a biological system (the manner of functioning, adaptive characteristics, regulation mechanisms, information and energy processes, relations, effects, and changes),
- Predicting athlete's behavior,
- Simulation to determine optimal changes in athletes' adaptive characteristics, processes and specific skills according to the requirements of sports fields and applied programs.

An individual or group transitions from one state (initial) to the other (transitive or final) projected state. Therefore, the state of an individual athlete or group is presented via state variables, whereas the set of all state variables shows the state space, while the motion through trajectories of state space is defined as system behaviour (of an individual athlete or a group) in the given space (Milosevic& Milosevic 2013a; Milosevic & Milosevic 2014).

The state of the system is shown via motor variables (muscle contraction and bioenergetics potential, specific motor skills) since they are the prominent parts of every motion. Other variables such as psychological and morphological, variables showing energy and tactical requirements of fights-competitions, and others have an influence on the quality and speed of specific motion in sports, either directly or serving as a reducer or intensifier of motor variables' influences. Thus, it is rather necessary to be familiar with their relation to motor variables for the purpose of improving management (Milosevic& Milosevic 2013a; Milosevic& Milosevic 2014). With such a predefined state model, the general model of managing input (space for input variables U), state space (X), and output (space for output variables Y) are shown in Figure 1 where operators (blocks) depict the following transformations:

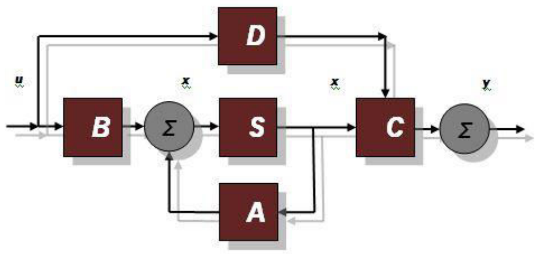

Figure 1. State model (Milošević, B.M. & Milošević, M.M. 2014).

A : X → X_{n+1} - system matrix,
B : U → X – input matrix,
C : X → Y – output matrix,
D : U → Y – direct input-output relation matrix

Where S shows thecurrent response operator of an athlete's organism between two transitional states.
Matrix A shows training programs, that is the matrix of training system functioning. It consists of the coefficient presenting the relation between training which is depicted via models, methods, scope and intensity, distribution of training and education stimuli, as well as other environmental factors together with effects and changes which are generated by the scope of the state of the system.

Matrix B is the managing matrix (control operator) which is the matrix of the input variables' (U) decomposition. Matrix C is the mechanism of the system's functional composition of decomposed space state (X). Matrix D shows the relation between the criteria of system management in the managing space.

The system performance is presented in its mathematical form using the following equations:

$X_{n+1} = Ax_n + Bu, \ Y_n = Cx_n + Du, \ x(t_0) = x_0$

The data that follows provides the information on the main issue when programming and managing the management model.

It provides adequate support in the form of gathering greater amount of precise output data at the right time (current and cumulative effects and changes generated by applying education training programmes) which describes the system (by using sub-systems of binary relations according to the state or system output). The issue of state recording is resolved through observer constitution (Figure 2), that is the mechanism for evaluating or measuring relevant state variables and output of the given system (Milosevic& Milosevic 2013a; Milosevic & Milosevic 2014). Such an expanded model manages the observer, operators of the reference input value (F) and feedback (K), as the space of evaluated states (X) and reference stimulus (V) which is shown in Figure 2.

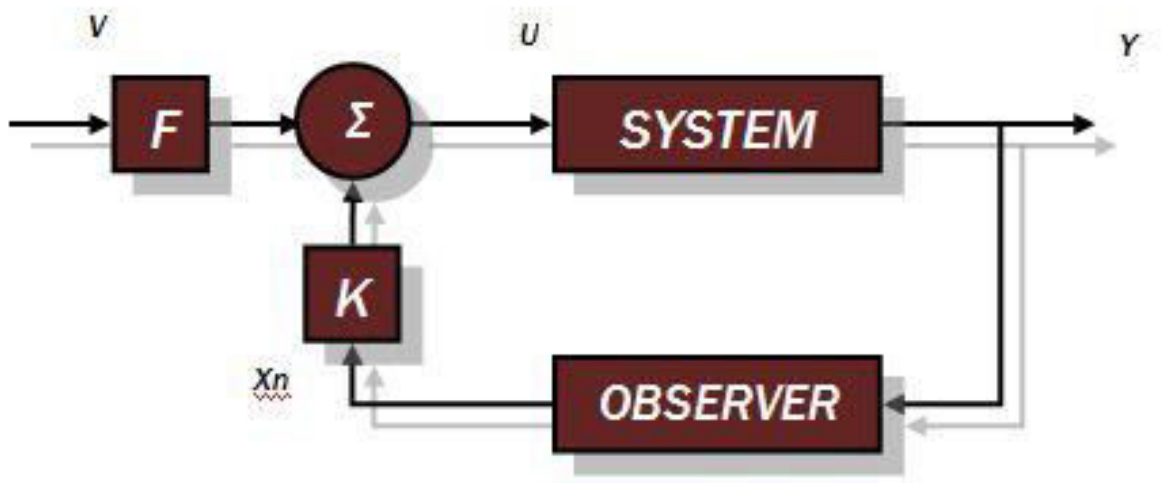

Figure 2. Observer (Milošević, B.M. & Milošević, M.M. 2014).

As opposed to the system matrix A , which represents a natural auto regulation system behaviour as shown in Graph 1, the observer is identified as a mechanism for observing variables of the manifested state in the extended form, which in combination with the reference operator input F and imposed feedback (regulator K) portrays forced managing system of athletes' states.

The aforementioned managing concept provides more thorough dealing with this issue which implies, accepts and incorporates wider social interest, financial limitations and other non-specific factors. The extended system is presented using the following differential equation:

$x_{n+1} = A_0x_n + B_0Y_0 + Bu$

x € X shows the estimated athlete's state, A_0, B_0 shows observer's specific characteristics presented mathematically.

Semantic logical algorithm definition

In accordance with the model of managing effect, change and methodological basis, an algorithm (a set of rules) has been constructed, which is used (designing) for making educational training programs for the needs of all sports.

Algorithm steps in management model are represented as matrices A, B, C, D (Figure 1) and observer (Figure 2). Each algorithmic step has a mathematical background that would be used, among other things, in the development of software for management of education and training in sports, but in this paper it will only be presented its final and key determinants.

The algorithm has the following format:

Step One:
Defining population: age, gender, sensitive zones data, health status, morphological status, data on psychological status, data on physical status, capacities and the level of technical as well as of tactical skills of both individuals and the entire student or competing population (Amanović, et al. 2015; Pyne, et al. 2009; Yue, et al. 2008).

Step Two:
Defining variables for the assessment of athletes' abilities, their skills, advancement, energy and tactical requirements of fights – competitions, physical condition of sportspeople, aerobic, anaerobic non-lactate and lactate education training, speed and force training, cognitive effects and changes.

In addition, mechanic, myogenic, neurogenic, biochemical and physiological effects and changes in athletes' organisms (Milosevic& Milosevic 2013b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic & Milosevic 2013a; Milosevic & Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016).

Step Three:
Defining objects of management (educational objects, objects that define the fight – competition, followed by aerobic, anaerobic and energy status, status in speed and force, etc.) which are consequently changed under the influence of education and training (Bonacin, 2012; Bonacin et al., 2013; Lozovina, et al., 2011; Lozovina & Lozovin, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2013b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic & Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016).

Step Four:
Defining tests (the programme and procedure for measuring metric units) for the assessment of methods, education training, education training effects and changes (Bonacin, 2012; Momirović, et al., 1987; Milosevic & Milosevic 2013b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic & Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016).

Step Five:
Defining operations for calculating values in set units (Bonacin, 2012; Bonacin et al., 2013; Lozovina, et al., 2011; Momirović, et al., 1987; Nemec, et al., 2016).

Step Six:
Defining experiments for conducting diagnostics of physical and education status and the training statuses of an individual, group, team and specific age group (Bonacin, 2012; Bonacin et al., 2013; Lozovina, et al., 2011; Lozovina & Lozovina, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2013b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic& Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016).

Step Seven:
Calculating initial state and capacity (Bonacin, 2012; Momirović, et al., 1987; Milošević, et al., 2012; Milosevic & Milosevic 2013b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic& Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016; Milošević, et al., 2018).

Step Eight:
Calculating and evaluating dynamics of increase in observed variables of an individual, group and population according to the abilities of athletes and in accordance with the competition requirements (Bonacin, 2012; Momirović, et al., 1987; Milosevic & Milosevic 2014; Milošević, et al., 2018).

Step Nine:
Calculating the ideal final state of an individual, group (taxon), team and population in observed variables (Bonacin, 2012; Momirović, et al., 1987; Milosevic & Milosevic 2014; Milošević, et al., 2018).

Step Ten:
Differentiating between initial, transition, and final state among individuals and groups in a team or school (Bonacin, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2014).

Step Eleven:
Defining the material base is (conditions) in which education training or education is performed: the number of playgrounds, gymnasiums, open and enclosed fields, gyms, equipment, the number of coaches, the amount of available finances, and competition calendar (Amanović, et al. 2015; Pyne, et al. 2009; Yue,et al. 2008).

Step Twelve:
Defining a timeframe of the education training structure: the duration of specific training in minutes, the number of training sessions per day, the number of training sessions per week, the number of training sessions per month or year, the duration of a training session per day, week, month, or year expressed in minutes, the transition of daily, weekly, and education training regimens; calculating the time relation between physical and technical tactical preparation according to age and training; yearly, monthly, weekly and daily plan; defining periods without competitions, periods with one, two or more competitions per week, and the total number of competitions per year according to age group (Bonacin, 2012; Bonacin et al., 2013;Momirović, et al., 1987; Milosevic & Milosevic 2013b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic& Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016).

Step Thirteen:
Defining the set of classical and specific education training processes used by all age groups throughout yearlong education training sessions (Bonacin, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2013b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic& Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016).

Step Fourteen:
Defining the set of education training methods used with all age groups during the year long education training period (Bonacin, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2013b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic& Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016).

Step Fifteen:
Defining the voluntary influence of education and training: field (basic, targeted and advanced or situational training), the manner of influence

(establishing, developing, managing, renewing), the training regimen (aerobic, anaerobic, etc.), the type of influence (all skills and abilities which are developed according to the given age groups) (Milosevic & Milosevic 2014).

Step Sixteen:
Data input on education training program: the ordinal number of one or more training sessions, date or dates of training sessions for which the programmes is designed, athlete's name and surname or the name of the group (team – team 1 or team 2), the age of athletes (Milosevic & Milosevic 2014).

Step Seventeen:
Defining (setting) training goals by calculating the current and cumulative education training effects for individual athletes for one or more training sessions in his/her field of expertise, aerobic, anaerobic, speed and force based on the diagnosed initial state, dynamics of athlete's advancement, the requirements of the competitions as well as material conditions (Bonacin, 2012; Momirović, et al., 1987; Milosevic & Milosevic 2013b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic & Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016; Amanović, et al. 2015; Pyne, et al. 2009; Yue, et al. 2008).

Step Eighteen (start programming individual training sessions):
Defining goals and tasks for specific training session for the particular individual athlete, age group, group or team[1] (Bonacin, 2012; Momirović, et al., 1987; Milosevic & Milosevic 2013b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic & Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016; Pyne, et al. 2009; Yue,et al. 2008).

Step Nineteen:
Defining time structure of specific training session which corresponds to material conditions, age, skills level, current status and the dynamics of individual, team or group advancement which shall stimulate meeting the set goals (Bonacin, 2012; Momirović, et al., 1987; Milošević, et al., 2012;Milosevic & Milosevic 2013b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic & Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016; Amanović, et al. 2015;Pyne, et al. 2009; Yue,et al. 2008).

Step Twenty:
Calculating the final state according to the exact time of education or training session, material conditions (equipment, halls, courts, finances, competition calendar, etc.), set goals, the initial state of age group for which the final states are being projected, as well as the rules for changing certain variables that is components of the athlete's state in relation to sensitive zones (Bonacin, 2012; Bonacin et al., 2013; Lozovina, et al., 2011; Momirović, et al., 1987; Milosevic & Milosevic 2014).

Step Twenty-One:
Choosing a wider range of age-appropriate classical and specific training methods, using the corresponding level of skills and abilities of an individual or group, time structure, training period (period using competitions, are not held periods during which one or more competitions are held per week) and set goals for the particular training session (Milosevic & Milosevic 2013b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic & Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016).

Step Twenty-Two:
Choosing a wider range of training methods according to the intensity of influence on skills and abilities of an individual or a group, as those which enable achieving set training goals for a particular training session at the moment of training period (period during which competitions are not held, periods during which one or more competitions are held per week) while using chosen methods.

Every presented method is described in accordance with the effects, the number of exercises and the combinations of exercises, the number of repetitions of exercises or combinations, the duration of a single repetition, the amount and duration of intermissions, the duration of the training session or the number of series, the speed of doing an exercise or combination, that is the regimen (Milosevic& Milosevic 2013b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic & Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016).

Step Twenty-Three:
Defining the voluntary influence (effects and changes - advancement) of set training methods and models at the predefined time period of an athlete or a group of individuals. This is followed by evaluating their influence and choosing a specific training session solely for those who match the set goals, programmed changes, the dynamics of acquiring skills and abilities of individuals in the defined time for training (Bonacin, 2012; Momirović, et al., 1987).

Step Twenty-Four:
Calculating capacity variables that an athlete is able to perform, calculate and evaluate the amount of individual training realized during particular training sessions (the information, force production, energy production, the speed of the performance, the duration of performance, spatial perimeter of the performance, the amount and frequency of the training performed, the frequency and duration of intermissions, etc.) which generates the programmed current or cumulative effects and changes (the advancement in skills, speed, the

[1]The same methodological method of designing education and training can be applied to all sports however not in its entirety due to the specific methodological steps of some sports.

quantity of produced force, energy, lactic acid, oxygen debt, consumable oxygen, glycogen, phosphocreatine, the increase in force production, speed, energy, offense, defence, motion, recovery, decomposition and re-synthesis of energisers, etc.) for one or more training sessions (Bonacin, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2014; Nemec, et al., 2016).

Step Twenty-Five (start evaluation):
Quality control of education training programmes – observer Figure 2 (Bonacin, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2014; Nemec, et al., 2016).

Step Twenty-Six:
Evaluating education training effects and changes – observer Figure 2 (Bonacin, 2012; Momirović, et al., 1987; Milosevic & Milosevic 2013b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic& Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016).

Step Twenty-Seven:
Education training program programmed in the aforementioned manner is the basic input variable (U) in the managing model (Bonacin, 2012; Momirović, et al., 1987; Milosevic & Milosevic 2013b; Milosevic, et al., 2014a; Milošević, et al., 2014b; Milošević, et al., 2014c; Milosevic & Milosevic 2014; Nemec, et al., 2016; Milosevic, et al., 2016).

Step Twenty-Eight:
Generating and providing data input of the most effective training programmes for the basic and advanced sports education, and particularly for the education of managing matches and competitions for aerobic, anaerobic non-lactate and lactate training sessions, as training sessions in speed and force, as well as programming current and cumulative education, mechanic, myogenic, neurogenic, biochemical and physiological effects and changes, that is, the advancement that generates programmed training for one or more training sessions of specific age, team, group or individual athlete during the training period of one week, month or year – model output (Bonacin, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2014).

Information technology support for the model of managing education training effects an changes

As the suggested methodology requires complex operations consisting of a greater number of variables, in addition to applying relatively complex mathematical and statistical procedures, information technology support must be provided by programming hardware and software system with automatic data gathering and processing (Milosevic& Milosevic 2013a; Milosevic& Milosevic 2014). The main goal of this system is to gather all data and information needed for the planning, programming and managing training processes, observing and predicting athletes' states in the scope of their skills and performance technique.
The system's specific goals include (Bonacin, 2012; Momirović, et al., 1987; Milosevic & Milosevic 2014):

- Determining and observing specific skills based on the number of selected and organised information bothcomprehensive and applicable to the experts in the field,
- Providing adequate information needed for programming, managing and predicting the effects of sporting advancement through automatic data gathering, and data compiled through measuring and testing,
- Profiling the data on individual athlete's states based on gathered and relevant information,
- Programming various education training programmes (operatore) and managing generated effects and changes,
- Providing relevant information to experts and trainers as the basis for strategic planning and evaluation of expert work in the field,
- Performing rational and detailed selection of potential sports staff based on the collected data.

In order to meet the demands, it is essential to form the following four subsystems: (Milosevic& Milosevic 2013a; Milosevic& Milosevic 2014):

- Motor skills subsystem
- Specific skills subsystem
- Information on data and training effect programmes subsystem (operatori)
- The subsystem for programming education training programmes (operatori)

Apart from the aforementioned subsystems two additional subsystems are needed in order to collect data on morphological and psychological status as an integral part of the system(Milosevic& Milosevic 2014).

A data base for every mentioned subsystem is created while the usage of various mathematical and statistical operations is used as an integral part of the subsystem for programming training programs. It is easy to manage training effects and changes by performing those operations for the analysis of specific education training programmes on the athlete's change of state.

As an effect of the completed analysis the subsystem generates programming such training programs which are adjusted to meet the set goals and tasks in a particular sports field or training session. Consequently, the purpose of the system is acquiring, input and data analysis, programming and managing education training programmes. Technical support for programming and managing methodology for education training programmes include software program for force acquisition, EMG, timing, photocells, contact platforms, the equipment needed for competitions and fights analysis, modules for data input, calculating the coefficient of exponential equations, for calculating spline method coefficient equation, for graphing equations, client report, reports, writing and report analysis and peripheral equipment such as non-contact measuring system sensor, force platform, video system, probes, dynamometer, functional capacity evaluation equipment, cardiovascular endurance, biochemical testing and anthropometric testing.The following image (Figure 3) represents the functioning of this system and its role as the IT support to the management model:

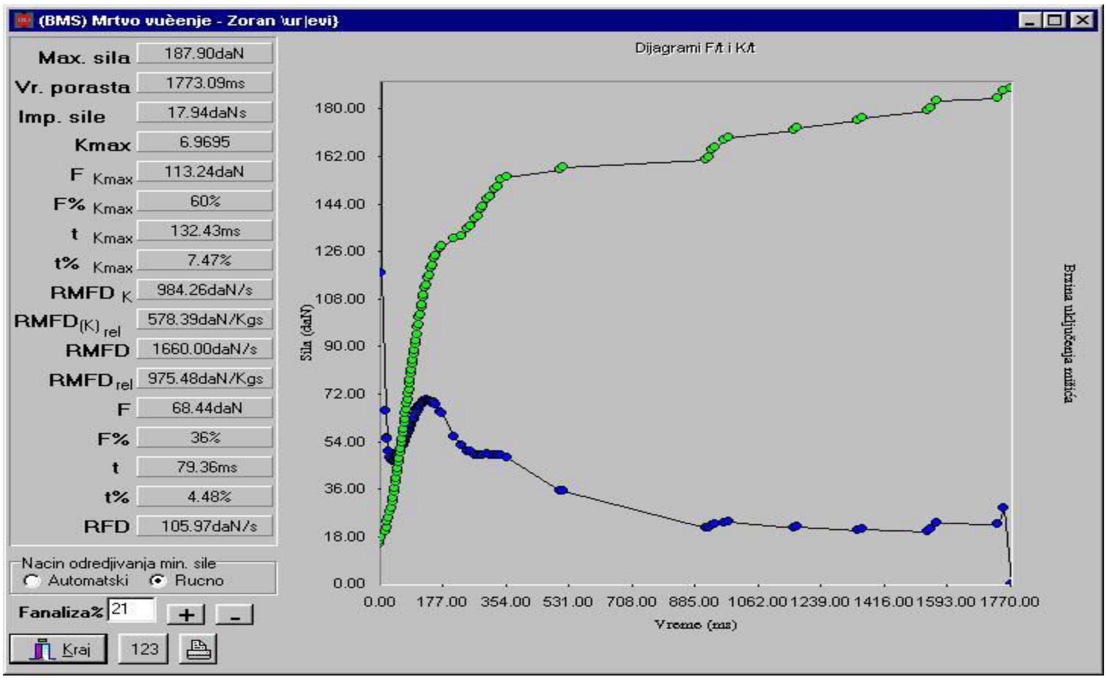

Figure 3. Example of the hardware and software system functioning - VAC Bioengineering.

Research methods for developing the algorithm and performing analyses for education training effects and changes

In certain steps for programming education training programmes a model of similarities and differences is used, just as residue, linear stochastic model, component, taxonomy, canonical and regression model (Momirović, et al., 1987; Milosevic& Milosevic 2013a; Milosevic & Milosevic 2014).

Defining current and cumulative training effects (goals) of an individual athlete for one or more training sessions is performed in accordance with the diagnosed initial state or transition state and energy requirements of competitions by applying polynomial trending (Bonacin, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2013a; Milosevic & Milosevic 2014; Nemec, et al., 2016).

Calculating performance capacity variables an athlete is able to perform and programming the quantity of individual training (the quantity of force production, the speed of performance, the duration of performance, the spatial perimeter of performance, the amount and frequency of performed training, the frequency and duration of intermissions, etc.) which generate the programmed current or cumulative effects and changes for one or more training sessions are performed by using non-linear multiple regression method (Bonacin, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2014; Nemec, et al., 2016).

Analysis and evaluation of technical, tactical, aerobic, anaerobic non-lactate and lactate training and force training, its current and cumulative mechanic, myogenic, neurogenic, biochemical and physiological effects of teams, national teams, or an entire sports field. All work with canonical and regression methods with or without separating previous transitive states (Bonacin, 2012; Momirović, et al., 1987; Milosevic & Milosevic 2013a;Milosevic& Milosevic 2014).

The analysis of practical and theoretical training effects structure of groups, teams, and national teams work with different factor models and methods. Comparing energy state of one training session to the energy state of one match or any other first-rate competition is performed by applying non-linear factor solutions. The efficiency of education training process is determined through the degree of similarity (Mahalanobis distance) of education training effects of one training session and energy force requirements of one fight or any other international competition (discriminant analysis). Comparative analysis, evaluation of various education training programmes and the selection of the best among them is performed by applying taxonomy and factor methods. Determining metric characteristics of observed variables, athlete's classification, and normative evaluation of education training effects is performed by conducting factor and robust discriminant analysis (Bonacin, 2012; Momirović, et al., 1987; Milosevic & Milosevic 2014).

Defining voluntary influence (field, the manner of influence, the type of influence, the regimen of influence, the intensity of influence) of training models and methods at the set time is completed through applying canonical and non-linear multiple analysis (Bonacin, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2013a; Milosevic & Milosevic 2014).

Defining the final number of training models and methods is completed through non-linear factor analysis solutions (Momirović, et al., 1987; Milosevic& Milosevic 2013a; Milosevic& Milosevic 2014).

The analysis of quantitative education training changes (technical, tactical, mechanic, myogenic, neurogenic, energy, biochemical and physiological) of teams, national teams, or the entire sports field is completed through applying: differences model, similarities model, residue model, linear stochastic model and canonical model (Bonacin, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2013a; Milosevic& Milosevic 2014).

The analysis of qualitative education training changes are conducted by applying component model, taxonomy model, canonical model and the analysis of regression parameters (Momirović, et al., 1987; Milosevic& Milosevic 2013a; Milosevic & Milosevic 2014).

The generated changes are analysed by applying spectral analysis of state change of one method (technical tactical skills, aerobic, anaerobic, force, etc.), spectral analysis of the curve of change of one variable registered on more subjects and in various points in time, the analysis of absolute and relative individual changes and the analysis of polynomial trending changes of an individual athlete, team, national team or the entire sports field (Bonacin, 2012; Momirović, et al., 1987; Milosevic& Milosevic 2013a;Milosevic& Milosevic 2014).

Calculating the function of training changes of an individual, team or a national team at a certain time, determining metric characteristics of observed variables and forming a normative for training changes evaluation (advancement) is completed by conducting taxonomy and non-linear regression analysis (Bonacin, 2012; Momirović, et al., 1987; Milosevic & Milosevic 2013a; Milosevic & Milosevic 2014).

Conclusions

Based on the above it can be concluded that the aim of this paper is fulfilled. The model for managing educational effects and changes has been defined. It's mathematical background is described. Each methodological step of creating algorithms of educational training programs is described in detail. The semantic logical design of each algorithmic methodological step has a mathematical background that can be used in the development of software solution for managing education and training in sport. Models and quantitative and qualitative methods used in the design of educational training programs have been defined. The same was done also for various calculations, analyzes and control of educational training effects and changes. Good external usability of output data, hardware and software support (VAC Bioengineering) and generation of data which can but also which can't be provided with in vivo experiments are, among other characteristics, the most important reason for recommending the presented model for further use in everyday coach practice.

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Received: May 15, 2020
Accepted: August 1, 2020
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