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PREDICTABILITY OF CROSS-COUNTRY SKIERS' COMPETITIVE PERFORMANCE IN TERMS OF SOCIOLOGICAL VARIABLES

NAPOVED TEKMOVALNE USPEŠNOSTI V SMUČARSKEM TEKU Z VIDIKA SOCIOLOŠKIH SPREMENLJIVK

Abstract

The purpose of the study is to establish the values of variables from the sociological area in predicting potential competitive performance in cross-country skiing. The sociological area, encompassing 11 variables, was studied within the MMPS model of potential performance (motor abilities, morphology, psychology, sociology). The sample consists of 48 cross-country skiers from three competitive categories. The expert modelling procedure was used to obtain scores (1-10) for the potential performance of the subjects at all levels of the sociological area. An analysis of the correlation between these scores and the actual competitive performance criterion shows that the sociological area in all three categories of subjects is insignificantly correlated with their competitive performance. Nevertheless, due to the small number of subjects the results cannot be generalised. After two subjects from each category were eliminated, this correlation increased substantially; in the category of older junior men it even reached the level of statistical significance. The results show that the original expert modelling procedure in the sociological area deserves further research attention and should be verified on larger samples of subjects practising not only this sport but also other sports.

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

Izvleček

S študijo smo želeli ugotoviti vrednost spremenljivk sociološkega prostora pri napovedovanju potencialne tekmovalne uspešnosti v smučarskem teku. Sociološki prostor, ki je zajemal 11 spremenljivk, smo proučevali v sklopu modela potencialne uspešnosti MMPS (motorika, morfologija, psihologija, sociologija). V vzorec je bilo zajetih 48 smučarjev tekačev v treh tekmovalnih kategorijah. S postopkom ekspertnega modeliranja smo pridobili ocene (1-10) o potencialni uspešnosti merjencev na vseh nivojih sociološkega prostora. Analiza povezanosti teh ocen s kriterijem dejanske tekmovalne uspešnosti je pokazala, da je sociološki prostor pri vseh treh kategorijah preizkušancev statistično neznačilno povezan z njihovo tekmovalno uspešnostjo. Vendar zaradi majhnega vzorca rezultatov ne moremo posploševati. Po izločitvi dveh preizkušancev iz vsake kategorije ta povezanost precej naraste, v kategoriji starejših mladincev celo do nivoja statistične značilnosti. Rezultati kažejo, da je izviren postopek ekspertnega modeliranja v sociološkem prostoru vreden nadaljnjega proučevanja in preverjanja na večjih vzorcih preizkušancev te in tudi ostalih športnih panog.

Ključne besede: sociologija, smučarski tek, ekspertno modeliranje, tekmovalna uspešnost

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INTRODUCTION

Sport may be conceived as a social phenomenon which is not a value in itself for society but a means of achieving general and special social objectives. The practising of sport is a result of social and personal factors. The basic social value of sport as a special social activity lies in its ability to substantially contribute to the maintaining of a balance between social and individual needs and goals. In its own right, sport is just an organised game, like a competition should be. Parallel to this, sport offers us the opportunity to cope with upsurges of emotions during matches. It also teaches us to adhere to the rules and respect social values.

Through a rough taxonomy of sets of motor, morphological, functional, cognitive, conative and sociological abilities, characteristics and qualities, a sportsperson may be defined as a bio-psycho-social being in which the mentioned dimensions interact in countless ways (Kurelić, Momirović, Mraković, & Šturm, 1979). Competitors go through various development changes, including social changes. The process of socialisation is not only limited to social development but also to moral and mental development, the forming of viewpoints and beliefs as well as the development of motor efficiency. The primary phases in the development of sensomotor and locomotor abilities, laying the foundations for one's subsequent engagement in sport, also form part of the socialisation process.

In some northern European countries cross-country skiing occupies a special place in society and is considered a national phenomenon. The northern philosophy of cross-country skiing, particularly its aspects of environmental awareness and perception of nature, is penetrating the minds of people with giant strides. Of course, recreational and competitive sport orientations cannot be equated. However, we can find the common points and, on that basis, build a knowledge base in the sociological sub-area of cross-country skiing.

The increasingly demanding requirements of elite sport call on individual sports disciplines to set up or design competitive and potential models of the performance of athletes in all life periods and in all phases of the transformation process. The competitive performance model is based on the actual result of an individual athlete (at the present time). When analysing competitive performance one has to progress from consequences to causes, while in potential performance (anticipating the future) it is the other way around – from causes to consequences. A general potential model of performance in Nordic skiing, to which cross-country skiing belongs, was designed on the basis of the concept of psychosomatic status (Jošt, Dežman, & Pustovrh, 1992). Nevertheless, decisions concerning transformation process management must not stem from partial findings. By applying expert knowledge and methods one may satisfactorily avoid the pitfalls of multivariant methods (which are still indispensable). Multi-parameter modelling is conceived as a process of evaluation. In this process a model has to be developed for the evaluation of individual ideas on the basis of the set goals and expectations (Chankong & Haimes, 1983).

The subject and problem of this research involved the study and evaluation of the potential competitive performance of cross-country skiers from three age categories (older boys, younger junior men and older junior men). For this purpose, a MMPS model was created to encompass 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 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 quality of each expert model depends on the knowledge base created by experts in the process of creating the model. Our project involved the most renowned cross-country skiing experts. 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 in 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 hierarchic 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. The basic criteria (tests) are at the bottom of the tree and, in higher nodes, they combine to form weighted and/or derived criteria. Thus, the higher-level criteria depend on those at lower levels. The value 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 decision rules (determination of weights). According to experts, these are the contributions of the individual variables to explaining 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 weights of all 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 results for 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 may use the rough results of the measurements of individual variables (tests) for calculating the score (ranging from 1 to 10) at all levels of the SMMS 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 SMMS model at the level of sociological variables.

This article deals only with the sociological sub-area, while other sub-areas of the athletes' psychosomatic status are referred to solely for the purpose of explaining the structure of the MMPS model of potential performance. A study of all areas of the MMPS model would be too exhaustive and be beyond the objectives of the research which were intentionally limited to a study of the sociological area. We present the first attempt to create a knowledge base in the sociological sub-area. The basic theoretical premise of this model is the phenomenal model of social stratification (Saksida & Petrović, 1972), which is supplemented by new findings in sport and particularly by research findings in the fields of social and demographic characteristics of cross-country competitors (Kerštajn, 1994; Pustovrh, 1991; Vrhovec-Kavčič, 1990;

Zevnik, 2004). The hypothetical sociological model is thus divided into three subsystems: the socialisation subsystem is defined by the dimensions which prepare an individual to assume their roles in the institutional social order (family, school etc.); the consequential subsystem is defined as a sanctioning of the individual's assumption of their position in the socialisation and institutional order; and the institutional subsystem defines the individual's position from professional, political and economic perspectives.

As these dimensions define the characteristics of a population, it is possible to apply them in a hierarchical classification of a sample of the population into relevant segments of the social system structure (Doupona, 1996). In our research, we strive to classify the sample of subjects in their sociological sub-area so as to establish the potential performance of cross-country skiers.

METHOD

Participants

The sample of subjects consisted of 48 active cross-country skiers from 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 (OLDB – born in 1988 and 1989), 17 younger junior men (YJM – born in 1986 and 1987) and 14 older junior men (OJM – born in 1984 and 1985).

Instruments

The MMPS model (motor abilities, morphology, psychology and sociology) encompassed 64 independent (predictor) variables. These are independent variables of the sociological sub-area (11): education of one's mother (EM), education of one's father (EF), conditions for training at the ski club (CTSC), the quality of expert work (QEW), organisation of the club's infrastructure (OCI), involvement of one's mother in sport (IMS), involvement of one's father in sport (IFS), function of one's mother in the club (FMC), function of one's father in the club (FFC), position of one's mother at work (PMW), and position of one's father at work (PFW).

Dependent (criterion) variable (SLO_FIS): the FIS points achieved by Slovenian competitors in the 2001-2002 season were selected. A lower value of this variable (lower number of points) means a better competitive performance. 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 from the authors).

The MMPS model of the potential performance of cross-country skiers was constructed in the form of a tree of criteria. Normalisers were set (positional configuration) for all elementary variables (tests). These are the points determining the utility function v which for a given measured (rough) result x on a basic criterion determines its value i.e. utility (Chankong & Haimes, 1983). The experts thus give only explicit, numerical and attributive values of the

utility function for some points, while for others the values are determined by calculating the straight line between two points by interpolation.

Table 1: An example of setting up the normalisers for the variable EM – education of one's mother:

value of variable	1	2	3	4	5	6	7
score of variable	3	5	7	10	7	5	3

Legend:
Numerical and descriptive values of scores:
$0 \leq f(x) \leq 2$ = unsatisfactory,
$2 \leq f(x) \leq 4$ = satisfactory,
$4 \leq f(x) \leq 7$ = good,
$7 \leq f(x) \leq 9$ = very good,
$9 \leq f(x)$ = excellent

The decision rules were formulated (dimensional configuration) for all nodes by the method of the dependent determination of weights (Ulaga, 2001). This is the value of the hypothetical contribution (in %) of each individual variable to competitive performance. The SMMS programme was used to calculate scores for each subject for all variables at all model levels, first for the elementary variables (tests) and then gradually for all composite variables at higher nodes, up to the highest node MMPS, i.e. the prognostic score of the subject's competitive performance. The calculation was made according to the following formula:

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

Svr – normalised value of higher-order variable

Snr – normalised value of lower-order variable

P – weight of the lower-order variable (decision rule)

At the highest level of the model, 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 model of potential performance was determined.

RESULTS AND DISCUSSION

Creation of a knowledge base formalism

One of the objectives of the research was to design a model of the potential performance (MMPS) of cross-country skiers from three competitive categories (from 13 to 18 years). With regard to both all previous research made within a narrow focus of cross-country skiing and the theory of psychosomatic status model, the highest weight in our model of potential performance was of course given to the motor sub-area. Realisation and mobilisation dimensions in competitive sport cannot adequately compensate for a deficiency at the potential level to which motor abilities belong.

Table 2: Structure of the sociological area (referentiality, dimensional and positional configuration) in the MMPS model of potential performance

TEST CODE	NAME OF TEST	WEIGHTS	NORMALISERS
MMPS	**Motorics, morphology, psychology, sociology**	100	
OC_SOCIO	**Sociological characteristics**	14	
SOC_SUB	Socialisation subsystem	2	
EDUC	Education	2	
EM	*Education of mother*	1	1:3, 2:5, 3:7, 4:10, 5:7, 6:5, 7:3
EF	*Education of father*	1	1:3, 2:5, 3:7, 4:10, 5:7, 6:5, 7:3
CONS_SUB	Consequential subsystem	8	
CW	Work in club	4,5	
CTSC	*Conditions for training*	1,5	1:2, 2:4, 3:7, 4:9, 5:10
QEW	*Quality of expert work*	1,5	1:2, 2:4, 3:7, 4:9, 5:10
OCI	*Organisation of the club infrastructure*	1,5	1:2, 2:4, 3:7, 4:9, 5:10
IPS	Involvement of parents in sport	3,5	
IMS	*Involvement of mother in sport*	1,8	1:7, 2:10, 3:7, 4:3, 5:3
IFS	*Involvement of father in sport*	1,7	1:7, 2:10, 3:7, 4:3, 5:3
INST_SUB	Institutional subsystem	4	
PAC	Functions of parents in the club	2	
FMC	*Function of mother in the club*	1	1:5, 3:7, 4:9, 5:10
FFC	*Function of father in the club*	1	1:5, 3:7, 4:9, 5:10
PPW	Occupation of parents	2	
PMW	*Position of mother at work*	1	2:10, 3:8, 4:5, 5:3
PFW	*Position of father at work*	1	2:10, 3:8, 4:5, 5:3

The dimensions of sociological status that are considered in this article in greater detail are important in the final mosaic of the model of the psychosomatic status, nevertheless in our potential performance model their predictability weight is smaller (14 percent). The decision to assign less importance to these dimensions was influenced by prudence in the hypothetical estimation of this sub-area's impact on the potential competitive performance of young cross-country skiers given that, as mentioned earlier, this is the first attempt to design such a model. Positional and dimensional configurations are shown in Table 2. It is worth mentioning that in some variables the positional configuration of an individual's rough result was hindered due to the small range of values obtained. Sometimes, only two values of a variable were obtained, which means that the variability was nearly zero.

The referentiality as well as the dimensional and positional configuration of the knowledge base posed a challenge to our research due to the homogeneity of the subject population (in sociological terms). The model consisted of three subsystems. The socialisation subsystem (SOC_SUB) is defined by the education node (EDUC) consisting of two variables which define the education of the mother and father (EM, EF) and reveal the correlation between the parents' education and competitive performance of their children. This subsystem comprises latent mechanisms enabling or at least facilitating the processes of motor information processing (Starkes & Allard, 1993). In our models the consequential subsystem (CONS_SUB) had the strongest predictive power. It was determined by two nodes indicating whether the fact that parents spend their leisure time on sport practice (IPS) has any impact on their children as well as the overall organisation of the club's infrastructure (CW). The node of the parents' sports activity has two variables (IMS and IFS), while the node of the overall organisation of a club's

infrastructure has three: CTSC, QEV and OCI. We agree with Messing and Voigt (1979; in Ambrožič, 1988), namely, that it is possible to distinguish between the children of sport active parents and those of sport inactive parents. The institutional subsystem (INST_SUB) features two nodes: parents' activity in the club (PAC) and parents' position at work (PPW). Each of the nodes has two variables defining the activity of the athlete's father and mother. Doupona (1996) established that income (related to one's position at work) and membership of a social class (which a club function undoubtedly involves) are two extremely important factors for children's involvement in sporting activities.

Example of results of evaluating a subjects' potential performance

The aim of expert modelling is to acquire quality information on the condition of subjects, based on which their actual competitive performance may be predicted with high probability.

Table 3: Scores of the potential performance of subjects 'A' and 'B' at the highest level and at the level of sociology in the universal reduced MMPS model of potential performance

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
MMPS		6.83	good		7.55	v. good
├─OC_SOCIO		8.36	v. good		7.67	v. good
│ ├─SOC_SUB		10.00	excellent		6.00	good
│ │ └─EDUC		10.00	excellent		6.00	good
│ │ ├─EM	4	10.00	excellent	6	5.00	good
│ │ └─EF	4	10.00	excellent	3	7.00	v. good
│ ├─CONS_SUB		8.12	v. good		8.74	v. good
│ │ ├─CW		9.33	excellent		9.00	excellent
│ │ │ ├─CTSC	5	10.00	excellent	5	10.00	excellent
│ │ │ ├─QEW	4	9.00	excellent	5	10.00	excellent
│ │ │ └─OCI	4	9.00	excellent	3	7.00	v. good
│ │ └─IPS		7.00	good		8.50	v. good
│ │ ├─IMS	1	7.00	v. good	2	10.00	excellent
│ │ └─IFS	1	7.00	v. good	3	7.00	v. good
│ └─INST_SUB		7.67	v. good		7.00	v. good
│ ├─PAC		7.33	v. good		6.00	good
│ │ ├─FMC	5	10.00	excellent	2	6.00	good
│ │ └─FFC	1	5.00	good	2	6.00	good
│ └─PPW		8.00	v. good		8.00	v. good
│ ├─PMW	3	8.00	v. good	3	8.00	v. good
│ └─PFW	3	8.00	v. good	3	8.00	v. good

Legend:
RES - raw test results; f (x) - numerical score; SCORE - attribute score;
Numerical and descriptive values of scores:
$0 \leq f(x) \leq 2$ = unsatisfactory,
$2 \leq f(x) \leq 4$ = satisfactory,
$4 \leq f(x) \leq 7$ = good,
$7 \leq f(x) \leq 9$ = very good,
$9 \leq f(x)$ = excellent

Table 3 shows two competitors ranked one after another (1st and 2nd place) on the scale of the selected criterion of FIS points (SLO_FIS), while the difference in their age is half a year. The general potential competitive performance of subjects 'A' and 'B' is evaluated as good (6.83) and very good (7.55), respectively. A look at the scores in the sociological sub-area reveals that the two competitors differ in terms of the structure of their parents' education (EDUC). However, it is difficult to draw generalised conclusions based on these differences and other variables of the sociological sub-area. This also applies to the consequential subsystem (CONS_SUB) where both competitors evaluated club work (CW) very highly. The final scores of the sociological sample (OC_SOCIO) of both competitors do not differ substantially.

Based on the actual informative value of the constructed model of potential performance (MMPS), competitor 'B' may be evaluated as being more promising in the long run in terms of their potential top performance in cross-country skiing. After all, this is shown by the difference in the FIS points achieved. Of course, the above is not the essential informative value of this model. The model becomes much more powerful if the instructor adapts the management of the athletes' transformation process 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 would become incorrect, especially if the group of athletes is large while the training means and methods remain the same for all athletes. With the correct planning of the transformation process in the long run and by taking the findings of this research into account, competitor 'A' may also achieve a high level of elite competitive performance.

Establishment of the validity of the sociological sub-area of the MMPS model of potential performance

The validity of the sociological area will be analysed in greater detail within the MMPS model.

The scores of individual variables of the socialisation subsystem (SOC_SUB) correlate with the criterion of performance in different ways depending on the competitive category (Table 4). For older boys, the score of education of one's father (EF) is statistically significantly correlated with the criterion of FIS points (SLO_FIS). Of course, it is impossible to generalise that the education of one's parents (father) holds important power for predicting performances in cross-country skiing. It is more likely that this correlation is only typical of the sample of older boys as already with younger junior men it is quite the opposite, while for older junior men it is almost non-existent. In cross-country skiing, secondary-school education is still the prevailing level of education of one's parents and this has not changed over the past decade (Pustovrh, 1991; Vrhovec-Kavčič, 1990; Zevnik, 2004), however, this is not necessarily correlated with competitive (non-)performance.

In our search for consistent correlations between the scores of individual variables of the consequential subsystem (CONS_SUB) and competitive performance, which was rated the highest in our model, we found that it is again more appropriate to talk about the directions of correlations rather than about the rules and strengths of correlation. Slightly more consistent correlations (in view of all three categories) with the performance criterion (SLO_FIS) were seen in the variables of the node of one's parents' sport activity (IPS). According to Južnič (1987), many behaviours and activities which are imparted to someone during the early periods of their life become a permanent pattern of behaviour in adulthood. A favourable climate

Table 4: Correlation between the scores of variables from the sociological sub-area and the selected criterion of competitive performance – SLO_FIS.

TEST CODE	MODEL MMPS		
	DEPENDANT METHOD		
	OLDB	YJM	OJM
MMPS	-0.53*	-0.47	-0.79**
├─OC_SOCIO	0.10	-0.08	-0.19
│ ├─SOC_SUB	-0.19	0.12	-0.12
│ │ └─EDUC	-0.19	0.12	-0.12
│ │ ├─EM	0.20	-0.12	-0.14
│ │ └─EF	-0.58*	0.30	-0.04
│ ├─CONS_SUB	0.24	-0.06	-0.14
│ │ ├─CW	0.46	-0.13	0.03
│ │ │ ├─CTSC	0.20	-0.21	0.02
│ │ │ ├─QEW	0.50*	0.14	0.00
│ │ │ └─OCI	0.44	-0.22	0.07
│ │ └─IPS	-0.13	0.05	-0.33
│ │ ├─IMS	-0.14	0.15	-0.32
│ │ └─IFS	-0.09	-0.05	-0.12
│ └─INST_SUB	-0.16	-0.14	-0.08
│ ├─PAC	-0.37	-0.23	-0.08
│ │ ├─FMC	-0.16	0.09	-0.07
│ │ └─FFC	-0.35	-0.34	-0.02
│ └─PPW	-0.02	-0.05	-0.05
│ ├─PMW	0.12	0.15	-0.09
│ └─PFW	-0.08	-0.18	0.01

OLDB *$p_{(0.05)}$ = 0.48, **$p_{(0.01)}$ = 0.61;
YJM *$p_{(0.05)}$ = 0.48, **$p_{(0.01)}$ = 0.61;
OJM *$p_{(0.05)}$ = 0.53, **$p_{(0.01)}$ = 0.66

and encouragement from one's parents are more important than one's parents' sport activity (Ambrožič, 1988). Probably the interaction of both – encouragement and one's parents' sports orientation – yields the optimal results. The values of correlation coefficients are not statistically significant; however, the correlations point in the desired direction, except for younger junior men. Parents play an important role in the process of the individual's socialisation in sport; nevertheless, some other factors are also influential. Searching for one's own identity, problems related to money, the rules and desires of one's parents as well as previous experience considerably influence the individual's decision to get involved in sport or retire from it (Coakley & White, 1999).

A similar trend is seen in the variables of the institutional subsystem (INST_SUB). The correlations between one's parents' activity in the club (PAC) and the criterion of competitive performance (SLO_FIS) in the categories of older boys and younger junior men can be pointed out. They are not statistically significant (-0.37, -0.23) but are still important since it may be concluded that through their work in the club parents influence the training and competition development of their children. Of course, in terms of contents these correlations do not reveal the real quality of the parents' influence. It often happens that parents exert too much pressure on the child (because of financial investments) and thus incapacitate them (Coakley, 1992).

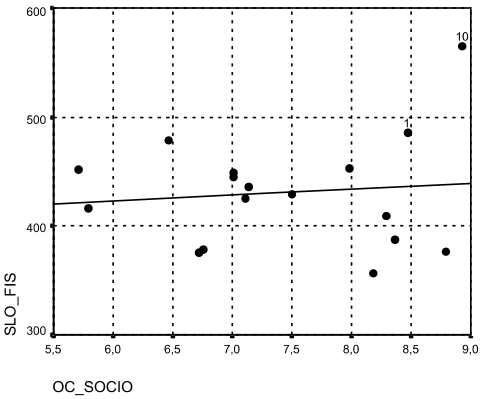

Figure 1: Correlation of the scores of sociological variables (OC_SOCIO) with the criterion of competitive performance SLO_FIS for older boys (OLDB)

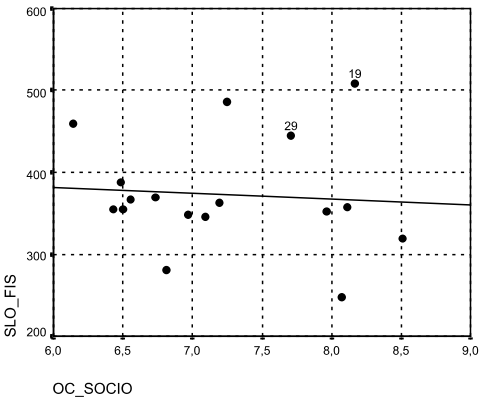

Figure 2: Correlation of the scores of sociological variables (OC_SOCIO) with the criterion of competitive performance SLO_FIS for younger junior men (YJM)

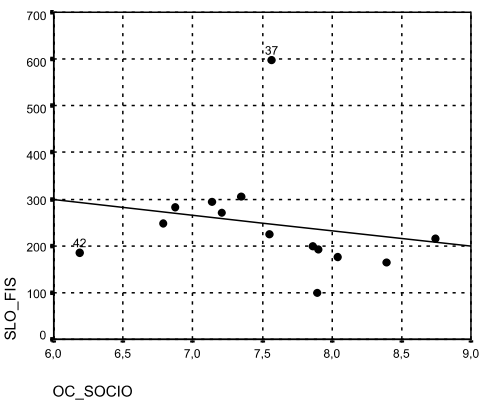

Figure 3: Correlation of the scores of sociological variables (OC_SOCIO) with the criterion of competitive performance SLO_FIS for older junior men (OJM)

As already established, the subjects of our research constitute a homogeneous sociological sample with a very broad criterial span of performance. It turned out that the correlation between the sociological sub-area and the criterion of competitive performance (SLO_FIS) in the categories of younger and older junior men pointed in the desired direction and was relatively high for the oldest category of competitors in particular. Both correlations show that more successful competitors in the mentioned categories have a more favourable social status than less successful ones. The result for the category of older boys does not indicate such a direction of correlation, nevertheless, one has to bear in mind that these boys have only just started practising this sport and that some of the factors which are now negative will change, particularly the consequential subsystem (work in club – CW). It is also worth stressing that the research data were acquired from a relatively small sample of subjects.

In the continuation a scattergram is used to analyse in greater detail the correlation between the score of the sociological sub-area (OC_SOCIO) and the criterion of competitive performance (SLO_FIS) for all three categories of competitors. The purpose is to establish whether there are subjects who are highly distinctive from others due to their (non)correlation.

Figures 1, 2 and 3 show that in all three competitive categories a certain number of subjects stand out due to their non-correlation (subjects nos. 1 and 10 in older boys, subjects nos. 19 and 29 in younger junior men and subjects nos. 37 and 42 in older junior men). A higher value for the variable OC_SOCIO means a better result (higher potential competitive performance), while a higher value for the variable SLO_FIS means a poorer result (lower actual competitive performance). Subjects 1, 10, 19, 29 and 37 have relatively high values for the variable (OC_SOCIO) but they are relatively unsuccessful in terms of competitive performance (variable SLO_FIS), while the opposite is the case for subject 42. After these subjects were eliminated, the correlation increased markedly (see Table 5).

Table 5: Correlation between the scores of sociological variables (OC_SOCIO) and the criterion of competitive performance SLO_FIS before and after the elimination of two subjects from each competitive category

		BEFORE ELIMINATION	AFTER ELIMINATION
		OC_SOCIO	OC_SOCIO
SLO_FIS	OLDB	0.10	-0.45
	YJM	-0.08	-0.41
	OJM	-0.19	-0.65*

Legend: * $p<0.05$

With the older junior men the correlation rises from -.19 to a statistically significant -.65, with the younger junior men from -0.08 to -0.41, while with the older boys even from .10 to -.45. This example is a good illustration of how with such a small sample of subjects a few entities may distort the overall picture of inter-correlation of the actual competitive performance and individual model variables.

Any partial treatment of a young athlete and/or cross-country skier in the sense of making comprehensive and final assessments of current and/or potential abilities is unacceptable. Therefore, by establishing relations and interactions between individual dimensions of psychosomatic status and by using expert knowledge in specific scientific disciplines we managed to design a universal reduced model of potential performance in cross-country skiing. The model

information should enable the treatment of each cross-country skier as a bio-psycho-social whole.

The ultimate goal of the generated universal reduced model of potential performance is to verify its validity. Validity is reflected in the information about the degree to which a measurement yields data (and what these data indicate) about the subject of measurement (Malacko & Popović, 1997). In our case, it is about the correlation between the actual performance and the established potential performance in cross-country skiing. This is the ultimate and most likely the paramount goal of expert modelling. In our example, no statistically significant correlations between the criterion of competitive performance (SLO_FIS) and the scores of potential competitive performance in the sociological area (OC_SOCIO) were established in any of the analysed competitive categories. This confirms the findings of researchers (Zevnik, 2004) claiming that Slovenian competitors are a relatively homogeneous sociological sample. In the categories of younger and older junior men the correlations move in the desired direction, which is slightly less evident in the youngest category (OLDB). Nevertheless, the situation changes considerably if two subjects substantially differing from the rest in terms of correlation are eliminated from each category. In the oldest category a statistically significant correlation occurs. This points to the fact that the established validity of the model in the sociological area has to be interpreted with a certain degree of prudence. It is evident that the results of the research depend on the size of the sample; however, in our environment it is currently impossible to significantly expand the sample as the athlete base in this sport is extremely small. Theoretically, the research could be repeated in some other country with a larger population of cross-country skiers. As the competitors do not have a unique criterion variable (they do not compete in the same competitive system), it is unreasonable to form an international sample. Based on scientific research it would be reasonable to complement the knowledge base of the existing expert model of the sociological area (referentiality, positional and dimensional configuration). It is a fact that this is the first research of its kind in sport and it would be reasonable to create an adequate knowledge base and conduct such research in other similar sports where competitive performance depends on certain basic sociological characteristics. Our research will be ready for additional analyses and comparisons when the results of similar research into the sociological area applying expert modelling also become known for other comparable sports.

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