The expert system for orientation of children into table tennis in the Republic of Slovenia

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Abstract

The orientation of children into table tennis in Slovenia is based on our expert system for the initial selection and orientation of children into different sports, which has been gradually introduced since 1989. The data for the system are gathered by the Information System SLO-FIT, which includes most of the children (more than 300 thousand each year) in primary and secondary schools of Slovenia.

The data on their morphological status and basic motor abilities of the anthropologic status are, at present, used for directing school children into 19 sports. One of these is table tennis. In 1994 we found more than 20,000 pupils, talented in sports (more than 1500 in table tennis).

The paper presents the professional, methodological and organizational aspects of the expert system for orientation into sports, especially into table tennis.

Introduction

The fact that some of many experts worldwide who are addressing the problem of talent speak about a "theory of sports talents" (Letzelter, 1980) proves that the problem of talent, which has its organizational, scientific and professional aspects, is much more complex than it seems.

Recently one of the largest projects in the field of sports in Slovenia has been Information System for Monitoring and Assessing Morphologic Characteristics and Motor Abilities of Youth Between Six and Eighteen Years of Age (Strel, Sturm, 1981). The aim of the project, which has been carried out with a complete data-base since 1987, is a longitudinal monitoring of the most important morphologic characteristics and motor abilities of the whole school-age population in the Republic of Slovenia. Defining the average, underachieving and exceptionally gifted pupils according to each single indicator of their motor abilities made it possible to develop different procedures for selecting children and orienting them into one of the many sports programs.

The selection and directing of children into table tennis in Slovenia is based on the previously mentioned Information System for Monitoring and Assessing Morphologic Characteristics and Motor Abilities of the school-age population. Actually it represents its superstructure.

The question we are confronted with is how to choose the most suitable sports discipline, since we know that early directing of children into sports is a very important condition for achieving international-level results. The potential top sportsmen and sportswomen should, irrespective of the sports discipline, be chosen among their

schoolmates at the right time and for the most suitable discipline. The purpose of the Slovenian project Selection and Orientation of Children into Sports Disciplines on the Basis of Expert Modeling was to start with a systematic scientific approach to finding children gifted for a certain sport. Finding out whether a child is gifted for a particular sport has been for many years a topical problem for many authors all over the world, so that eventually "a theory of sports talents" (Letzelter, 1980) could be developed. In Slovenia, such a theory could have its starting-point in the theory of the existence of the psychosomatic status of a sportsman and sportswoman. Hypothetically the dimensions of the psychosomatic status can be divided into potential dimensions, which define the talent, and into realizing and mobilizing dimensions, which define the realization of the potential dimensions. Ascertaining the talent does not mean a process but only a piece of information which is necessary for dealing with the problem. The next important item of information is the speed of the progress, since variability exists among the chosen candidates at the beginning and also during their progress. A high level of suitability for a particular sport does not necessarily mean rapid progress; a lower level of suitability at a more rapid pace may also make top results possible.

From the point of kinesiology the problem we are dealing with represents the greatest congruence between the specification equation of successfulness in table tennis (in our case), and the quantitatively assessed values of the components which constitute the status of the subjects for whom table tennis is the most suitable discipline. For each individual, table tennis (in this case) contributes to the quality of his life, which means good health and good physical condition. Moreover, going in for sports gives the participants a good chance to experience it as play, as self-actualization and a way of expressing one's own personality.

Most of the information on which the process of defining the level of the candidates' suitability for table tennis was based, was contributed by the variables obtained through motor tests. Table tennis is a motor activity in which basic and specific motor abilities are expressed through special kinematic structures which represent the content of the technique. Because of this fact, the above-mentioned kind of decision-making procedures is necessary. Theory requires a lot of measurements, which are indispensable because of the great number of parameters required by the nature of the problem. There are not many candidates for measurements in the comparatively small country of Slovenia, and these are only willing to make measurements directly connected with the training process. The small number of measured pupils is an unavoidable problem, since multi variable methods of data-processing, the most suitable methods for our purpose, require a great number of measured candidates.

A special value of expert methods in our case is that they do not limit either the number of used variables or the number of areas of psychosomatic status that are included in the decision-making procedures. The greater number of variables demands only such a form and arrangement of the decision-making system (criterion tree and decision-making rules) as would require a certain deviation from the theories about the dimension structure of individual sub spaces of the psychosomatic status. This deviation does not necessarily imply a great lack or loss of information in the final solutions of the decision-making process. (Sturm, 1992)

This paper presents the system which we have already stabled but evaluation of the results unfortunately hasn't been possible yet.

Description of the system

As already mentioned, the selection and orientation of children into table tennis and other sports in Slovenia is based on the Information System for Monitoring and Assessing Morphologic Characteristics and Motor Abilities of Children between Six and Eighteen Years of Age. The 3 morphologic and 8 motor tests are carried out once a year in all Slovenian schools, which means that more than 300,000 pupils are tested. The tests were chosen according to the plan and they represent the most global estimation of the morphologic status of children in Slovenia. Yet, we have to take into account the fact that such a system estimates an individual only superficially. A more complex estimate must also consider personal, intellectual, social, demographic and similar characteristics. Children who are considered as talented according to the first 11 tests are therefore invited to submit to additional tests, in the capital of Slovenia, Ljubljana. These additional tests include 39 motor, 12 anthropometric, 21 psychological and 8 social and demographic measurements; they were chosen by a group of sports experts (coaches, kinesiologists, psychologists, sociologists) assisted by methodologists and computer-experts.

The construction of the model and its application were performed with a personal computer and the ND computer program, a specialized program constructed within the project at the Faculty of Sports in Ljubljana; it is intended for solving qualitative decision-making problems (Leskosek, 1992).

Table 1: Basic battery of criteria for the evaluation of sports talent and the tests to measure them

Criterion (dimension)	Test (code, name and measurement unit)	
Longitudinal dimensions	HEIGHT	body height (cm)
Volume	WEIGHT	body weight (kg)
Subcutaneous fat	SKIN FOLD (mm)	upper arm skin fold
Flexibility	DEEP BEND bench(cm)	deep forward bend on
Coordination	POLYGON	polygon backwards (s)
Static and repetitive strength of arms	B ARM HANG	bent arm hang on horizontal bar (s)
Static and repetitive strength of the trunk	SIT UP	sit ups (number)
Explosive strength	STAND JUMP	standing board jump (cm)
Speed	SPRINT	60-m sprint (s)
Aerobic and anaerobic endurance	RUN 600M	600-m run (s)

However, the raw results achieved in the testing of a child do not tell much by themselves. They have to be evaluated from the standpoint of the age and sex of a child and from the standpoint of table tennis requirements. Therefore, prior to further

processing, all the raw results are correspondingly transformed and evaluated as follows:

1. First of all the raw data (table 2 - column 2) are entered into the computer.
2. The raw results are transformed into standardized and normalized T-values (T=10.t+50 - see Ferguson, 1966) (third column) according to the sex and age of the pupils.
3. The deviation of the pupil's T-value from the ideal value (determined by an expert) for a certain sports discipline is calculated (Deviation-column).
4. Each result (T-value) gets a descriptive and a numerical mark. The descriptive mark has 4 levels: unacceptable, acceptable, good, excellent. The numerical estimate includes values from 1 to 5, but these can be surpassed, since extreme results are possible. The levels expressed in numerical form are as follows:

less than	**2.0**	**= unacceptable**
	2.0-3.0	**= acceptable**
	3.0-4.0	**= good**
	4.0 and more	**= excellent**

An example of test scores of a 10-year-old school girl and their transformed values for table tennis is shown in table 2.

Table 2 An example of raw and transformed test scores

Test	**Result result**	**T Score(deviation)**		**Descriptive (Num)**
Height	133.0(cm)	59(7.0)	excel.	4.1
Weight	38.5(kg)	40(17.0)	unacc.	1.8
Skin-fold	12(mm)	45(19.0)	acc.	2.2
Polygon	11.0(s)	79(5.0)	exc.	5.5
Arm Plate (Tapping)	35(times)	72(0.0)	exc.	4.7
Stand jump	150(cm)	64(10.0)	good	3.0
Run 60 m	11.1(s)	67(7.0)	excel.	5.4

This completes the evaluation of the tests. The next step is the estimation of the nodes and branches of the criterion tree.

Table 3: Criteria tree

Score	Child's talent for table tennis
Anthropo.	Anthropometric characteristics
Height	Body height
Mass	Body weight
rel. weight	Relative weight
skin fold	Skin fold of the upper arm
Motor	Motor abilities
Coordination	Informative component of motor abilities
polygon	Polygon backwards
tapping	Arm plate tapping with hand
Stand jump	Standing broad jump
Sprint	60 m sprint

Each node value is calculated as a weighted average of branch values which are direct successors of the node in question, i.e.:

Estimate of Coordination (Table 4):

$$EC = \frac{11.1 \chi 5.5 + 35 \chi 4.7}{11.1 + 35} = 4.9 \text{ (see Table 4)}$$

In the same way as the numerical marks, we get also the deviation from the ideal values and from the T-values.

Verification and use of the expert system

Table 4: An example of a computer printout

	Result		T	Deviation	Mark
GEN MARK		65	3.9	4.0	exc.
ANTHROPO.		46	13.7	2.5	acc.
Height	133.0	59	7.0	4.1	exc.
MASS		40	17.0	1.8	unacc.
rel weight	0.263	35	15.0	1.3	unacc.
skin fold	12	45	19.0	2.2	acc.
MOTOR		71	0.8	4.5	exc.
COORDI.		76	-2.6	4.9	exc.
polygon	11.0	79	-5.0	5.5	exc.
tapping	35	72	0.0	4.7	exc.
stand jump	150	64	10.0	3.0	good
run 60m	11.1	67	-7.0	5.4	exc.

This model has been gradually implemented in practice. Problems of communication with the parents, teachers of physical education and coaches still have to be taken into

account. Further problems are caused by the provisions of the Law on Protection of Personal Data which requires a parent's assent for use of the data from the Information System SLO-FIT.

Conclusion

Solving the problem of directing children into table tennis demands very good expert knowledge, which must be as wide as possible and should be applied very systematically. Yet we must take into account that science is not "almighty" and that one can never determine for sure the most suitable sports discipline for each individual. Those who expect this from science are lacking knowledge in kinesiology. Despite this fact, the use of expert methods and statistical procedures, as applied in Slovenia, reduce the mistakes that are made when sportsmen and sportswomen are chosen by intuition only, without any expert knowledge.

The use of the system in practice is not of sufficient duration to enable a reliable assessment of its predictive power in identification of future top sportsmen and sportswomen. However, an attempt was made to obtain the marks in retrograde for some of the young sportsmen and sportswomen with high achievements, who were measured with tests from the system before it was used for the orientation process.

Although the system is still being developed, the data from the year 1994 show that, among the 20,000 tested children of both sexes, 1,500 are suitable for table tennis. This justifies the existence of both projects in such a small "sports area" as Slovenia.

References

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