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CONFIRMATION OF CONCEPTUAL VALIDITY OF CZECH VERSION OF GROUP ENVIRONMENT QUESTIONNAIRE BY STRUCTURAL EQUATION MODELING

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SUMMARY

The Group Environment Questionnaire (GEQ) is an instrument intended for the study of cohesion in sport teams. The main aim of this study was to confirm the conceptual validity within the Czech vision of Group Environment Questionnaire by method of structural equation modeling. For translation of the questionnaire was utilized a modified direct translation method. A total of 1169 participants (848 men and 321 women) completed the GEQ. For data analysis we applied both exploratory and confirmation factor analysis approach. The original model was tested to verify the structural theory and diagnosis quality of this tool. Results of original GEQ 4-factor model showed poor fit of the with underaverage values RMSEA 0.086 and CFI 0.894, TLI 0.874 and lack coefficients of generic reliability. After reanalysing the data there was established a modified Bi-factor strucutre of GEQ version without five original items. Bi-factor model with general factor at IA-T, GI-T and separate factors IA-S, GI-S gave the best values of fit RMSEA 0.056, CFI 0.981 and TLI 0.965.

Key words: GEQ, cohesion, team sport, SEM, exploratory factor analysis

INTRODUCTION

Team cohesion (also called team work or team spirit) is considered by many authors to be one of the most important group variable in sport teams (Carron, Brawley, & Widmeyer, 2002). It can be defined as "a dynamic process that is reflected in the tendency for a group to stick together and remain united in the pursuit of its instrumental objectives and/or for the satisfaction of member affective Leeds" (Carron, Brawley & Widmeyer, 1998, p. 213).

Team cohesion is a multidimensional construct in which we find basic characteristics (Carron, Brawley & Widmeyer, 2002): a) dimensions of task and social cohesion, b) dynamic nature, c) instrumental base, and d) affective dimension.

The conceptual model of team cohesion was created by Carron, Widmeyer and Brawley (1985) and its development was principally influenced by two issues that are related to cohesion. The first issue is the need to distinguish between the individual and the group, the second issue is the necessity of differentiation between task and social interests of the group and its members (Carron et al., 1985, Zander, 1971). The authors suggested two general conceptual categories; 1. Individual Attractions to the Group (a view of a group member, what individually attracts him/her to the group), and 2. Group Integration (how the team works as a group). It was also proposed that these perceptions can appear as task and social aspects. These results distinguish four possible related constructs that unite people in a group (Carron, Brawley, & Widmeyer, 2002). These constructs are: a) Individual Attraction to the Group – Task Cohesion, b) Individual Attractions to the Group – Social Cohesion, c) Group Integration – Task Cohesion, and d) Group Integration – Social Cohesion (Carron et al, 2002, Carron et al, 1985, Widmeyer, Brawley, & Carron, 1985).

The Group Environment Questionnaire (GEQ)

The GEQ is recognised among international methods and is one of the most applied instruments in present team cohesion research. The Group Environment Questionnaire (GEQ) is a four-scale instrument with 18 items that measure the perceived cohesion of sport teams. According to Carron et al. (1985) the GEQ is internaly consistent and has a good content validity. In spite of high amounts of completed studies, a construct validity remains inconclusive Carron et al. (2002).

The GEQ was originally developed in North American and studied both male and female athletes aged between 18 and 30 from recreational as well as competitive team sports (Carron et al, 2002). It is important to consider that some GEQ items may be perceived differently in the Czech population. Therefore suitable language and phrases are neccessary to express the corresponding meaning.

The main aim of this study was to confirm the conceptual validity of the Czech version of GEQ.

Structural Equation Modeling

The term structural equation modeling (SEM) does not designate a single statistical technique but instead refers to a family of related procedures. Other terms such as covariance structural analysis, covariance structure modeling, or analysis of covariance structure are also used in the literature to define these techniques under a single label. These terms are essentially interchangeable. Another term used is casual modeling. A somewhat dated expression first associated with SEM analysis cannot generally be taken as evidence for causation (Wilkinson, 1999). The idea of multiple indicators for latent variable is from factor analysis (Lawley & Maxwell, 1971). Factor analysis is a multivariate technique which was developed to analyze correlations between observed variables (indicators) and latent unobservable variables (atributes) mathematically called factors (Rao & Sinharay, 2007).

Exploratory factor analysis

The exploratory factor analysis model is a statistical method for investigating common but unobserved sources of influence in a collection of variables. The model explicitly breaks down the variability of variables into a part attributable to the factors and shared with other variables, and a second part that is specific to a particular variable but unrelated to the factors. The major theoretical appeal of the method is that it provides a way to investigate constructs (Tinsley & Brown, 2000).

Confirmatory factor analysis model

Confirmatory factor analysis (CFA) is a form of structural equation modeling that specifically deals with measurement models. A fundamental feature of CFA is its hypotheses-driven nature. In other words researchers must have a firm priori of sense based on past evidence and theory, which indicators are relate to which factors (Brown, 2006). The results of CFA include estimates of factor variance and covariance, loadings of the indicators on their respective factors and the amount of measurement error for each indicator. All indicators specified to measure a common factor have relatively high standardized factor loading on the factor > .70 and estimated correlation between the factors are not excessively high < .90 in absolute value (Kline, 2011).

METHODS

Subjects

For the purpose of this study we addressed adult athletes (N = 1169) competing in team sports. There were 848 men (mean age 23.20, SD 5.88) and 321 women (mean age 23.56, SD 6.25). The team sports included soccer, ice-hockey, basketball, volleyball and handball.

Translation of the questionnaire

For translation of the questionnaire we addressed 3 experts in the field of physical education and sport. They utilized a combination of the modified direct translation procedure (Behling & Law, 2000) and the protocol analysis (Hines & Snowden, 1993).

In the first step we received 3 versions of translations from the specialists that were working independently from each other. They were asked to provide a sensitive translation of the questionnaire so that the meaning of words and phrases was not altered. The aim was not an exact translation, but a meaningful conversion of the original GEQ version.

In the next step we reviewed the translated versions, group them together and the combined draft was returned to translators for re-evaluation. After that we discussed the first Czech version of the questionnaire with the experts on a collective meeting. At the end we addressed 10 students (4 women and 6 men involved in team sport) who were required to complete the questionnaire. We then asked them for feedback regarding their comprehension of the instruction and formulations in the questionnaire. These remarks were taken into consideration in creating the final Czech version of the GEQ (appendix B).

Factorial validity and reliability

The aim of this study was to verify if aspects of team cohesion are similar within the czech sports population. The factor structure was tested by method of structural equation modeling. We applied both the exploratory and confirmatory approach through program M-plus 6.0 (Muthen & Muthen, 2010) which was used to analyse samples. The original model was tested to verify the structural theory and diagnostic quality of this tool which assesses team cohesion. Since our data are categorical ordinal, Muthen (1984) recommend to use parameters of estimation, the method of Weighted least square parameter estimates using a diagonal weight matrix with standard errors and mean- and variance-adjusted chi-square test statistic that use a full weight matrix. Fit of the model was expressed by several indices of the model fits, Sattora-Bentler Chi-square, Comparative Fit index (CFI), (Bentler, 1990) and Root Mean Square of Approximation (RMSEA) (Steiger, 1990). Authors Browne & Cudeck (1993) described index CFI as coefficent with value between 0–1, value 0.95 and higher indicates good fit. Values of RMSEA lower than 0.05 show a very good fit, 0.05–0.08 good fit, 0,08–0,10 average fit and higher than 0,10 indicate bad fit of model. Other indices we used were SRMR, Standardized Root Mean Residual for exploratory approach (recommended value $\leq$ 0.07) (Jöreskog & Sörbom, 1988). The SRMR is an absolute measure of fit and a value of zero indicates perfect fit. The SRMR has no penalty for model complexity. A value less than 0.08 is generally considered a good fit (Hu & Bentler, 1999).

TLI Tucker-Lewis index (recommended value $\geq$ 0.95) (Truckem & Lewis, 1973) and WRMR Weighted Root Mean Square Residual (recommended value $\leq$ 1). Approximation of generic reliability each construct was performed by computing of coefficient McDonalds omega (McDonald, 1991).

RESULTS

Factorial validity of original GEQ structure

The outcomes from structural equation modeling (Tab 1) suggested that a four dimensional structure with the original 18 items indicated only average values of fit model. Additionally comparing our results with data provided by authors of GEQ was complicated, because authors of the original GEQ version indicated it's psychometrics property only by coefficient of internal consistency Cronbachs alpha of each constructs which was in the range of 0.73–0.83 (Carron, Brawley, & Widmeyer, 2002). Confirmation of factor structure by SEM was not executed. Therefore we couldn't compare indexes of fit (Tab 1) with original study. In the present study was the fit of the model RMSEA on the level 0.085, CFI 0.894, TLI 0.874 and WRMR 1.810, that were really underaverage vaules. As well as chi-square 0.874 showed rather poor fit of the model. These results can be caused by specificity of cohesion problematic which authors of original GEQ mentioned as the main reason for instability of this latent domain cross life span or cultures (Carron et al, 2002). There was also evident that each factor contains at least one indicator which has factor validity lower than 0.50. Construct GI-T even contains two of these items. Item a12 from factor GI-T with factor validity on level 0.216 is apparently measuring something different. However, it was interesting that in our structural model there were strong correlations between constructs IA-S and GI-S on level 0.848 and IA-T – GI-T on level 0.827 which means, each pair of constructs was indicating similar latent areas.

Table 1. Confirmatory factor analysis of orginal GEQ version

Model	Chi-Square	df	CFI	TLI	RMSEA	WRMR
4-factors	1210.794	129	0.894	0.874	0.086	1.810

Reliability of original GEQ structure

For comparison of psychometrics properies we focused on reliability which was discussed in the original vision of GEQ. We estimated generic (construct) reliability by coefficient of McDonald ω which is a direct expression on the level of diagnostics error of the whole construct. In comparison with the original GEQ we found similar values of generic reliability coefficients in three constructs IA-S – 0.69, IA-T – 0.71, GI-S – 0.72. Fourth dimension called GI-T lacked generic reliability on the unacceptable level 0.50. Item a12 at construct GI-T had the poorest factor loading 0.216. We suggested that this was the main reason for poor reliability of this construct. Whole correlation matrix of original GEQ version is in (appendix A).

Based on facts about diagnostics quality and fit of the model of original version GEQ we decided to re-analyse data and tried to develop a modified structure of GEQ for Czech population with better psychometric properties. In process of developing a modified version of GEQ we restricted both the number of factors and items and there were omitted problematic indicators.

First we evaluated all items through procedure of exploratory factor analysis.

Table 2. Exploratory factor analysis models

Model	Chi-Square	df	CFI	TLI	RMSEA	SRMR
1-factor	2319.273	135	0.782	0.752	0.119	0.086
2-factors	1115.222	118	0.900	0.871	0.086	0.054
3-factors	678.043	102	0.942	0.914	0.070	0.038
4-factors	382.330	87	0.970	0.948	0.054	0.027
5-factors	237.492	73	0.984	0.966	0.044	0.021
6-factors	173.047	60	0.989	0.971	0.041	0.018

CFI = Comparative fit index (recommended value ≥ 0.95)
TLI = Tucker-Lewis index (recommended value ≥ 0.95)
RMSEA = Root Mean Square of Approximation (recommended value ≤ 0.08)
SRMR = Standardized Root Mean Residual (recommended value ≤ 0.07)

An examination of the goodness-of-fit information for the EFA results produces ambiguous results. Using the RMSEA cut-off value of 0.08, and CFi cutt-off value 0.95

3-factor solution is supported, instead of that CFI 0.942 is slightly under a cutt off board. We decided to use 3-factor EFA model as basic due to transparent dividing of items to factors. From (Tab. 2) is clear that the 1 and 2-factor solution is not supported by the pattern of fit indices.

To adjudicate between these different solutions, the factor loadings for solutions ranging from three to six extracted factors were examined. The factor pattern and loadings for these models are presented in appendix C.

The 3-factor solutions presented in Tab. 2 produce general meaning. Factor 2 (see appendix C) contains items which represent constructs IA-T and GI-T, factor 3 (appendix A) contains items which represent constructs I-AS and GI-S from original version of GEQ. However several items in this model didn't have a clear loading to any factor – A9, A12. Moreover A2 was single item with the highest factor loading on factor 1 which seems that this item was measuring something different. The 4-factor model showed generally good fit indexes although this model start loosing clear structure. Item a1 showed relationship to the same factor as A2 and other items showed not clear loadings in this model (A3, A5, A8, A12, A15, A16, A18). Item cross-loadings and inconsistency were also apparent for the 5-factor and 6-factor solutions (appendix A) of factor loadings.

Therefore we finally decided to take as a basic model for CFA three EFA factor model which we due to deleting inconsistent items A2, A9 and A12 reduced to CFA 2-factor model.

Table 3. Confirmatory factor analysis without items A2, A9, A12

Model	Chi-Square	df	CFI	TLI	RMSEA	WRMR
2-main factors	777.410	89	0.922	0.908	0.082	1.619
4-factors	628.229	84	0.938	0.923	0.075	1.416

CFI = Comparative fit index (recommended value ≥ 0.95)
TLI = Tucker-Lewis index (recommended value ≥ 0.95)
RMSEA = Root Mean Square of Approximation (recommended value ≤ 0.08)
WRMR = Weighted Root Mean Square Residual (recommended value ≤ 1.00)

CFA goodness-of-fit information showed that 2-factor model solution without three inconsistent items has relatively poor fit, as demonstrated by the CFI, RMSEA, and WRMR values (model 1) and from residual matrix with a lot of unclearness, values in residual matrix higher than 0.100. In the 4-factor model with missing three items were factors divided according to the original theory of GEQ (I-AS, I-AT, GI-S, GI-T). This model showed both significantly improved values of all fit indexes and also values from residual matrix (appendix D). However according psychometrics theory these improvements were not sufficient to accept this model. Therefore we focused on character and meaning of other inconsistent items from 4 factor EFA analysis with retaining four factor model. In factor IA-S we found two very similar items by meaning either by factor loading A3 and A7. Further we did two CFA 4-factor models. First without item A7 and later without A3.

Table 4. Confirmatory factor analysis without items A2, A7, A9, A12

Model	Chi-Square	df	CFI	TLI	RMSEA	WRMR
4-factors	543.609	71	0.937	0.919	0.079	1.383

CFI = Comparative fit index (recommended value ≥ 0.95)
TLI = Tucker-Lewis index (recommended value ≥ 0.95)
RMSEA = Root Mean Square of Approximation (recommended value ≤ 0.08)
WRMR = Weighted Root Mean Square Residual (recommended value ≤ 1.00)

The 4-factor model without items A2, A7, A9, A12 showed significant improvement of weighted root mean square residual.

Table 5. Confirmatory factor analysis without items A2, A3, A9, A12

Model	Chi-Square	df	CFI	TLI	RMSEA	WRMR
4-factors	537.457	71	0.939	0.921	0.076	1.284

CFI = Comparative fit index (recommended value ≥ 0.95)
TLI = Tucker-Lewis index (recommended value ≥ 0.95)
RMSEA = Root Mean Square of Approximation (recommended value ≤ 0.08)
WRMR = Weighted Root Mean Square Residual (recommended value ≤ 1.00)

Most of the fit values remained almost unchanged but WRMR and results from residual matrix got an additional improvement.

Based on a fact that in diagnostics tool could be other redundant or missfiting items the whole questionnaire was consulted with experts for content validity. Finaly from factor GI-S was deleted the poorest item a13 loading 0.45 (this item surveys how often the team spends it's free time together by socializing). In the next step was done CFA 4-model without five items A2, A3, A7, A9, A12 and A13.

Table 6. Confirmatory factor analysis without items A2, A3, A9, A12, A13

Model	Chi-Square	df	CFI	TLI	RMSEA	WRMR
4-factors	390.802	59	0.953	0.937	0.070	1.121

CFI = Comparative fit index (recommended value ≥ 0.95)
TLI = Tucker-Lewis index (recommended value ≥ 0.95)
RMSEA = Root Mean Square of Approximation (recommended value ≤ 0.08)
WRMR = Weighted Root Mean Square Residual (recommended value ≤ 1.00)

CFA 4-factor model solution without five items seen in (Tab. 6) showed significant improvement of all goodness of fits, even CFI and RMSEA on acceptable level, however we rejected this model for unaverage values of TLI and WRMR which were 0.937, 1.121 respectively and for unexplanation from residual matrix (appendix D) .

For another explanation of relationships in GEQ we focused on correlations between factors. We found quite high correlation between IA-S–GI-S = 0.843 and IA-T–GI-T = 0.873. Therefore first we evaluated second order factor structure with one main factor F and subfactors IA-S, GI-S, IA-T and GI-T.

Table 7. Confirmatory factor analysis Second order factor model without items A2, A3, A9, A12, A13

Model	Chi-Square	df	CFI	TLI	RMSEA	WRMR
4-factors	909.150	61	0.879	0.845	0.110	1.899

CFI = Comparative fit index (recommended value ≥ 0.95)
TLI = Tucker-Lewis index (recommended value ≥ 0.95)
RMSEA = Root Mean Square of Approximation (recommended value ≤ 0.08)
WRMR = Weighted Root Mean Square Residual (recommended value ≤ 1.00)

Second order factor model solution with one main factor F and subfactors IA-S, GI-S, IA-T and GI-T showed very poor fit. We rejected this model with conclusion that at least two pairs of subfactors are measuring some different dimension.

For explanation of structure and relationships between factors we finaly transformed previous 4-factor model from Tab. 7 and evaluated two bi-factor CFA models where correlations between general factor and subfactors were fixed at 0. We managed G bifactor model where items a1 A5, A7, A11, A15, A17 from factors IA-S and GI-S had also directly relation to G factor. In this case other two factors IA-T and GI-T didn't have the bifactor structure. Then we assessed H bifactor model where items A4, A6, A8, A10, A14, A16, A18 from factors IA-T and GI-T had directly relation to H factor and remaining two factors IA-S, GI-S were analysed under rules of common CFA model.

Table 8. Confirmatory factor analysis Bi-factor models without items A2, A3, A9, A12, A13

Model	Chi-Square	df	CFI	TLI	RMSEA	WRMR
G Bi-factor	363.041	52	0.956	0.933	0.072	1.046
*H Bi-factor	256.850	51	0.981	0.965	0.056	0.924

* Accepted model
CFI = Comparative fit index (recommended value ≥ 0.95)
TLI = Tucker-Lewis index (recommended value ≥ 0.95)
RMSEA = Root Mean Square of Approximation (recommended value ≤ 0.08)
WRMR = Weighted Root Mean Square Residual (recommended value ≤ 1.00)

Instead of improvement of fit information from G Bi-factor model we had to reject this model due to Heywood case expressed by correlation greater than one between factors GI-S–IA-T and GI-T–GI-S.

Finaly the best model was H bi-factor model which showed significant improvement of all fit indeces with values on acceptable or even very good level. The H bi-factor model show conceptually clear factor-loading patterns that are mostly consistent (appendix D).

Interesting foundation is that items A4, A6, A8, A10, A14, A16, A18 have on one side general factor and on the other two subfactors IA-T and GI-T. This final model also includes separate factors IA-S and GI-S. This model also showed the best residual matrix with no unaccepted vaules greater then 0.100. We suggest that this should be a subject of a future study that will be focused on problems of scoring of new model strucutre of the czech GEQ version. We recommend to utilize a procedure of IRT models for polytomous data.

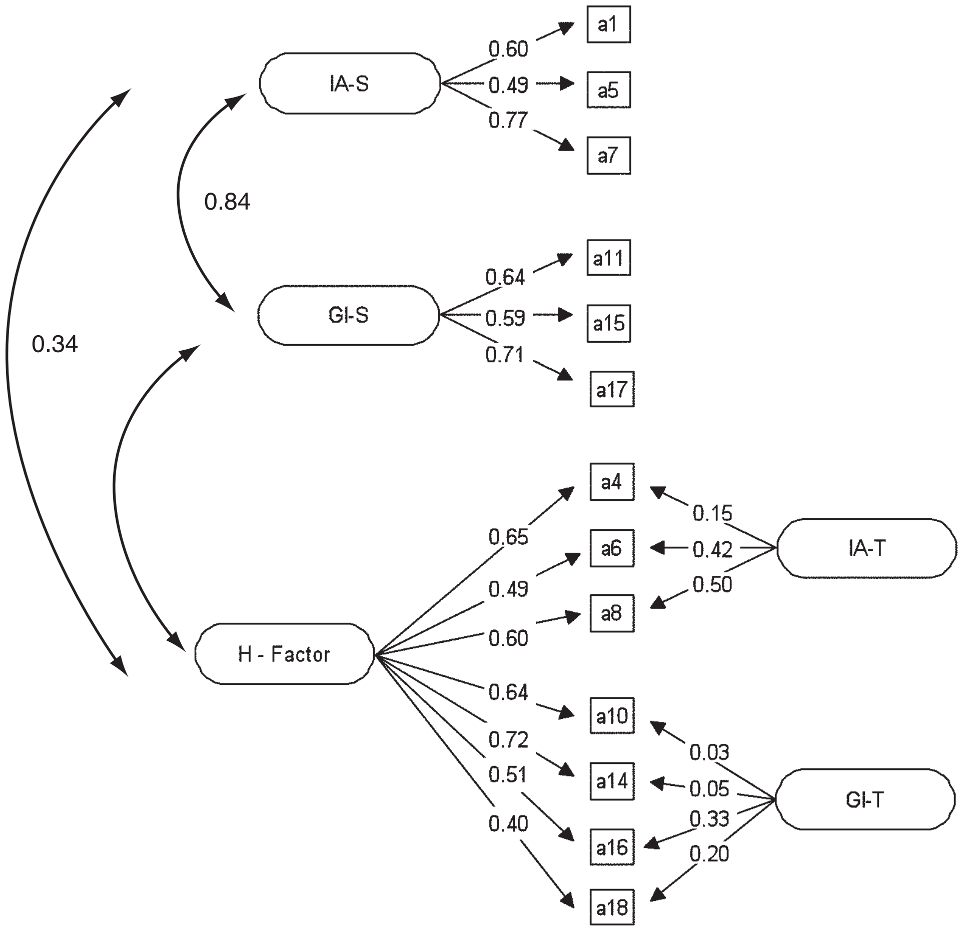

Figure 1. Final Bi-factor structure of modify GEQ version

Reliability of modified GEQ structure

Final approximated coefficients of generic (constructs) reliability in modify Bi-factor GEQ version were similar to the original GEQ. Main H factor with two subfactors IA-T GI-T = 0.64, IA-S = 0.72 and GI-S = 0.77.

CONCLUSION AND DISCUSSION

There were several issues to solve during the translation of GEQ into Czech language. The main problem was the translation of expressions that were specific to american culture in the original version. Therefore the reason why the GEQ questionnaire was not translated literally and we did not apply the back translation method. Utilizing the back translation method in similar cases is not recommended due to the low reliability (it does not offer much information regarding the target language vision, because only the original and the back translated forms are compared (Banville, D., 2000; Behling, O. & Law, K. S., 2000).

We can conclude that structural equation modeling did not confirm the same structure and similar coefficients of diagnostics quality of the czech version of GEQ. Results of the original GEQ structure in translated version indicated very poor fit RMSEA on the level 0.085, CFI 0.894, TLI 0.874 and WRMR 1.810. We also found high correlations between two pairs of factors IA-S and GI-S on level 0.847 and IA-T – GI-T on level 0.827 and identified poor generic reliability of fourth factor GI-T 0.50. It was necessary to leave out some items and modify the GEQ structure for the czech environment. The original czech version of GEQ was formed and re-evaluated by SEM. In first step we evaluated all items through explorative factor analysis procedure and determine 3-factor explorative model as a base model for next confirmatory analysis. Than we utilised a confirmatory approach from 2-factor model to bi-factor model. During the analyses we deleted several items which measured different constructs. Finally as the best model was discovered bi- factor model (Figure 1), main factor H with two subfactors IA-T, GI-T and other two separate factors IA-S and GI-S. This model showed acceptable vaules of all fit indices CFI 0.981 TLI 0.965 RMSEA 0.056 WRMR 0.924. More over there were also seen improvement of generic reliability values against the original model H factor with two subfactors IA-T GI-T = 0.64, IA-S = 0.72 and GI-S = 0.77.

However, we realized that restricted numer of items might lead to loss of some important information of all measured behavioral domain. Therefore we recommend to repeat the process of content validity and suggest another indicators which could sufficiently express these issues.

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OVĚŘENÍ KONCEPTUÁLNÍ VALIDITY ČESKÉ VERZE DOTAZNÍKU GROUP ENVIRONMENT QUESTIONNAIRE POMOCÍ METODY STRUKTURÁLNÍHO MODELOVÁNÍ

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SOUHRN

Dotazník Group Environment Questionnaire (GEQ) je nástroj určený ke sledování týmové koheze u kolektivních sportů. Hlavním cílem této studie bylo ověřit konceptuální validitu u české verze dotazníku GEQ metodou strukturálního modelování. Pro převod dotazníku byla použita modifikovaná metoda přímého překladu. Studie se účastnilo 1169 sportovců (848 mužů a 321 žen). Pro ověření konceptuální validity původního modelu a zjištění diagnostické kvality tohoto nástroje byla použita metoda konfirmativní faktorové analýzy. Výsledky původního 4-faktorového modelu ukázaly slabý fit modelu s velice podprůměrnými hodnotami indexů fitu RMSEA 0.086, CFI 0.894 aTLI 0.874 a také neakceptovatelný koeficient generické reliability konstruktu GI-T. Na základě těchto skutečností jsme se proto rozhodli pro re-analýzu dat, která ukázala jako nejlepší bi-faktorovou strukturu s jedním generálním faktorem H, který obsahuje dva subfaktory IA-T a GI-T a dalšími dvěma oddělenými faktory IA-S a GI-S. Hodnoty všech indexů fitu byly v tomto bi-faktorovém modelu akceptovatelné RMSEA 0.056, CFI 0.981 a TLI 0.965 včetně hodnot residuální matice.

Klíčová slova: GEQ, koheze, týmový sport, SEM, explorativní faktorová analýza

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APPENDIX A

Correlation martix (with variances on the diagonal) of 18 items of original GEQ version

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
A1																		
A2	0.375																	
A3	0.500	0.318																
A4	0.259	0.246	0.334															
A5	0.262	0.133	0.286	0.100														
A6	0.254	0.383	0.265	0.374	0.114													
A7	0.442	0.262	0.518	0.180	0.390	0.264												
A8	0.260	0.303	0.354	0.488	0.159	0.508	0.327											
A9	0.132	0.101	0.243	0.157	0.347	0.254	0.325	0.228										
A10	0.109	0.054	0.215	0.464	0.147	0.292	0.121	0.332	0.379									
A11	0.292	0.149	0.326	0.224	0.218	0.192	0.444	0.275	0.211	0.207								
A12	0.043	0.014	0.071	0.076	0.116	0.172	0.040	0.139	0.184	0.222	0.006							
A13	0.300	0.144	0.313	0.038	0.228	0.019	0.364	0.102	0.107	0.021	0.388	0.081						
A14	0.178	0.145	0.219	0.466	0.104	0.338	0.183	0.428	0.185	0.465	0.266	0.132	0.148					
A15	0.291	0.125	0.397	0.223	0.311	0.162	0.347	0.202	0.350	0.308	0.343	0.062	0.292	0.197				
A16	0.139	0.162	0.307	0.280	0.169	0.294	0.274	0.349	0.251	0.368	0.248	0.124	0.184	0.309	0.363			
A17	0.363	0.246	0.381	0.226	0.291	0.258	0.446	0.284	0.221	0216	0.501	0.125	0.398	0.250	0.384	0.302		
A18	0.141	0.089	0.197	0.221	0.126	0.229	0.189	0.294	0.107	0.209	0.151	0.077	0.147	0.282	0.191	0.264	0.288	

APENDIX B

Items of the original/czech version of GEQ:

1. I do not enjoy being a part of the social activities of this team. / Nerad/a se účastním společných mimosportovních akcí našeho týmu.
2. I am not happy with the amount of playing time I get. / Nejsem spokojen/a s množstvím času, kdy jsem nasazen/a do soutěže.
3. I am not going to miss the members of this team when the season ends. / Po skončení sezóny mi lidé z týmu nebudou chybět.
4. I am unhappy with my team's level of desire to win. / Nejsem spokojen/a s touhou našeho týmu vyhrávat.
5. Some of my best friends are on this team. / Několik lidí z týmu patří mezi mé nejlepší přátele.
6. This team does not give me enough opportunities to improve my personal performance. / V našem týmu nemám dost příležitostí zlepšit svůj osobní výkon.
7. I enjoy other parties more than team parties. / Raději si vyjdu se svými přáteli, než s lidmi z našeho týmu.
8. I do not like the style of play on this team. / Nemám rád/a styl hry našeho týmu.
9. For me, this team is one of the most important social groups to which I belong. / V současné době je pro mě náš tým tou nejdůležitější skupinou lidí.
10. Our team is united in trying to reach its goals for performance. / Náš tým je jednotný v úsilí dosáhnout stanoveného cíle.
11. Members of our team would rather go out on their own than get together as a team. / Lidé z našeho týmu si za zábavou vyjdou raději sami, než jako tým.
12. We all take responsibility for any loss or poor performance by our team. / Každý člen týmu nese zodpovědnost za špatný výkon nebo prohru.
13. Our team members rarely party together. / S týmem si jdeme sednout do hospody jen výjimečně.
14. Our team members have conflicting aspirations for the team's performance. / Členové našeho týmu mají rozdílné představy o tom, čeho bychom měli společně dosáhnout.
15. Our team would like to spend time together in the off-season. / Náš tým by rád strávil nějaký čas společně i po skončení sezóny.
16. If members of our team have problems in practice, everyone wants to help them so we can get back together again. / Když má někdo problém v tréninku, celý tým se mu snaží pomoci, aby se dostal zpátky do hry.
17. Members of our team do not stick together outside of practice. / Členové našeho týmu spolu mimo tréninky nemají mnoho společného.
18. Members of our team do not communicate freely about each athlete's responsibilities during competition or practice. / V našem týmu není zvykem otevřeně hovořit o zodpovědnosti jednotlivých členů v zápase či v tréninku.

APPENDIX C

Factor loadings from exploratory factor analysis

3-factors model

	1	2	3
A1	0.342	–0.003	0.521
A2	0.482	0.196	0.162
A3	0.206	0.085	0.577
A4	0.134	0.697	0.059
A5	–0.108	–0.091	0.557
A6	0.310	0.583	–0.010
A7	0.134	–0.085	0.739
A8	0.277	0.639	0.037
A9	–0.242	0.197	0.366
A10	–0.355	0,709	0.009
A11	–0.020	–0.004	0.620
A12	–0.100	0.273	–0.028
A13	0.004	–0.280	0.690
A14	–0.012	0.644	–0.001
A15	–0.211	0.049	0.602
A16	–0.102	0.357	0.267
A17	0.018	0.026	0.654
A18	0.013	0.287	0.149

4-factors model

	1	2	3	4
A1	0.465	–0.035	0.363	–0.038
A2	0.599	0.039	0.061	–0.127
A3	0.379	0.053	0.392	0.097
A4	0,242	0.600	0.005	–0.032
A5	0.094	–0.135	0.303	0.377
A6	0.525	0.342	–0.111	0.066
A7	0.310	–0.079	0.510	0.174
A8	0.429	0.476	0.019	–0.010
A9	0.032	0.033	0.068	0.653
A10	–0.137	0.612	–0.018	0.388
A11	–0.017	0.202	0.608	–0.018
A12	0.062	0.128	–0.138	0.278
A13	–0.075	–0.005	0.710	–0.119
A14	0.041	0.658	0.100	–0.012
A15	–0.040	0.113	0.428	0.322
A16	0.034	0.349	0.210	0.190
A17	0.071	0.187	0.594	0.022
A18	0.054	0.317	0.176	–0.003

5-factors model

	1	2	3	4	
A1	0.669	0.21	–0.002	0.014	0.037
A2	0.434	0.350	–0.035	–0.117	–0.024
A3	0.639	–0.042	0.093	0.172	0.053
A4	0.390	0.048	0.646	–0.019	–0.053
A5	0.168	0.011	–0.169	0.413	0.114
A6	0.078	0.661	0.109	0.047	0.047
A7	0.341	0.100	–0.172	0.223	0.319
A8	0.158	0.403	0.315	–0.008	0.159
A9	–0.006	0.139	–0.043	0.689	–0.040
A10	–0.018	–0.049	0.597	0.444	–0.001
A11	–0.015	–0.031	0.054	0.021	0.671
A12	–0.085	0.194	0.059	0.274	–0.085
A13	0.095	–0.216	–0.070	–0.064	0.640
A14	–0.006	0.093	0.549	0.016	0.263
A15	0.178	–0.166	0.106	0.390	0.255
A16	–0.011	0.084	0.243	0.221	0.271
A17	0.005	0.062	0.007	0.057	0.667
A18	–0.069	0.120	0.197	0.005	0.320

6-factors model

	1	2	3	4	5	6
A1	0.703	0.040	0.038	0.012	0.011	–0.042
A2	0.421	–0.036	0.371	–0.118	–0.015	–0.009
A3	0.622	0.108	–0.034	0.169	–0.040	0.043
A4	0.357	0.674	0.073	–0.032	–0.003	–0.029
A5	0.233	–0.154	–0.011	0.438	0.013	0.002
A6	0.036	0.057	0.679	0.062	0.034	0.072
A7	0.431	–0.146	0.098	0.255	0.175	0.058
A8	0.139	0.259	0.411	0.003	0.040	0.188
A9	0.012	–0.018	0.132	0.745	0.020	–0.183
A10	–0.042	0.585	–0.053	0.461	–0.022	0.016
A11	–0.021	0.163	0.000	0.006	0.927	–0.006
A12	–0.105	0.026	0.177	0.281	–0.105	0.200
A13	0.244	–0.097	–0.237	–0.022	0.233	0.365
A14	0.004	0.491	0.091	0.038	0.069	0.250
A15	0.247	0.098	–0.193	0.417	0.043	0.151
A16	0.009	0.164	0.056	0.241	–0.016	0.333
A17	0.149	–0.028	0.033	0.108	0.269	0.362
A18	–0.061	0.074	0.089	0.002	–0.062	0.502

Residual matrices of main confirmatory models

1) 4-factor model without items: A2, A9, A12
Residuals for Covariances/Correlations/Residual Correlations

	A1	A3	A4	A5	A6	A7	A8	A10	A11	A13	A14	A15	A16	A17	A18
A1															
A3	0.048														
A4	0.023	0.047													
A5	–0.021	–0.149	–0.090												
A6	0.047	0.014	–0.051	–0.053											
A7	–0.012	–0.025	–0.110	0.054	0.013										
A8	0.001	0.038	–0.023	–0.036	0.058	0.018									
A10	–0.068	0.003	0.098	0.006	–0.032	–0.087	–0.064								
A11	–0.046	–0.073	0.019	–0.027	0.024	0.038	0.053	–0.034							
A13	0.037	0.008	–0.123	0.033	–122	0.058	–0.72	–0.171	0.059						
A14	–0.016	–0.012	0.079	–0.041	–0.009	–0.052	0.006	0.069	–0.001	–0.060					
A15	–0.014	0.024	0.029	0.081	–0.006	–0.024	–0.013	0.084	–0.056	–0.009	–0.054				
A16	–0.042	0.096	–0.082	0.033	–0.023	0.064	–0.039	0.008	0.010	–0.002	–0.079	0.132			
A17	–0.007	–0.053	–0.001	0.019	0.064	0.000	0.039	–0.046	0.028	0.035	–0.048	–0.055	0.032		
A18	0.009	0.040	–0.048	0.025	–0.010	0.028	0.009	–0.056	–0.030	0.006	–0.009	0.020	–0.004	0.087	

2) 4-factor model without A2, A3, A9, A12, A13
Residuals for Covariances/Correlations/Residual Correlations

	A1	A4	A5	A6	A7	A8	A10	A11	A14	A15	A16	A17	A18
A1													
A4	0.049												
A5	–0.025	–0.084											
A6	0.068	–0.055	–0.049										
A7	–0.010	–0.095	0.028	0.025									
A8	0.030	–0.020	–0.028	0.057	0.036								
A10	–0.049	0.090	0.010	–0.042	–0.075	–0.070							
A11	–0.033	–0.005	–0.037	0.000	0.030	0.027	–0.053						
A14	0.007	0.077	–0.034	–0.014	–0.036	0.006	0.057	–0.017					
A15	–0.001	0.008	0.073	–0.026	–0.029	–0.033	0.068	–0.034	–0.066				
A16	–0.016	–0.072	0.044	–0.017	0.085	–0.026	0.009	0.004	–0.072	0.128			
A17	0.005	–0.029	0.007	0.037	–0.011	0.011	–0.068	0.049	–0.066	–0.032	0.024		
A18	0.027	–0.044	0.031	–0.009	0.042	0.015	–0.059	–0.037	–0.007	0.015	0.007	0.079	

3) H Bi-factor model without items A2, A3, A9, A12, A13
Residuals for Covariances/Correlations/Residual Correlations

	A1	A4	A5	A6	A7	A8	A10	A11	A14	A15	A16	A17	A18
A1													
A4	0.093												
A5	–0.024	–0.049											
A6	0.052	–0.019	–0.063										
A7	–0.009	–0.040	0.026	0.002									
A8	0.010	0.015	–0.046	–0.001	0.008								
A10	–0.029	0.045	0.026	0.025	–0.052	–0.059							
A11	–0.030	–0.013	–0.037	0.002	0.029	0.023	–0.024						
A14	0.044	0.007	–0.005	–0.012	0.009	–0.003	0.009	0.032					
A15	0.001	0.001	0.073	–0.025	–0.031	–0.038	0.094	–0.034	–0.022				
A16	–0.058	–0.056	0.008	0.042	0.029	0.038	0.031	–0.049	–0.037	0.079			
A17	0.008	–0.038	0.007	0.038	–0.012	0.007	–0.037	0.050	–0.012	–0.033	–0.035		
A18	0.006	–0.040	0.013	0.030	0.013	0.056	–0.048	–0.062	0.008	–0.009	–0.009	0.051	