Venceslav Kapus
Boro Štrumbelj
Bojan Leskošek
Jakob Bednarik
Dorka Šajber-Pincolič

AN EXTENDED TWENTY-TWO TESTS SYSTEM FOR IDENTIFYING CHILDREN TALENTED FOR SWIMMING

RAZŠIRJENI DVAINDVAJSET TESTNI SISTEM ZA IDENTIFIKACIJO OTROK, TALENTIRANIH ZA PLAVANJE

Abstract

In this article an information system is presented whose purpose is to discover children talented for swimming and help include them into swimming schools or clubs in which they will have the possibility for further development of their talent into a successful carrier, if they so desire and have their parents´ support. The system is based on the sports educational chart, which is practised in practically all primary and secondary schools in Slovenia, with the purpose of evaluating and monitoring the morphological and motor development of the children. A rough assessment of their suitability for swimming, on the basis of the eleven tests from the Sport card, is made by the physical education teacher with the help of the »Talent« system. The children that show talent for swimming (four types: sprint, long distance, breast and medley) are invited by the teacher - in co-operation with the swimming clubs - to a beginner´s swimming course. The pupils that respond are involved into an extended twenty-two tests system for talent assessment, with additional tests. These additional tests are: anthropometric (weight and spec. weight, vital capacity) and motoric (flexibility: bar extended behind head; feet flexibility: toes pointing, toes curling and foot turn. outwards; dynamic power: sit-ups and pull force on land; special motoric: slide length, pull force - in water and swimming speed on 50 m).

Used methods: normalisation of original measurements, assessment of basic criteria both quantitatively (ND) and qualitatively (DEX), balancing the final assessments between the various swimming types.

Keywords: swimming, talent, identification system

Izvleček

V članku je predstavljen informacijski sistem katerega namen je iskanje otrok talentiranih za plavanje. Slednjim se omogoča vključevanje v plavalne šole ali klube v katerih bodo imeli možnost nadaljnjega razvijanja talenta v uspešno plavalno kariero, če tako želijo in imajo podporo staršev. Sistem je osnovan na Športno-vzgojnem kartonu, ki se izvaja v praktično vseh osnovnih in srednjih šolah v Sloveniji, z namenom evalvacije in spremljanja morfološkega in motoričnega razvoja otrok. Grobo oceno primernosti za plavanje, na osnovi enajstih testov športno-vzgojnega kartona opravi učitelj športne vzgoje s pomočjo sistema imenovanega »Talent«. Učenci, ki kažejo nadarjenost za plavanje (štiri zvrsti: šprint, dolge proge, prsno in mešano) so povabljeni v povezavi s plavalnimi klubi na začetni plavalni tečaj. Učenci, ki se odzovejo so vključeni v razširjeni dvaindvajsettestni sistem za ugotavljanje talenta z dodatnimi testi. Ti dodatni testi so: antropometrijski (teža in specifična teža, vitalna kapaciteta) in motorični (gibljivost: zaklon s palico; gibljivost stopala: ekstenzija stopala in rotacija stopala; dinamična moč: dvig trupa v sedu, poteg z rokama na suhem; specialna motorika: dolžina drsenja, sila potega v vodi in hitrost plavanja na 50 m).

Uporabljene metode: normalizacija originalnih meritev, določanje osnovnih kriterijev kvantitativno (ND) in kvalitativno (DEX), uravnoteženje končnih odločitev med različnimi plavalnimi tipi.

Ključne besede: plavanje, talent, sistem identifikacije

University of Ljubljana – Faculty of Sport, Gortanova 22,
SI-1000 Ljubljana, Slovenia
phone: ++386 61 140-10-77
fax: ++386 61 448-148
e-mail: Boro.Strumbelj@sp.uni-lj.si

Introduction

The knowledge about oneself and one´s abilities goes hand in hand with securing the quality of life and employment for the individual and the entire society. It remains an undisputed fact that the complex web of sports activities, and particularly physical education itself, play an important part in that process. According to the publication Guidelines for Physical Education in Schools(12,4), the ultimate goal of physical education should be seen in »methodical stimulation of and search for individuality and talent for a particular sport«, which a young person can grow fond of and improve later in his/her life.

Discovering individuals with talent for sport and their joining in training of that sport which suits their characteristics, abilities, capabilities, and interests best of all, are part of the basic, expertly and organisationally extremely demanding processes dealt with by the modern sport science and profession (1). The consequences of wrong decisions are numerous and often painful. The wrong choice of a sport and unrealistic goals, especially those set too high, often show only after years of intensive training and numerous sacrifices made by the young athletes and their families. Facing the reality can in such cases end in bitter disappointment and may cause psychological traumas.

Competitive sport is a field of activity which is relatively highly valued in Slovenia. Considering the size of its population, Slovenia is one of the most successful countries in the world as far as sport is concerned. In Slovenia, great importance is attributed to competitive sport, and consequently to the field of selection and orientation of children talented for sport. With this aim in view, the Faculty of Sport in Ljubljana has for several years been carrying out a project named Computer-Aided System of Initial Selection and Orientation of Children to Sports, in collaboration with the Jožef Stefan Institute, the Faculty of Organisational Sciences as well as numerous coaches and PE teachers (3,5,9,11,13). The aim of the project has been to develop procedures of initial selection and orientation to sports and employ these in practice. The system builds on Information System for Monitoring Motoric and Physical Development in the School Youth in Slovenia, which has already gained ground throughout Slovenia (12).

Methods

Multi-attribute decision models for the evaluation of children´s talents for swimming on the basis of the eleven tests (three morphological and eight motoric tests) have been developed and tested in practice.

Table 1.: The example of decision model based on ND method. (Swimming - short distances)

				Utility function (scores)								
	Weight	Correlation with sucess	Champion	12	20	30	40	50	60	70	80	88
SCORE	100											
+ ANTHROPOM	32											
+height	19	K	69	0	9	20	41	61	82	99	88	80
+MASS		13										
+rel.weight*	8	K	53	20	36	55	75	94	80	51	23	0
+skin-fold	6	P	12	100	89	76	63	50	37	24	11	0
+MOTORICS	68											
+INFORM COMP.	19											
+forward t.bend.	6	N	80	0	11	24	37	50	74	98	100	100
+COORDIN	13											
+ polygon	4	P	19	100	100	93	72	50	37	24	11	0
+ tapping	9	N	82	0	11	24	37	50	70	90	100	100
+ENERGY COMP.	49											
+POWER	36											
+ bent arm hang	9	N	79	0	11	24	37	50	75	100	100	100
+ DYN. POWER	26											
+ sit-ups	2	N	83	0	11	24	37	50	68	86	100	100
+long jump st.p.	24	N	84	0	11	24	37	50	67	83	100	100
+60 m run	13	P	12	100	89	76	63	50	37	24	11	0
+600 m run	0	P	22	100	100	100	87	69	51	33	15	0

* rel. weight = weight / height

Decision models have been developed for four types of swimmers: sprinters, long distance swimmers, breast and medley stroke swimmers. The models are transparent and presented both in the quantitative (ND models) (9) and qualitative (DEX models) (3) forms. Normalisation of original measurements, assessment of basic criteria, assessment of derived criteria both quantitatively (ND) and qualitatively (DEX) and balancing the final assessments between the various swimming types have been made.

For this purpose the Talent expert system has been developed, a computer program (source written in Delphi) for personal use running under Microsoft® Windows™ 3.1 or later versions.

Results

In table 1 the example of basic decision model (11 tests) based on quantitative (ND) method is presented.

Instructions for explanation of the decision model

On the left side of the Table there is given the structure of the decision criteria. The tests are written with small letters, while the abilities measured by these tests, or nodes are written with capital letters. The highest node represents the score of the performance potentials of a candidate in the chosen branch of sport. Then there follow weights which show the relative significance of individual tests, or nodes for the performance of candidates. For each test the following data are also given:

- the correlation between the test result and expected performance in respective branch of sport: N means growing mutual relation (higher test result value means better performance), P - failing relation (lower test result value means better performance) or K = combined relation (the optimum result is somewhere in the middle, while the worst either extremely high or extremely low results);
- the champion model, i.e. the values of an »ideal« athlete in the chosen branch of sport expressed in T-values (standardised and normalised values with m = 50 and s = 10);
- the normalisers, i.e. test results which determine the utility function, or mark for the respective result attained by an individual pupil (expressed in T - values).

In table 2 comparison between qualitative (DEX) and quantitative (ND) method for a randomly selected children is presented.

We have developed also decision model on the basis of extended system for talent assessment (twenty-two tests), which also takes into account special motor and functional abilities and morphologic characteristics important for the success in swimming. These additional tests are:

Table 2.: Comparison between ND and DEX method. (Swimming - short distances)

	ND				DEX
	Res.	T	Decll.	Mark	
SCORE		58	16,2	77 exc.	exc.
+ANTHROPOM		59	13,4	76 exc.	exc.
+height	141,0	61	8,0	84 exc.	exc.
+MASS		57	21,1	66 good.	good.
+rel.weight	0,266	60	7,0	80 exc.	exc.
+skin-fold	10	52	40,0	47 sat.	good.
+MOTORICS		57	17,5	77 exc.	exc.
+INFORM COMP.		56	21,5	71 good.	good.
+forward t.bend.	50	63	17,0	81 exc.	exc.
+COORDIN		53	23,4	67 good	sat.
+polygon	12,5	41	22,0	70 good	sat.
+tapping	31	58	24,0	66 good	sat.
+ENERGY COMP.		58	16,0	80 exc.	exc.
+POWER		68	14,9	81 exc.	exc.
+bent arm hang	59	59	20,0	73 good	good
+DYN. POWER		71	13,1	85 exc.	exc.
+sit-ups	35	55	28,0	59 good	exc.
+long jump st.p.	186	72	12,0	87 exc.	exc.
+60 m run	10,1	31	19,0	75 exc.	exc.
+600 m run	138	32	10,0	100 exc.	good.

a) anthropometric: spec. weight and weight, vital. capacity;

Specific weight and weight have influence on swimmers buoyancy (7,8). With better buoyancy the swimmer is able to swim with less energy loss (8). This energy can be used for creation of propulsion instead for keeping buoyancy. Vital capacity also influence buoyancy (7,8). However, for the swimmers is well known that have higher vital capacity than population (15). With higher vital capacity they are able to increase their aerobic capacity since ventilation seems to be one of the limiting factor during swimming (13) .

b) motoric:

- flexibility: bar extended behind head;
- feet flexibility: toes pointing, toes curling and foot turning outwards.

Flexibility is one of the most important factors, which influence success in swimming (6,7). The swimmers with better shoulder flexibility are able to achieve better stroke characteristics (increased stroke length) in front crawl, butterfly and backstroke disciplines, which results in faster swimming (10,8). A good shoulder flexibility also allows to the swimmer more

efficient energy utilisation because of better co-ordination of agonists and antagonists during single stroke. A good extension of ankle (measured with toes pointing and toes curling) is very important for an optimal leg kick of swimmers in butterfly, front crawl and backstroke disciplines. On the other hand a good rotation of the foot is necessary to obtain so called propeller effect of the foot which is very important in breaststroke kick (15).

- dynamic power: sit-ups and pull force on land;

Today's technology of measuring force during swimming is very complex (2). Because of that we inserted two tests for measuring dynamic power on dry land. A pull force capacity of swimmer on land has very good correlation with success in swimming on short distances (2). Sit-ups allows us to have a better check-up of swimmers condition and training status with other tests (8).

- special motoric: slide length, pull force - in water and swim. speed 50 m.

The length of the swimmers slide in the water, pull force and maximal swimming speed on 50 m allows us to estimate some hydrodynamic characteristics of the swimmers important to orient a single swimmer in the most adequate disciplines for him (8).

The formal structure of decision model (Table 3.) is the same as the structure of basic model Table 1.).

Table 3.: The example of extended decision model based on ND method. (Swimming - long distances)

				Utility function (scores)								
	Weight	Correlation with sucess	Champion	12	20	30	40	50	60	70	80	88
SCORE	100											
+–ANTHROPOM	25.6											
+–height	3.5	K	60	0	9	20	41	61	82	99	88	80
+–vital. cap	7.0	N	73	0	11	24	37	50	74	98	100	100
+–MASS	15.1											
+–rel. weight	3.5	K	56	20	36	55	75	94	80	51	23	0
+–skinfold	2.3	K	53	20	36	55	75	94	80	51	23	0
+–spec. weight	7.0	P	73	100	100	93	72	50	37	24	11	0
+–weight	2.3	P	71	100	100	93	72	50	37	24	11	0
+–MOTORICS	74.4											
+–BASIC MOT.	57.0											
+–INFORM COMP.	32.6											
+–FLEXIBILITY	26.7											
+–forward t. bending	5.8	N	67	0	11	24	37	50	74	98	100	100
+–bar extend.b.head	7.0	P	73	100	100	93	72	50	37	24	11	0
+–FEET FLEXIBILITY	14.0											
+–toes pointing	7.0	P	73	100	100	93	72	50	37	24	11	0
+–toes curling	3.5	N	58	0	11	24	37	50	74	98	100	100
+–foot turn.outward	3.5	N	58	0	11	24	37	50	74	98	100	100
+–COORDIN	5.8											
+–polygon	2.3	P	60	100	100	93	72	50	37	24	11	0
+–tapping	3.5	N	69	0	11	24	37	50	70	90	100	100
+–ENERGY COMP.	24.4											
+–POWER	15.1											
+–bent arm hang	4.7	N	68	0	11	24	37	50	75	100	100	100
+–DYN. POWER	10.5											
+–sit-ups	3.5	N	63	0	11	24	37	50	68	86	100	100
+–long jump st.p	2.3	N	63	0	11	24	37	50	67	83	100	100
+–pull force on land	4.7	N	63	0	11	24	37	50	67	83	100	100
+–60 m run	2.3	P	74	100	89	76	63	50	37	24	11	0
+–600 m run	7.0	P	82	100	100	100	87	69	51	33	15	0
+–SPECIAL MOT.	17.4											
+–slide length	7.0	N	73	0	11	24	37	50	67	83	100	100
+–pull force – in water	5.8	N	68	0	11	24	37	50	67	83	100	100
+–swim. Speed 50m	4.7	P	63	100	100	100	87	69	51	33	15	0

Discussion

The basic aim of the Talent expert system has been to bring expertise in swimming talent identification to physical education teachers and coaches, to pupils and their parents. The system does not deal with identification of talent swimmers that might eventually lead to world-class sport results, but deals primarily with counselling children who have no wish or ability to take up competitive sport. The Talent system should encourage physical education teachers to deepen their expert work and support them in their judgements and advice to pupils who are choosing their sport. In our case the children that show talent for swimming are invited by the teacher in cooperation with swimming clubs - to a beginner´s swimming course. The pupils that respond are involved into an extended system for talent assessment, which also takes into account special motor and functional abilities and morphological characteristic. The children with the best obtained results and with will to practice after additional testing are included into special groups which train in as best possible conditions as can be organised for their further development.

Conclusion

In conclusion we would like to emphasises that no decision model and thus no computer program can with certainty predict a child´s talent and even less the future sport results. The complexity of human being, his/her wishes, wills, and, naturally, the environment in which he/she lives and works, (un)fortunately cannot be entirely mirrored by formal models. That is why all results of the Talent system should merely be used as guidelines, as they have been designed only as an aid in advising children.

In the future a twenty-two tests system has to be tested with measurements for single age category of swimmers and eventually corrected on the basis of obtained results on the sample of Slovenian swimmers.

References

1. Bednarik J., Kapus V. Odnosi med nekaterimi morfološkimi ter osnovnimi motoričnimi in plavalnimi razsežnostmi mladih plavalk. Ljubljana: Fakulteta za telesno kulturo, 1988
2. Bednarik J., Kugovnik O., Kapus V., Strojnik V. Tethered swimming as an instrument for evaluation swimming force and correlation of swimming force and success in swimming. In: Proceedings of the 6th ICHPER-Europe congress, Physical activity for better life-style in a new Europe. Prague: Faculty of physical education and sport, 1992: 29-32
3. Bohanec M., Rajkovič V. DEX: an expert system shell for decision support, Sistemica 1990; 1(1): 145-157
4. Bohanec M. et al. Talent: ekspertni sistem za usmerjanje otrok in mladine v športne panoge: uporabniški priročnik. Ljubljana: Zavod Republike Slovenije za šolstvo, 1997
5. Kapus V., Jošt B. Računalniško podprt sistem začetnega izbora in usmerjanja otrok v športne panoge in evalvacija modela uspešnosti v posameznih športnih panogah na podlagi ekspertnega modeliranja. Ljubljana: Fakulteta za šport - Inštitut za kinezilogijo, 1995
6. Kapus V. Konstitucijski tipi plavalcev. Telesna kultura 1984; 4(32): 13-15
7. Kapus V. Structure and canonic relations of some morphologic and motoric dimensions of psychosomatic status of young swimmers. In: Researching motor abilities of children between 6 and 14 years of age. Ljubljana: Faculty of physical education - Institute for kinesiology, 1988: 161-181
8. Kapus V. The influence of morphologic characteristics on the relations between basic and swimming abilities. Ljubljana: Faculty of physical education - Institute for kinesiology, 1988: 293-314
9. Kapus V., Bednarik J., Leskošek B. A system of early selection and advising of children to engage in sport swimming on the basis of expert modelling according to the ND programme. In: Proceedings of the II. International Symposium Sport of the Young, Ljubljana - Bled: Faculty of Sport, 1993: 470-473
10. Keskinen KL. Stroking Characteristics of Front Crawl Swimming. Jyvaskyla: University of Jyvaskyla, 1993
11. Leskošek B., Bohanec M., Rajkovič V., Šturm J. ND-Expert System for the Assessment of Sports Talent. In: Proceedings of the II. International Symposium Sport of the Young. Ljubljana-Bled: Faculty of Sport, 1993: 441-446
12. Strel J. et al. Sports Educational Chart. Ljubljana: Ministry of Education and Sport, 1997
13. Štrumbelj B. Nekateri omejitveni dejavniki v plavanju na 400 m prosto (Master's thesis). Ljubljana: Fakulteta za šport, 1998
14. Šturm J. et al.. Izbor in usmerjanje otrok v športne panoge na podlagi ekspertnega modeliranja. Ljubljana: Fakulteta za šport - Inštitut za kineziologijo, 1992
15. Volčanšek B. Sportsko plivanje. Zagreb: Fakultet za fizičku kulturu Sveučilišta u Zagrebu, 1995