IMPACT OF PSYCHOLOGICAL DIMENSIONS OF PSYCHOSOMATIC STATUS ON POTENTIAL COMPETITIVE PERFORMANCE IN CROSS-COUNTRY SKIING

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Abstract:

The purpose of the study was to establish the values of the variables of the psychological area in predicting the potential competitive performance of cross-country skiers. The psychological area, encompassing 24 variables, was studied within the model of potential performance MMPS. The sample consisted of 48 cross-country skiers of three competitive categories. The expert modelling procedure was used to obtain the scores of the potential performance of the subjects at all levels of the psychological area. An analysis of correlation between these scores and the actual competitive performance criterion (SLO_FIS) showed that the psychological area in all three competitive categories of subjects was differently but statistically insignificantly correlated with their competitive performance. The average scores of individual psychological dimensions increase gradually with the subjects' chronological age, however, there are some deviations possibly resulting from the not yet stabilised psychological structures. The monitoring of the average scores of the subjects' potential competitive performance in terms of psychological variables by different age category can predict a regular development trend in the psychological make-up of cross-country skiers.

Key words: *cross-country skiing, competitive performance, psychology, expert modelling*

Introduction

The subject and problem of this research involved the study and evaluation of the potential competitive performance of cross-country skiers in three age categories (older boys, younger junior men and older junior men). For this purpose a motor, morphological, psychological and sociological (MMPS) model was created, encompassing the motor, morphological, psychological and sociological areas of the athletes' psychosomatic status. As the model fails to cover all areas of the athletes' psychosomatic status, it may be categorised as a 'reduced model' for studying the potential competitive performance. Since all competitive categories of athletes may be evaluated by the same model, it may also be categorised as a 'universal model'.

The determination of the structure of the motor abilities is mostly based on those studies that are founded on the hierarchical structure of the motor area which is substantiated by factors. These aspects were the central theme of some studies conducted in the USA (Schmidt, 1991; Schmidt & Lee, 1999) and in Eastern Europe. From the point of view of a decision tree, we underpinned our study by the general hierarchical structure of the motor area which was proven for the first time by Kurelić, Momirović, Stojanović, Šturm, Radojević and Viskić-Štalec (1975) based on 38 motor tests. It involves the factorisation completion of the hierarchical structure of the motor area with two main factors, namely, the *energy* and *information* components of movement.

The periods defining the different age structures of the subjects follow specific morphological rules. Faster physical development in younger age categories of cross-country skiers may offer a great advantage which often counterbalances the deficiencies in one's cross-country skiing technique (Rusko, Hanin, Ronsen, & Smith, 2003). The structure of the morphological area stems from the studies of many authors (Kurelić et al., 1975; Stojanović, Momirović, Vukosavljević, & Solarić, 1975; Hošek & Jeričević, 1982) who proposed a general theoretical model with four latent dimensions (longitudinal dimensionality, voluminosity, subcutaneous fatty tissue and transversal dimensionality). Moreover, two specific cross-country skiing studies were also considered - Jošt (1988) and Pustovrh (1994).

The structure of the sociological area was based on the general phenomenon model of social stratification (Saksida & Petrović, 1972) consisting of the socialisation, institutional and consequential

subsystems. The definition of the sociological area was underpinned by the findings of specific studies (Pustovrh, 1991; Kerštajn, 1994; Zevnik, 2004) postulating that athletes (even elite ones) cannot influence the main performance indicators in cross-country skiing (setting of own goals and the selection of training programmes or suppliers of skiing equipment, etc.).

Scientific debates on the impact of the motor and physiological abilities on a competitor's success often create the impression that these dimensions are the only relevant indicators and predictors of top results. Yet it is known that two athletes with similar motor and physiological status may score substantially different results (Rushall, Hall, Roux, Sasseville, & Rushall, 1988). In cross-country skiing, this is a particularly frequent phenomenon (different maximum oxygen consumption and similar performance, being aged older is usually an advantage, etc.). Moreover, in adolescence an athlete has to cope with the problems of one's own perception and self-image and to weather a psychosocial crisis (Hanin & Syrjä, 1997). It is the psychological factors that often play a decisive role in their performance and, consequently, them persevering in this sports discipline.

The psychological area, with some modifications in personality traits and intelligence, was based on the model which Tušak (1995) presented using a sample of ski jumpers. This area was defined by three comprehensive sets: special psychological abilities; the motivational components of personality; and personality traits. The partial model, as part of the universal reduced MMPS model, was tested for the first time in this sport and, together with a presentation of the expert modelling method, represents the focal point of this article.

As cross-country skiing involves a relatively simple motor structure, we assumed that a broader model need not be defined for this set of special psychological abilities. Correlation between special psychological dimensions and performance may be established through the criteria of intelligence and concentration required to cope with mental strain.

Sport differs from other social categories primarily in terms of the athletes' strong focus on achievement and competitiveness and, on the other hand, their determination to improve their results. Individuals may oscillate between states of mind in which they are focused either on themselves or on their task at hand. A predominantly task-oriented athlete tends to perceive their abilities on the basis of personal achievement and their personal success is measured by personal improvement and the acquiring of mastery through effort. On the contrary, an ego-oriented person tends to construct their perceptive ability in a normative way (Nicholls, 1989). An ego- or task-orientation is related to the concept of internal and external motivation (Deci, & Ryan, 1985). Patterns of internal motivation are stronger when the goals are set in a way that enables their achievement via a task-oriented approach (Papaioannou & McDonald, 1993; Seifriz, Duda, & Chi, 1992; White & Duda, 1994). On the other hand, the motives of ego-oriented individuals seem to correlate more with external motivation (status/recognition incentives). Duda (1989) also established that task-oriented athletes show a greater endurance and practice for a longer time which proves that their internal motivation is stronger. It is the interaction between the internal motivation and endurance that plays a major role in cross-country skiing. Another characteristic worth mentioning is monotony which is otherwise typical of the majority of cyclic movements with a pronounced endurance component. It may be accompanied by sometimes very extreme weather conditions at the time of training and competition, which may relatively quickly erode the positive (self-)motivational attitude of a young cross-country skier.

The motivational aspect should naturally be explained through the prism of personality traits. These can be defined by three structural sets which in a way predict the specific reaction or behaviour of an individual in a given situation (Tušak, 1995). The first structural set includes those traits that are relevant to an athlete's attitude to their work and training, and focuses on achievement. The second structural set concerns the social-psychological traits mainly determining the competitor's attitude to other people, their communication with fellow competitors, coaches, parents and the public (extroversion). The third set shows the strongest correlation with a competitor's performance as it involves the establishing of their endurance component which constitutes a strong psychological precondition for engaging in cross-country skiing. Performance is strongly correlated with anxiety and efficient coping with stress situations which are sometimes represented by the environment in which the athletes train and perform. Owing to the increased stimulation of the autonomous nervous system this condition is accompanied by disturbances in body functioning with a direct impact on the competitor's performance.

An important role in evaluating the so defined reduced psychosomatic status of a cross-country skier is played by the method of expert modelling. Namely, a weakness of the multivariate methods (although they are still necessary) is their limitation as regards the nature of variables (linear correlation, normality of distribution, etc.) and particularly the number of subjects measured. In some sports where the number of athletes is quite small, it is difficult to conduct a study using multivariate methods, because it is simply impossible to provide a sufficiently large sample. Even a large number of variables and psychosomatic status dimensions is

often questionable. By applying expert knowledge and methods one may avoid these pitfalls in a satisfactory way.

The quality of each expert model depends on the knowledge base created by experts in the process of creating the model. Our project hosted the most renowned Slovenian cross-country skiing experts. The results of Slovenian and authors from other countries were taken into consideration (Pustovrh, 1991; Slabanja, 1991; Jošt, Dežman, & Pustovrh, 1992; Torkar, 2001). The knowledge base is a body of knowledge about the theory of athletes' performances and preparation in cross-country skiing (facts and rules describing the relations and phenomena in problems and/or methods, heuristic principles and ideas for problem solving). In the expert system the knowledge base in all discussed areas of the MMPS model is written in a formalism used for the application of the SMMS (Sport Measurement Management System, Version 1.0) computer programme. The formalism of the knowledge base was designed on the basis of three components (Ulaga, 2001): knowledge base referentiality (forming of a criterion tree), dimensional configuration of the knowledge base (determination of weights) and positional configuration of the knowledge base (determination of normalisers). All three components form an inseparable whole. The MMPS model has a hierarchical tree structure and encompasses the criteria applied in the study of athletes' potential competitive performance. The tree illustrates the hierarchical order and inter-correlation between the criteria (Table 1). The basic criteria (tests) are at the bottom of the tree and, in higher nodes, they combine into weighted and/or derived criteria. Thus, the higher-level criteria depend on those on lower levels. The multi-parameter decision theory offers a formal basis for the development of a model in which the basic problem is combining scores by a parameter to create a single overall score (Chankong & Haimes, 1983). The values of the basic criteria (tests) are determined for each subject separately on the basis of the measurements performed. The dimensional configuration of the MMPS model is determined by the decision rules (determination of weights). According to the experts, these are the contributions of individual variables to explain the potential competitive performance and are expressed in percentages (weights). The model was built by applying the method of the dependent determination of weights (Ulaga, 2001). According to this method, in each individual node the total contribution of the weight of all variables of a lower order that form a variable of a higher order equals 100 in relative terms. In nominal terms, the sum total of all the weights of all the lowest-order variables (tests) in the MMPS model is 100. The positional configuration of the knowledge base refers to the creation of normalisers for individual basic variables (tests). These are numerically expressed boundaries of the results in individual variables. These boundaries define individual qualitative scores (inadequate, adequate, good, very good, excellent). Based on such a 'manual' and expert construction of the MMPS model, the SMMS computer programme (Leskošek, 2000) may use the rough results of the measurements of individual variables (tests) to calculate the score (ranging from 1 to 10) at all levels of the MMPS model. The score at the highest level of the MMPS model is calculated 'automatically' and represents the total score of all studied areas in terms of the potential competitive performance of the subject. Another aim of the study was to establish the validity of the established MMPS model at the level of psychological variables.

Methods

Subjects

The sample of subjects consisted of 48 active cross-country skiers of three competitive categories who had participated in at least four competitions for the Slovenia Cup in the 2001-2002 season. The subjects included 17 older boys (OLDBOY – born in 1988 and 1989), 17 younger junior men (YOJUN – born in 1986 and 1987) and 14 older junior men (OLDJUN – born in 1984 and 1985). All participants took part in the research project voluntarily. We obtained their written consent for participation in the research project. For the subjects that were younger than 18 years we obtained a written consent from their parents and personal coaches. Anonymity was guaranteed for all participants.

Instruments

The model of potential performance MMPS (motor abilities, morphology, psychology and sociology) encompassed 64 independent (predictor) variables. This article only deals with the independent variables of the psychological area (24):

Elementary independent variables of special mental abilities: with the TN-10-A test (Pogačnik, 1994) a general factor of intelligence was measured (FLUINT – *fluid intelligence*). With the TKD test (Bele-Potočnik, 1976) *concentration* and *achievement* were measured (FUNENC – *function of encouragement*, FUNCON – *function of control*).

Elementary independent variables of motivation or dynamic personality components. Costello's questionnaire of achievement motivation (Costello, 1967) was used to measure general achievement motivation (PERBOW – *performance (success) based on work,* PERIOW – *performance (success) irrespective of work*). Willis' questionnaire of competitive motivation (Willis, 1982) was used to measure competitive motivation (POSCM – *positive competition motivation,* NEGCM – *negative competition motivation,* MOP – *motive of pow-*

er). Self-motivation (SELFMO) was measured by a self-motivation questionnaire (Dishman, Ickes, & Morgan, 1980).

Elementary independent variables of personality traits. The following variables were measured by the FPI – Freiburg Personality Inventory-76 (Bele-Potočnik, Hruševar, & Tušak, 1990): NEUROT – *neuroticism*, SPONTAGG – *spontaneous aggressiveness,* DEPRES – *depressiveness*, IRRIT – *irritability,* SOCIAB – *sociability,* SELFCON – *self-control,* REACAG – *reactive aggressiveness,* INHIBI – *inhibition,* SINCER – *sincerity,* EXTRO – *extroversion*, EMOTINS – *emotional instability,* MASCUL – *masculinity,* ENDUR – *endurance,* COMANX – *competition anxiety,* ANXAPT – *anxiety as a personality trait.* The variable ENDUR – *endurance* was additionally measured by an endurance questionnaire (Černohorski & Železnik, 2002), while the variables COMANX – *competition anxiety* and ANXAPT – *anxiety as a personality trait* were additionally measured using Spielberg's anxiety scale (Spielberg, 1970).

Dependent (criterion) variable. FIS (Fédération Internationale de Ski) points (SLO_FIS) scored by the Slovene competitors in the 2001-2002 competitive season. The calculation of points for the entire season was based on the average of the four most successful competitions of each individual athlete in the competitive season.

Procedure

The measurements were carried out in March 2002 at the Faculty of Sport in Ljubljana (a more detailed description of the measurement protocol is available with the authors at the Faculty of Sport in Ljubljana).

The model of potential competitive performance of cross-country skiers (MMPS) was made in the form of a decision tree. Normalisers (positional configuration) were set for all elementary variables (tests). These are the points determining the utility function *v* which for the given measured (rough) result *x* on a basic criterion determines its value, i.e. utility (Chankong & Haimes, 1983). The function is determined by defining an arbitrary number of points in the variable for rough results. The expert thus gives only explicit, numerical and attributive values of the utility function for some points, while for others, values are determined by calculating the straight line between two points by means of interpolation.

An example of the normalisers for the variable PERIOW (performance (success) irrespective of work):

variable value	0	1	2	3	4	5	6	7	9	10	13
variable score	0	2	4	7	9	10	9	7	4	2	0

Numerical and descriptive values of scores: 0 - 1.99 = unsatisfactory, 2 - 3.99 = satisfactory, 4 - 6.99 = good, 7 - 8.99 = very good, 8.99 - 10.00 = excellent

The decision rules (dimensional configuration) were formulated for all nodes in the model by the method of dependent determination of weight. This is the value of hypothetical contribution (in %) of each individual variable to competitive performance at the node of the model. In each individual node, total contribution of weight of all lower-order variables constituting a higher-order variable equals 100 in relative terms. In absolute terms the sum total of all weights of the lowest-order variables (tests) in the MMPS model is 100.

With regard to all previous research into a narrow focus of cross-country skiing and the theory of psychosomatic status model, the highest weight in our universal reduced model of potential performance was of course given to the motor sub-area (Table 1). Realisation and mobilisation dimensions in competitive sport cannot adequately compensate for a deficiency at the potential level to which the motor abilities belong. Nevertheless, in the continuation we will focus on the psychological sub-area, while any other will be mentioned only to the extent necessary to understand the problem.

The referential framework of the knowledge base in the psychological sub-area of athletes was taken from the psychological model which had been prepared for ski-jumpers (Tušak, 1995). It was adapted to expert knowledge in the fields of psychological behaviour and motivational dynamics of cross-country skiers as well as the characteristics of this sport. The decision rules were applied to define the share of psychological area in the MMPS model, which hypothetically was 26% (Table 1).

Our aim was to measure the area of psychological abilities and qualities with three substantive sets. Despite the fact that motivation is a very important component of performance in cross-country skiing, priority was given to the structural aspects of personality. Namely, a specific response of an athlete in a given motivational situation depends on their structural personality traits. These traits in a way direct the dynamic aspect of a personality, i.e. motivation. From the point of view of competitive performance, competitive qualities (COMPPRO) are the most important, and within them the ability to cope with stressful situations. In this period motivation is closely connected to competitiveness which in our sample of cross-country skiers was low. Priority is thus given to *competitive motivation* (COMPMOT), as this motivation is specific and should arouse in an athlete a desire to succeed in a competition (POSCM). Highly *special psychological abilities* (SPECPSYAB), especially *intelligence* (INTELLIG), are not evaluated as the crucial factor to high performance in cross-country skiing and

Table 1. Structure of psychological area (referentiality, dimensional and positional configuration) in a universal reduced model of potential performance MMPS

TEST CODE	NAME OF TEST	WEIGHTS	NORMALISERS
SC_POTCP	**Potential competition performance**	100	
├─SC_MOTOR	**Motor abilities**	36	
├─SC_MORF	**Morphological characteristics**	24	
├─SC_SOCIO	**Sociological characteristics**	14	
└─SC_PSYCHO	**Psychological abilities and properties**	26	
├─SPECPSYAB	Special psychological abilities	4	
│ ├─INTELLIG	Intelligence	1.5	
│ │ └─FLUINT	Fluid intelligence	1.5	0:0, 14:2, 18.25:4, 21.25:7, 23.75: 9, 27:10
│ └─CONCENT	Concentration and achievement	2.5	
│ ├─FUNENC	Function of encouragement	1.7	0:0, 61:2, 81:4, 111:7, 145:9, 244:10
│ └─FUNCON	Function of control	0.8	0.48:10, 5.75:9, 6.45:7, 7.8:4, 8.47: 2, 15:0
├─MOTIVAT	Motivation	10	
│ ├─GENPERFMOT	General performance motivation	2.4	
│ │ ├─PERBOW	Performance (success) based on work	1.7	0:0, 1:1, 2:2, 4:4, 6:7, 8:9, 9:10
│ │ └─PERIOW	Performance (success) irrespective of work	0.7	0:0, 1:2, 2:4, 3:7, 4:9, 5:10, 6:9, 7:7, 9:4, 10:2, 13:0
│ ├─COMPMOT	Competition motivation	5	
│ │ ├─POSCM	Positive competition motivation	2.8	10:0, 50:2, 56:4, 65:7, 72:9, 80:10
│ │ ├─NEGCM	Negative competition motivation	1	10:0, 20:2, 28:4, 32:7, 36:9, 38:10, 41:9, 44:7, 49:4, 60:2, 72:0
│ │ └─MOP	Motive of power	1.2	0:0, 33:2, 35:4, 39:7, 45:9, 68:10
│ └─SELFMOT	Self-motivation	2.6	
│ └─SELFMO	Self-motivation	2.6	40:0, 116:2, 125:4, 142:7, 156:9, 173:10
└─PERSONTRA	Personality traits	12	
├─SPECSTRUTRA	Special structural traits	4.6	
│ ├─MASCUL	Masculinity	1.5	0:1, 2:2, 3:4, 4:7, 5:9, 7:10
│ ├─DEPRES	Depressiveness	0.8	0:10, 2:9, 3:7, 5:4, 6:2, 7:1
│ ├─SINCER	Sincerity	0.5	0:1, 2:2, 3:4, 5:7, 6:9, 7:10
│ ├─SPONTAGG	Spontaneous aggressiveness	0.9	0:10, 2:9, 3:7, 5:4, 6:2, 7:1
│ └─IRRIT	Irritability	0.9	0:10, 1:9, 2:7, 5:4, 6:2, 7:1
├─SOCPROP	Sociopsychological properties	2.2	
│ ├─INHIBI	Inhibition	0.3	0:10, 2:9, 3:7, 5:4, 6:2, 7:1
│ ├─SOCIAB	Sociability	0.6	0:1, 1:2, 3:4, 5:7, 6:9, 7:10
│ ├─REACAG	Reactive aggressiveness	0.6	0:10, 1:9, 2:7, 4:4, 6:2, 7:1
│ └─EXTRO	Extroversion	0.7	0:1, 2:2, 3:4, 5:7, 6:9, 7:10
└─COMPPRO	Competition properties	5.2	
├─ENDURANCE	Endurance	2	
│ └─ENDUR	Endurance	2	0:0, 11:2, 13:4, 15:7, 18:9, 20:10
├─ANXIETY	Anxiety	1.2	
│ ├─ANXAPT	Trait anxiety	0.5	20:10, 30:9, 38:7, 45:4, 51:2, 80:0
│ └─COMANX	Competition anxiety	0.7	25:10, 29:9, 38:7, 47:4, 54:2, 90:0
└─ABCOWSTR	Ability to cope with stress	2	
├─EMOTINS	Emotional instability	0.6	0:10, 1:9, 3:7, 5:4, 6:2, 7:1
├─NEUROT	Neuroticism	0.6	0:10, 1:9, 2:7, 3:4, 5:2, 7:1
└─SELFCON	Self-control	0.8	0:1, 2:2, 3:4, 5:7, 6:9, 7:10

cyclic sport disciplines in general (Dolenec, 2001; Kolar, 2001), therefore we attached less significance to them. In the node of *concentration* and *achievement* (CONCENT) the *function of encouragement* (FUNENC) is slightly more important than the *function of control* (FUNCON).

The programme SMMS was used to calculate scores for each subject for all variables at all levels; first for elementary variables (tests) and then gradually for all composite variables at higher nodes, up to the highest node, i.e. prognostic score of the subject's *competitive performance* (SC_POTCP).

The calculation was made using the following formula:

$$Svr = (Snr_1 \times P) + (Snr_2 \times P) + \ldots + (Snr_n \times P)$$

where: Svr – normalised value of a higher-order variable; Snr – normalised value of a lower-order variable; P – weight of a lower-order variable (decision rule, weight).

At the highest levels of the models, Pearson's correlation coefficient was used to establish the correlation between the scores of predictor variables and the criterion variable. Thus the validity of the universal reduced model of potential performance was confirmed.

Results

Establishment of validity of psychological sub-area within the model of potential performance MMPS

The final correlation between the score of the psychological area (SC_PSYCHO) and the performance criterion ranges from low in older boys to medium in younger junior men and older junior men, and in none of the categories reaches any statistical significance. The individual results of correlations show that *intelligence* (INTELLIG), the *ability to concentrate* (FUNCON) and *psychological ability for achievements* (FUNENC) are feeble predictors of performance (Table 2). While in the older boys the trends in scores and the correlation with the performance criterion in the above mentioned dimensions move towards an expected and desired direction, in younger and older junior men, the correlation between these dimensions and the criterion is low and even the opposite of what was expected (inferior competitors achieve better scores).

The score of the *motivation* node (MOTIVAT) correlates medium strongly with the

Table 2. Correlation between the scores of variables of psychological area and the selected performance criterion (SLO_FIS)

TEST CODE	MODEL MMPS		
	OLDBOY	YOJUN	OLDJUN
SC_POTCP	-0.53*	-0.47	-0.79**
└─SC_PSYCHO	-0.34	-0.07	-0.47
├─SPECPSYAB	-0.42	0.31	0.42
│ ├─INTELLIG	-0.35	0.29	0.04
│ │ └─FLUINT	-0.35	0.29	0.04
│ └─CONCENT	-0.33	0.20	0.43
│ ├─FUNENC	-0.36	0.09	0.43
│ └─FUNCON	-0.15	0.40	0.31
├─MOTIVAT	-0.19	-0.31	-0.28
│ ├─GENPERFMOT	0.13	0.37	-0.12
│ │ ├─PERBOW	0.20	0.30	0.13
│ │ └─PERIOW	-0.12	0.32	-0.67**
│ ├─COMPMOT	-0.37	-0.55*	-0.31
│ │ ├─POSCM	-0.40	-0.54*	-0.40
│ │ ├─NEGCM	0.30	-0.36	0.45
│ │ └─MOP	-0.41	-0.19	-0.28
│ └─SELFMOT	-0.04	-0.24	-0.10
│ └─SELFMO	-0.04	-0.24	-0.10
└─PERSONTRA	-0.20	0.10	-0.68**
├─SPECSTRUTRA	-0.09	0.15	-0.82**
│ ├─MASCUL	-0.32	0.10	-0.75**
│ ├─DEPRES	-0.31	0.17	-0.35
│ ├─SINCER	0.16	0.15	0.49
│ ├─SPONTAGG	0.45	-0.15	-0.63*
│ └─IRRIT	0.06	0.09	-0.59*
├─SOCPROP	-0.14	-0.09	-0.23
│ ├─INHIBI	-0.11	0.18	0.04
│ ├─SOCIAB	-0.21	0.12	-0.30
│ ├─REACAG	0.08	-0.12	-0.17
│ └─EXTRO	-0.15	-0.25	-0.06
└─COMPPRO	-0.24	0.11	-0.62*
├─ENDURANCE	0.13	0.14	-0.59*
│ └─ENDUR	0.13	0.14	-0.59*
├─ANXIETY	-0.39	0.03	-0.12
│ ├─ANXAPT	-0.41	-0.04	-0.18
│ └─COMANX	-0.29	0.06	-0.07
└─ABCOWSTR	-0.38	-0.03	-0.56*
├─EMOTINS	-0.35	0.07	-0.37
├─NEUROT	-0.06	0.03	-0.30
└─SELFCON	-0.36	-0.15	-0.46

OLDBOY (older boys) *$p_{(0.05)}$ = 0.48, ** $p_{(0.01)}$ = 0.61,
YOJUN (younger junior men) *$p_{(0.05)}$ = 0.48, ** $p_{(0.01)}$ = 0.61,
OLDJUN (older junior men) *$p_{(0.05)}$ = 0.53, ** $p_{(0.01)}$ = 0.66.

Table 3. The scores of potential performance of the subjects A and B at the highest level (SC_POTCP) and at the level of psychology (SC_PSYCHO) in the universal reduced model of potential performance MMPS

TEST CODE	MODEL MMPS					
	Competitor A (SLO_FIS = 165.40, RANK = 2, AGE = 17.5 YEARS)			Competitor B (SLO_FIS = 99.50, RANK = 1, AGE = 18 YEARS)		
	RES	f(x)	SCORE	RES	f(x)	SCORE
SC_POTCP		6.83	good		7.55	very good
└─SC_PSYCHO		7.90	very good		7.80	very good
├─SPECPSYAB		5.71	good		3.54	satisfactory
│ ├─INTELLIG		5.75	good		8.00	very good
│ │ └─FLUINT	20	5.75	good	22.5	8.00	very good
│ └─CONCENT		5.70	good		1.92	unsatisfactory
│ ├─FUNENC	96	5.50	good	60	1.97	unsatisfactory
│ └─FUNCON	6.88	6.04	good	9	1.84	unsatisfactory
├─MOTIVAT		7.24	very good		8.75	very good
│ ├─GENPERFMOT		6.53	good		9.12	excellent
│ │ ├─PERBOW	5	5.50	good	9	10.00	excellent
│ │ └─PERIOW	4	9.00	excellent	7	7.00	very good
│ ├─COMPMOT		6.55	good		8.24	very good
│ │ ├─POSCM	66	7.29	very good	75	9.38	excellent
│ │ ├─NEGCM	26	3.50	satisfactory	30	5.50	good
│ │ └─MOP	49	9.17	excellent	45	9.00	excellent
│ └─SELFMOT		9.41	excellent		9.47	excellent
│ └─SELFMO	163	9.41	excellent	164	9.47	excellent
└─PERSONTRA		8.78	very good		7.78	very good
├─SPECSTRUTRA		8.73	very good		8.34	very good
│ ├─MASCUL	5	9.00	excellent	5	9.00	excellent
│ ├─DEPRES	0	10.00	excellent	3	7.00	very good
│ ├─SINCER	2	2.00	satisfactory	4	5.50	good
│ ├─SPONTAGG	1	9.50	excellent	2	9.00	excellent
│ └─IRRIT	1	9.00	excellent	1	9.00	excellent
├─SOCPROP		8.80	very good		6.80	good
│ ├─INHIBI	1	9.50	excellent	4	5.50	good
│ ├─SOCIAB	7	10.00	excellent	7	10.00	excellent
│ ├─REACAG	2	7.00	very good	4	4.00	good
│ └─EXTRO	6	9.00	excellent	5	7.00	very good
└─COMPPRO		8.82	very good		7.62	very good
├─ENDURANCE		9.00	excellent		9.00	excellent
│ └─ENDUR	18	9.00	excellent	18	9.00	excellent
├─ANXIETY		9.65	excellent		7.90	very good
│ ├─ANXAPT	25	9.50	excellent	33	8.25	very good
│ └─COMANX	26	9.75	excellent	35	7.67	very good
└─ABCOWSTR		8.47	very good		6.53	good
├─EMOTINS	0	10.00	excellent	4	5.50	good
├─NEUROT	1	9.00	excellent	2	7.00	very good
└─SELFCON	5	7.00	very good	5	7.00	very good

RES - raw test results, f (x) - numerical score, SCORE - attribute score
Numerical and descriptive values of scores: 0 - 1.99 = unsatisfactory, 2 - 3.99 = satisfactory, 4 - 6.99 = good, 7 - 8.99 = very good, 8.99 - 10.00 = excellent.

performance criterion. Of all the three motivational sub-nodes, the score of *general productive motivation* (GENPERFMOT) shows the lowest correlation with the performance criterion. In older boys and younger junior men the expected correlation even has a negative sign, while in older junior men it is relatively low. *Competitive motivation* (COMPMOT) better correlates with the criterion SLO_FIS than the general productive motivation and, in the category of younger junior men, it shows a statistically significant correlation (-0.55). *Positive motivation* (POSCM) is directed correctly and has a high predictive power in all three competitive categories (in younger junior men it is even statistically significant). In all three categories *self-motivation* (SELFMOT) is insignificantly correlated with the competitive performance criterion, while in the categories of older boys and older junior men this correlation is insignificant.

In older boys, the score of *personality qualities* (PERSONTRA) correlates medium strongly with the performance criterion, while in younger junior men, better competitors achieve a lower score of personality traits and in the case of older junior men the correlation with the criterion is statistically significant (-0.68). In the category of older junior men the first node of the personality qualities dimension SPECSTRUTRA (*special structural traits*) statistically significantly correlates with the criterion SLO_FIS. Within this node, other coefficients of correlation with the criterion are also high (MASCUL – statistically significant). Substantive differences were expected in the node of *competitive qualities* (COMPPRO). It turned out that conclusions were only possible in the category of older boys and older junior men (statistically significant). In the category of younger junior men the correlations were low. As regards the variable *endurance* (ENDURANCE), a better (higher) score is more strongly correlated with the inferior competitors, which was the case both in older boys and younger junior men. The established correlations between the scores of nodes of *anxiety* (ANXIETY) and *stress-coping* (ABCOWSTR) and the performance criterion were relatively good in the category of older boys.

Example of results of evaluation of subjects' potential performance

Table 3 shows two competitors ranked one after another (1st and 2nd place) on the scale of selected criterion (SLO_FIS), while the difference in their age is half a year. The general potential performance of the competitor A and B is evaluated as good (6.83) and very good (7.55), respectively.

Monitoring of average scores of potential competitive performance in the area of psychological abilities and qualities by the subjects' chronological age

In the continuation (by means of charts) we will focus on the introduction of trends in the average scores of only those variables for which it is believed, based on expert findings, that they bear important information in the planning of performance in terms of psychological abilities and qualities. The ratios between the numerical and the attributive scores for individual competitive categories are given at the end of the chapter (Table 4).

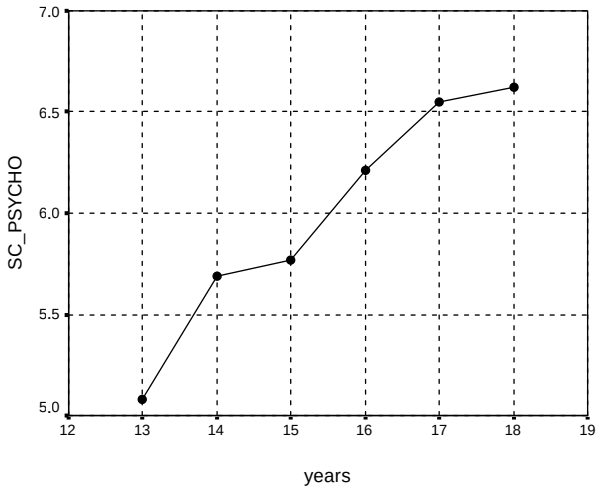

Chart 1. Trends in average final score of psychological area (SC_PSYCHO)

The average score of psychological area (SC_PSYCHO) has been increasing evenly throughout the selected years (Chart 1). There is no dramatic upsurge in the average score in view of the subjects' age.

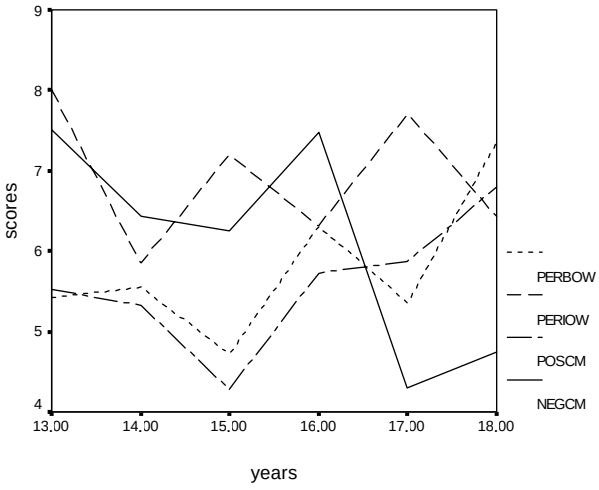

Chart 2. Trends in average scores of some elementary variables of the motivational component of psychological area

The previous results of the psychological area already indicated that the general productive motivation was not a strong predictive component of performance in cross-country skiing. This is evident in Chart 2.

Until the age of 16, there seems to be a slight confusion in the competitive motivational area (NEGCM, POSCM). The competitive motivation, focusing on avoidance of failure (NEGCM) and representing the negative component of the competitive motivation, is initially (at the age of 13) very high and then gradually decreases. Between 15 and 16 years of age it suddenly grows and then plunges. The score rises again to some extent between 17 and 18 years. Similar trends were recorded in the average score of *positive motivation* (POSCM) until the age of 16 years, however, later these trends met the expectations.

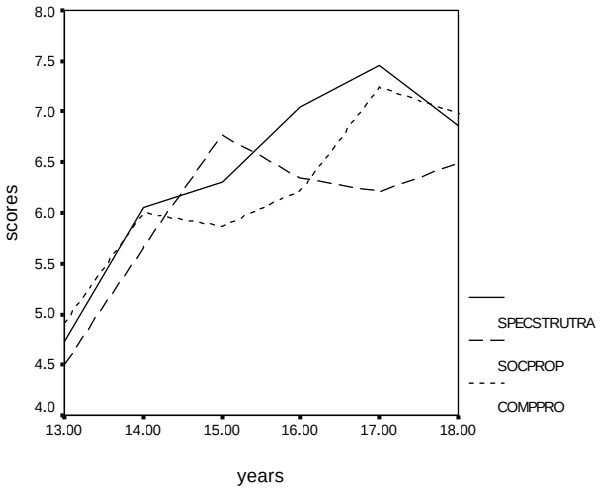

Chart 3. Trends in average scores of the aggregated criteria of personality qualities

By and large, the average score of all three main dimensions of personality qualities increases with years (Chart 3). Nevertheless, the direction in which the scores move is not the same for all three components. The expected gradual upward trend in average scores is most distinctive in the dimension of *special structural qualities* (SPECSTRUTRA), where a slight decrease was recorded in the final year. The rise in average scores of s*ociopsychological qualities* (SOCPROP) and *competitive qualities* (COMPPRO) is visible in individual competitive categories, but within the categories it fluctuates by age. In the category of older boys (13 and 14 years) there is an upward trend in both scores.

The universal (i.e. for all ages) reduced model of competitive performance was constructed for the purpose of cross-country skiing. Positional configuration (determination of normalisers) of the knowledge base was built uniformly. Our purpose was to obtain quality scores for a cross-country skier through different age periods within competitive categories. Thus, the younger subjects could also achieve lower numerical scores, but this does not mean that they are less apt for this type of sport. The final attributive scores of individual competitive categories are presented in the continuation (Table 4) – they are based on the monitored average scores of the subjects' potential competitive performance in terms of psychological variables by age category.

Table 4. Numerical and attributive scores adjusted to individual competitive categories

	OLDJUN	YOJUN	OLDBOY
EXCELLENT	7.00 - 10.00	5.50 - 10.00	4.50 - 10.00
VERY GOOD	6.50 - 6.99	5.00 - 5.49	4.00 - 4.49
GOOD	6.00 - 6.49	4.50 - 4.99	3.50 - 3.99
SATISFACTORY	5.50 - 5.99	4.00 - 4.49	3.00 - 3.49

OLDJUN - competitive category of older junior men (born in 1984 and 1985),
YOJUN - competitive category of younger junior men (born in 1986 and 1987),
OLDBOY - competitive category of older boys (born in 1988 and 1989).

Discussion and conclusions

It is true that based on the correlations between special mental abilities and the performance criterion one cannot draw conclusions about higher or lower intelligence – after all, intelligence is not the key factor of competitive performance. However, the fact remains that higher cognitive abilities help in implementing the motor activities and thus boost one's performance. According to Vernon and Mori (1992), the higher the speed of nervous impulse transmission, the higher the efficiency of the central nervous system which results in higher motor and intellectual efficiency.

We have established a low correlation between *general productive motivation* (GENPERFMOT) and the performance criterion. General productive behaviour in sport is a typical characteristic of athletes intensifying their endeavours to achieve better results and devoting their undivided attention to work. In our case, *performance based on work* (PERBOW) is a quality of the less successful cross-country skiers. Evidently, it may also be established on a sample of cross-country skiers that the aspiration to succeed with minimum effort is much stronger in younger categories, which has already been shown in some other research conducted in Slovenia (Tušak, 1997). The reason probably lies in lack of strong competitiveness, which diminishes the effort and desire to work hard. The competitors look towards the future (daydreaming), because the present is too easy. Only the inferior athletes believe

that it is possible to reach their top-ranked peers by working diligently.

If the direction of the score of positive motivation is considered to be correct in all three categories, a higher score of negative motivation (NEGCM) in older boys and older junior men is more correlated with the inferior competitors, which additionally hinders a proper motivational preparation. As regards its internal structure, this aspect of motivation is negative.

A high correlation between masculinity and performance of successful athletes was also established by Havelka and Lazarević (1981), therefore, the correlation result is not surprising. What is slightly surprising is the correlation between *sincerity* (SINCER) and the criterion SLO_FIS (in all categories), because it indicates that better competitors perceive sincerity as one of their weaknesses to be concealed from their opponents. Other correlations in this node include the correlation between the score of *spontaneous aggressiveness* (SPONTAGG) and the performance criterion in the category of older boys. Regretfully, this high correlation, albeit statistically insignificant, is directed in the wrong way. Notwithstanding the level of performance of young athletes, high values in this personality qualities are not desirable (possible physically, verbally and mentally aggressive acts), even if these athletes are in the period of emotional immaturity.

The correlation between the node of sociopsychological qualities (SOCPROP) and the performance criterion as well as the model variables of this node differs considerably by age category. There is no common denominator based on which a conclusion could be drawn that better and worse competitors differ substantially in this structural quality. We would probably get a similar picture in a non-selected population.

In a way, the trends in the node of *competitive qualities* (COMPPRO) caution us about the negative motivational component of effort and work on the one hand and a too low competitiveness on the other hand, since "good" results may be achieved without endurance. We have also established that better competitors were less anxious and less emotionally unstable as well as calmer. These are the principal advantages of competitors in competitions. According to Zimbardo (1996) people cope with stressful situations more effectively, if they are in a good shape. A similar correlation trend was also seen in the category of older junior men; however, it was more in the node of stress-coping. In younger junior men, strong oscillations are seen throughout the node of personality qualities and a low correlation with the performance criterion SLO_FIS.

When interpreting comparisons between two competitors some caution is needed as well as good knowledge of the specifics of a cross-country skiing competition and training. In the final score of mental abilities and qualities (SC_PSIH) both competitors come very close. Nevertheless, some quality differences favouring competitor B are also identified. In terms of special psychiological abilities (SPECPSYAB) competitor A achieved higher values; nevertheless, in cross-country skiing these values are less important than the motivational dimension. In all three motivational nodes (GENPERFMOT, COMPMOT, SELFMOT) competitor B achieved substantially higher values. Inside these nodes the following variables are to be noted: *performance (success) based on work* (PERBOW), *positive competition motivation* (POSCM) and *self-motivation* (SELFMO) which are the key predictors of an athlete's performance from the motivational aspect. In terms of personality, the two competitors differ primarily in the segment of *sociopsychological qualities* (SOCPROP). Competitor A is slightly more *extroverted* (EXTRO), more *dominant* (REACAG) and less *inhibited* (INHIBI). The scores in the node of *competitive qualities* (COMPPRO) are also in favour of competitor A. He is less anxious, emotionally more stable and much less neurotic. He is relaxed and cheerful, which are probably those components with which he compensates for lower motivation.

Based on the actual informative value of the constructed model of potential performance (MMPS), competitor B may be evaluated as more promising in the long run in terms of potential top performance in cross-country skiing. After all, this is shown by the difference in the achieved FIS points. Of course, this is not the crucial informative value of this model. The model becomes much more powerful, if the instructor adapts his/her management of the transformation process of athletes according to this information as well as improves the athletes' efficiency in a certain time period. Without this information, it is highly possible that the management of the training process is incorrect, especially with larger training groups and the same means and methods for all. With correct planning of the transformation process in the long run and by taking into account the findings of this research, competitor A may achieve a high level of elite competitive performance.

Monitoring the scores of athletes' potential competitive performance in terms of psychological variables by age period enables a timely response to any potential deviations which have not yet become decisive (Chart 1). Many times a slight, almost imperceptible upward trend in the average score of the psychological area is the cause of errors in the psychological preparation of competitors. According to Roberts and Treasure (1995), the "training folklore" (equal means of loading for all) increases errors in the motivational approach. Probably, we may agree with this assertion and apply it

to the entire psychological area. It is also true that a proper response to the information of a psychological nature calls for expert knowledge which is not as good as it could be.

In the segment of productive motivation (Chart 2) it is not possible to determine a common psychological and developmental denominator that would encompass all downward and upward trends in both motivations, the one focusing on *performance (success) based on work* (PERBOW) and the other focusing on *performance (success) irrespective of work* (PERIOW). Obviously, the scores of both motivational dimensions in cross-country skiers are too wide apart. While the score of one motivational form is plummeting, the other is soaring, with the average score PERBOW in all monitored years being slightly too low.

The growth in uncertainty and ambivalence in the area of competitive motivation (NEGCM, POSCM) is proportional to the level of engagement in sport. In a way, motives link with stimuli from the environment and instigate emotional states which stir athletes to approach a goal or avoid it. Cross--country skiers' self-confidence grows with every achievement, and the initial insecurity gradually turns into a motive to achieve success. Younger athletes' experience of success is also connected with the fear of how to continue to be successful in the future. Another reason for such motivational situation may be found in the final year before a competitor moves to a higher age category. The demands of the environment (coaches, parents) increase suddenly and competitors' reactions may be very different. Such a trend in competitive motivation is understandable; however, it should not serve as an alibi for the responsible persons to observe passively a negative motivational situation.

Oscillation in *sociopsychological qualities* (SOCPROP) in the category of young junior men (15 and 16 years) may be ascribed to a search for identity which explains the ups and the downs. The decline in competitive qualities of younger junior men (17 and 18 years) may be ascribed to the already structured elite in this category. Probably, the oscillation is more a consequence of the characteristics of the sample than of the developmental laws.

In the long-term positional configuration the main goal of the transformation process is to achieve the *top level* in the senior men category. Transformation of numerical scores into attributive enables perception of the *top level* in other (younger and older) competitive categories as well as facilitates comparison between the subjective score (of the instructor) and the score of any model variable. Hence, others may speak about a cross-county skier critically but (s)he may monitor the trends in his/her own development in an impartial way. This method is suitable for quick and quality corrections of training programmes.

Evaluation of psychological dimensions of cross-country skiers should shed some more light on the variable part of performance in this sport. Nevertheless, these relations are very complex so that generalised conclusions drawn on the basis of the trends and correlations between individual elementary and aggregate variables are unreliable in terms of methodology and substance. There is probably no motor reaction that would not correlate with a whole range of psychological dimensions in one or another way. The question is what the relationship between these variables is and how much variability they contribute to such a psychological structure. Therefore, in spite of the thesis about the connections and inseparability of psychological abilities and qualities, one has to content oneself with an analytical approach to searching of those dimensions that facilitate and justify the prediction of competitive performance in cross-country skiing.

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