UNIVERSAL MATHEMATICAL MODULATION OF MODERN TRAINING GLOBAL PARAMETERS CONTROL

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Abstract

Sports training is systematic transformation process which, according to a predefined plan and program changes the state of objects (athletes) in order to achieve one or more pre-set goals. Since this is a very complex process with many possible deviations from the set plan, and that deviations potentially come from several sources, it is necessary to determine the universal methods and procedures that the transformation process can be objectively monitored so we can make appropriate and timely interventions towards the desired goals. Based on all this, it is obvious that such supervision is primarily to be globally credible and reliable in a way that can be done an objective comparison of deviations from the set plan. Such objectivity, of course, with sufficient cognitive and logical definition of the direction of the target process, can be achieved only with use of mathematical tools. This paper proposes a new and original approach to such monitoring global parameters. After a detailed inspection of global parameters, we proposed later steps in the monitoring and control other specific parameters depending on the current processes.

Key words: training, processes, transformations, control, tool, mathematics, universal

Introduction

Sports training are the process by which the state of the athletes sustained action approaching an imaginary target value (Bouchard et al., 1997; Bompa, 2000; Malacko and Rado, 2005; Malacko, 2009; Lozovina et al., 2011; Malacko, 2011). The target value is set at some point based on some knowledge of: 1) the current state of objects (athletes), 2) the possibility of changing the state of objects (genetics, etc.), 3) the desired state of objects in the final stage of the process (the target), and 4) about the process that is training that leads athletes to finish (Bryk and Raudenbush, 1992, Bloom, 1997; Casa et al., 2000; Böhlke and Robinson, 2009; Malacko, 2009).

Due to the extreme complexity of certain procedural paradigm and the total of such transformation phrases, potentially occur numerous deviations from the desired trajectory of the main processes or sub-processes that trajectory main composite process consists of (Csikszentmihalyi, 1993). The reasons for the deviations may be caused by abilities of athletes, changes in its status and other characteristics, but also the sources of deviations can be the training and generator technology (coach), meeting other professional and scientific activities (medicine, kinesiology, management, psychology, ...) as well as other environmental conditions (Birren et al., 1980, Baron and Kenny, 1986, Hansen and Gauthier, 1989; Hogervorst et al., 1996; Malina, 1996; Hewstone and Stroebe, 2001; Palazzetto, 2003, Schmidt and Wrisberg, 2004).

In today's world, in which the amount of information and the amount of change can be expressed only by exponential functions, and where, in addition to the original, the amount of derived information and knowledge on some important segments of the procedures that we are interested in virtually undetectable, what is certain is that, at some objective way, we isolate the essential parts of the overall findings because we are otherwise suffocate or, what is even worse, resort to trivial and unprofessional solutions.

So, in this sea of data, in the forest of tangled lines of action and a vast number of influences on us, the athletes themselves and the transformation process, it is inevitable to establish minimum rules i.e. procedures which will be the whole complex process to try to track and monitor, in order to if it is needed (and still is!), had the opportunity of performing interventions to process and condition of athletes tried to hold within not too much and certainly acceptable limits of deviation (Becker and Suls 1983, Fry et al., 1991, Côté et al., 1995; Eliasz 1996; Chmura et al. 1998; Trninić et al., 2000, Ward et al., 2002, McGarry and Franks, 2007; Trninić et al., 2009; Trninić et al., 2010; Forster, 2006; Bonacin et al., 2009; Chadwick, 2009). This is, of course, in all further compounds the problem that has long left the area careless training romanticism and mere occasional entertainment. Therefore, it should be emphasized that, in sport and kinesiology often with overdose of practical enthusiasm training portrayed as "an ordinary process of learning is mainly a little
coaching techniques and tactics," with an emphasis on physical exercise with a considerable degree of neglect of sophisticated tools for planning, development, monitoring and evaluation.

These sophisticated tools, if you want to be objective, cannot and must not be solely a personal assessment of the individual, regardless of their role in the whole process and regardless of the strength of whatever possible to expert estimates that such an individual is trying to present. These tools certainly sophisticate conditional quality work in sport and kinesiology and eliminate ignorance, speculation, stubbornly ignorant behaviour and superficial pragmatism. If the sport and kinesiology want advancement and fair chances for children and athletes, then we must take the most objective tool to the desired honest, objective and measurable objectives are monitored and evaluated, namely mathematics and mathematical cybernetics supported (Šoti 1973, Šimić, 1990; Goldstein, 1995; Gréhaigne and Godbout, 1995, Zhu and Erbaugh, 1997; Luke, 2004, Wood and Zhu, 2006; Bonacin, 2009, Gonzales et al., 2009; Bonacin and Caesar, 2010; Bonacin, 2011; Dolles and Soderman, 2012; Bonacin et al., 2012; Lozovina and Lozovina, 2012; Bonacin, 2013).

Methods

For the purposes of this study, a number of publications dealing with mathematical models usable for monitoring and control processes, transformation processes and sport specific training were analyzed. Also, publications which offer possible solutions on phenomenological and cybernetic foundation for complex view of managing actions in transformations of any system have been analyzed. Finally, the authors have, based on such conceptual approach suggested a new model which can potentially achieve the objectives of sport and kinesiology, particularly in the area of an excellent sport achievement.

Models and discussion

A detailed inspection of more than 400 publications dealing with modelling training and supervision of the control operator may register several categories that realistically represent the general approach of the training technology as a serious and technologically-oriented process. These approaches are not somehow global models and include the status of objects, change object, target and transformation process. Taking into account the fact that there is a huge reservoir of published ideas and that their number is certainly so great that they cannot be inspected at all reasonable times, the authors have opted for the choice of such solutions that correspond to the four general approaches / models but which at the same time correspond to copyright ideas of the article. In this way, should first of all define the basic procedure that is systematic analysis. In their analysis, the system is the foundation of everything.

He in turn is defined as a set of elements that are in some kind of relations that together have at least one common feature, and as a dynamic construct that is able to change under the influence of external and / or internal cognition. In this way defined by the phenomenological paradigm training process, because the athlete (team) is essentially a system that transforms. In doing so, there are many important concepts, and we are especially interested in the diversification of the system, system optimization and system stability.

Diversification of the system

Regardless of the nature of the input information in the system, diversification of the difference between the number of output (y) and the input (x) denotes the information and a $\delta (\delta = y - x)$.

\[ \begin{align*}
\delta &= y - x \\
\delta > 0 &\quad \text{S} \\
\delta < 0 &\quad \text{S} \\
\delta = 0 &\quad \text{S}
\end{align*} \]

Figure 1. Diversification of the system

Very simply put, if the input is the technology of the training task (e.g. exercise) that the athlete(s) should execute, then it is generally undesirable to be $\delta > 0$, because that would mean that at one target inputs have different reactions for which is not safe that we have the solution causes, and thus the possible consequences. Basically ideally that $\delta < 0$, because it would mean that all of our activities lean towards one goal and that is, for example, sports scores.

Optimization of the system

The system is optimized or in the process of optimization if each of his next states has a higher level of achievement by predefined parameters. In sport and kinesiology it is a procedure that leads athletes in the state of sports form to possibly achieve good or even great results. So, by sports training we do not achieve results, but provide athletic shape as a condition to achieve results. It is obvious that optimization (positive if executed or inadequate if not) is possible to precisely determine then when the real consequences of our actions set in, but in training usually it’s too late if irreversible processes set in.
Unfortunately, such segments of composite process occur in kinesiology and sport, so the returning to a hypothetical state is impossible. For those reasons, optimization must be supervised in an objective way. One of such ways is shown in graph 2. As you can see, the goal is to maintain optimality within acceptable limits without excessive maximizations. Namely, an athlete is not an object which can propel the infinite adaptation, so it is crucial to determine the achievements, limits and critical points that do not exceed, because then the whole process becomes irrational and far from optimal.

As can be clearly seen in the beginning of organized labour and the optimal behaviour (training) leads to a decline in effort ("cost") of unknown input parameters (B). Athlete (team) is better, i.e. the system is optimized. Specified time will act in this way and will continue to exist in the desired optimum range. Our goal is to be in such a regime maintaining as long as possible. However, after some time, sports Form (x) can no longer be achieved and that all this is still optimal, which means that it should be changed postulated parameters or content and training methods and optimization of re-checked. Otherwise, load curves and the "cost" sports form (A) inordinately increasing the shifts are minor which can be expressed as \(\Delta = x_{i+1} - x_i \) (by x).

Breakpoint in which performances of athletes un-optimized area is marked with a "d" on the x-axis, and essentially represents a projection of the extreme convex curve of the composite load (C). From that point can be expected to overtraining, injury, loss and what else undermines the integrity of the long-term results.
It is also obvious that after reaching the extreme C functions no longer return to the previous state, but the system behaves in a way that is increasingly moving away from the optimal state. Therefore, when such a situation occurs, further stubbornly insisting on previously physical training loads, physical training methods and training facilities such system more and usually faster moving away from its optimum. Obviously should recognize the extreme point of convexity and make appropriate adjustments of the training process.

Figure 3. Unstable system

\[ t = \text{time}, \quad y = \text{degree of instability}, \quad 1-6 = \text{consecutive checkpoint} \]

The biggest problem in all this is that if it is a long-term transformation procedure, it is not uncommon for overlooking the fact that the process passed the point "d" if the convexity is mild (and usually is in the long-term processes), and is expected to "have time" for correction and should not be rushed.

The credibility of this model is not difficult to verify because it is obvious that the system behaves in a way that seeks a state, but is based on the chart two more than clear that this condition is characterized by the increasing needs i.e. cost or burden (A) in order to maintain optimal. It is also clear that quality improvements (at x) smaller and smaller, i.e. that the benefits of such investment knowledge, time, resources and loads smaller and smaller. The system starts to "eat" itself, because inappropriate consumes resources without purpose and meaning, as in sport means defeat, loss and sports injuries. The only solution to this situation (if you went too far) was dissolution of the existing models work.

System stability

System stability can most easily be defined as the ability of the system to be expelled from the steady state based on internal knowledge back into such a steady state with no major loss of resources and time, or within acceptable pre-set limit.

Of course, the possibility of restoring stability will depend on the disorder, its intensity and duration, or a combination of these two features of the disorder. Generally we know three general cases: 1) unstable systems that are quickly eliminated from the balance and difficult to return, 2) stable systems which return to a steady state, and 3) indifferent, i.e. those who do not show large discrepancies in the effects of certain types. Description of the system which, thrown off balance never achieves a stable condition, but is systematically moving away from this state. As demonstrated by the stability of the selected parameters in paragraphs 1-6, so the exit trajectory is increasingly moving away from a state of balance. Approximate function is usually continuous and not oscillatory and does not change the sign in relation to the reference equilibrium. Example: an athlete who is stale and with series of repaired microtrauma such as the joints or muscles, falls deeper and deeper into a state of crisis, avoiding the training, not advocates, and reported worse results. Description of the system which, thrown off balance (followed steps 1-7) achieved a stable state, and systematically (asymptotically) is approaching stability, as demonstrated by the stability of the selected parameters in paragraphs 1-7, and the output trajectory toward ever closer to state balance. Approximate function is usually continuous and not oscillatory and does not change the sign in relation to the reference equilibrium.
Figure 4. Stable system

\( t = \text{time}, \ y = \text{instability degree}, \ 1-7 = \text{consecutive checkpoint} \)

Example: weekly monitoring of athletes / teams in the last game before the playoffs, in terms of local or general achievement where unbalancing occurred because of the loss of an important but not the elimination game. The team has a chance to get back in the game so one by one training day by day hard work is establishing balance and the team works well again.

Graph 5. Oscillatory stable system

\( t = \text{time}, \ y = \text{instability degree}, \ 1-6 = \text{consecutive checkpoint} \)

Fig. 5 is description of the system which, thrown off balance (steps 1-6) achieved a stable state, and systematically (oscillatory) approaching stability, as demonstrated by the stability of the selected parameters in paragraphs 1-6, and the output trajectory toward ever closer to state balance.
Approximate function (if possible) is oscillating and changing the sign in relation to the reference equilibrium. Example: effects in smaller ejection from equilibrium, egg loss of irrelevant details / left for reasons that could not be easy controlled (errors of judges, unexpected venues such as snow conditions, the disease three best players, etc.). This exposed the system safely returned to a stable condition but with light beam up until the establishment of global parameters.

Graph 6. Oscillatory unstable system

t = time, y = instability degree, 1-6 = consecutive checkpoint

Description of the system which, thrown off balance (followed steps 1-6) never achieves a steady state, and systematically oscillates around the equilibrium position and is approaching stability, as demonstrated by the stability of the selected parameters in paragraphs 1-6, so the exit trajectory steadily approaching and moving away from a state of balance.

Approximate function (if possible) is oscillating and changing the sign in relation to the reference equilibrium. Example: A team in which there is constant tension between the equally spaced clicks that are out of meetings to meet face and complicate life for everyone.

While no one-clicks "down" system will permanently oscillate around the equilibrium position and create various types of losses, until the collapse when "eating club substance".

Conclusion

Sports technology today can not seriously exist, and in particular cannot continue to thrive if they do not take into account the numerous transparent knowledge and insights from other areas of the human domain. Some of these areas are mathematics and cybernetics, which can be an extremely positive contribution to the development of kinesiology thoughts and sport in general. This article gives some sub-models of supervision of transformation processes in terms of the stability of athletes, diversification of inputs and outputs and optimization, which all together weighs particular universal controller model. How could clearly be seen, the present model allows undeniably effective and reasoned supervision of physical training events and adequate timely corrections. It is therefore recommended to monitor and conduct training of any kind with any entity.

References


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**UNIVERZALNA MATEMATIČKA MODULACIJA NADZORA GLOBALNIH PARAMETARA MODERNOG SPORTSKOG TRENINGA**

**Sažetak**

Sportski trening je sistematski transformacijski proces kojim se po unaprijed definiranom planu i programu mijenjaju stanja objekata (sportaša) kako bi se ostvario jedan ili više prethodno postavljenih ciljeva. Budući se radi o izuzetno kompleksnom procesu s mogućim brojnim odstupanjima od postavljenog plana, a koja odstupanja potencijalno dolaze iz više mogućih izvora, potrebno je utvrditi univerzalne metode i procedure kojima se taj transformacijski proces može objektivno nadzirati, kako bi se mogle izvršiti adekvatne i pravodobne intervencije u pravcu željenih ciljeva. Temeljem svega ovoga očito je da takav nadzor prije svega mora biti globalno vjerodostojan i pouzdan na način da se mogu objektivna usporedba odstupanja od postavljenog plana. Takvu objektivnost, naravno, uz dovoljnu spoznajnu i logičku definiranost u pravcu ciljanih procesa, moguće je postići jedino matematičkim alatima. U članku se predlaže novi i originalni pristup takvom nadzoru globalnih parametara. Nakon detaljne inspekcije globalnih parametara, u kasnijim koracima se predlaže nadzor i kontrola ostalih konkretnih parametara u ovisnosti o aktualnim procesima.

**Ključne riječi:** trening, procesi, transformacije, nadzor, alat, matematika, univerzalno

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