ADDITION TO THE CLASSIFICATION OF THE GYMNASTIC ELEMENTS

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Abstract

Using factor analysis in oblique projection on 38 gymnastic elements, performed on 5 different gymnastic devices, three factors were isolated. The first factor is responsible for realization of gymnastic elements in sagittal level spot from weave in hanging, support on hands and support on palms with straight arms. The second factor is responsible for performance of elements in frontal and sagittal level spot supporting on arms, while the third factor is responsible for performance of gymnastic elements in sagittal level spot supporting on arms. Common characteristic for all gymnastic elements with significant projections on isolated factors is performance of elements in sagittal and frontal level spot with weave in hanging, support on hands and support on palms with straight arms, with movements of opening and folding in pelvic and shoulder ankle.

Key words: *gymnastic elements, classification, hangs on arms, support on hands, factor analysis.*

INTRODUCTION

In certain scientific areas classification allows faster development of phenomena. In sports gymnastics many authors, based on different criteria, attempted to divide or classify the gymnastic elements, in order to determine the position on certain gymnastic movements and elements in certain system of movements.

The author J. Petrovič (1979) studying the classification of gymnastic elements, states Ling`s classification of gymnastic elements based on **anatomical structure** as a criteria or by parts of the body that participate in the performance of gymnastic elements (arms, legs or trunk). Classification based on the structure of the gymnastic elements as a criterion is made in the USSR. This classification contains the following elements as a foundation: a) changing the position of the body in relation to the device; b) changing the position of a certain body part over another part of the body. On this basis, elements are divided as following:

Static positions (swings, support on hands, changing positions from support on hands to support on palms with strength arms and vice versa)

Exercises with weave and their modifications - exercises with swings forward and swigs back, exercises with extension in pelvic joint from place, extensions in pelvic joint with swing back, exercises with extension of pelvic joint with swing forward, exercises with rotation forward with additional support with legs, exercises with rotation back with additional support on legs, exercises with swings with legs up to position of support on palms with straight arms.

According Opavski (cited at Petrovič, 1979) gymnastics elements on vault and floor are divided according to the form of the movement: swing translocation of the body from higher to lower positions and vice versa, rotations, from support on hands, support on palms with strength arms, swing forward, rotations forward, jumps, jumps over vault, maintaining static positions Inc.

The author Petrovic (1979) suggested classification of the elements according following criteria:

- mechanic elements
- energetic elements
- elements performed in rhythm

According this classification jumps over vault

and acrobatic elements on floor are characterized as specific exercises. This classification is made according the type of the muscle contraction.

Dynamic exercises: exercises with swing and weave, exercises without swaying and weaving.

Static exercise: positions, supports, weavings and sittings.

Proposed examples for classifications of the gymnastic elements points out that it is made according following criteria: anatomical structure, structure, form, complexity of mechanical and energetic elements and elements performed in rhythm. Until today, classification of the gymnastic elements is not yet completed and finished. But with the development of technique, science and statistical methods, classification of the gymnastic elements is changing and improving. Factor analysis applied on different number of gymnastic elements could be used for classification of the gymnastic elements according there latent structure.

Latent structure of gymnastic elements is explored by many authors using statistical methods. Vagner.I. (1985) studied 195 examiners that were estimated in 18 gymnastic elements of all gymnastic devices. In the matrix of correlation, 15 gymnastic elements have high and positive correlations. According the author, acording its structure, these gymnastic elements contains closing and opening in the hip joint in sagittal axis and frontal axis (front - back). Closing and opening could be performed at the following three ways: (1) with digression of the legs, (2) with digression of the trunk (3) with simultaneously approaching and digression of the legs and the trunk

Using factor analysis on several gymnastic elements, two factors were isolated:

Factor responsible for the performance of gymnastic elements in hang and changes at that position.

Factor responsible for the performance of gymnastic elements position of support on hands and changes at that position.

In the studies realized by Pop - Petrovski (1997) and Mitevski. (2000), using factor analyses applied on several gymnastic elements several factors were isolated on following gymnastic devices: floor, vault, shaft, uneven bars, pommel horse and rings.

This study is an attempt for classification of gymnastic element's based on their latent structure using factor analysis.

METHOD OF WORK

The aim of this research is to determine the latent structure of 38 gymnastic elements performed on 5 gymnastic devices using factor analysis as a foundation for classification of the gymnastic elements according there latent structure. This research was realized on a sample of 148 pupils, estimated in following 38 elements: 5 elements on circles, eight elements of pommel horse, 10 elements on floor, nine elements performed on parallel bars and six elements performed on vault.

Besides the basic measures of central tendency, dispersion and normality of the distribution of all gymnastic elements, matrix of interrelation was also calculated as a foundation for using factor analysis, oblique projection.

RESULTS AND DISCUSSION

Using factor analysis applied at 38 gymnastic elements (Table 1), three characteristic roots were isolated and they explain the common variability of the system of gymnastics elements with 70%. Separately, first root has the largest contribution in explanation of changes of the system, explaining 57.6%, second root explains 18.7% and the third root explains 5.25%. It can be concluded that the structure of gymnastic elements with significant projections on the first factor contained common characteristics of movements of gymnastic elements that performs at following devisees: parallel bars, circles and vault. Communalities have high values from .57 to .83 and indicate that partially applied gymnastic elements have significant participation in the explanation of isolated major components.

Based on the results from factor analysis it could be concluded that all gymnastics elements performed on parallel bars have a significant projections of the first isolated factor (from .32 to .42). These elements perform from position of swing and support on hands and support on palms with strength arms. Gymnastic elements movement forward on circles (. 33) and skip over vault with hanged legs (.31), also have a significant projection on the first isolated factor. In the matrix of correlation the element moving forward on circles has highest correlations with gymnastic elements: swing in hang and lending from rotation backward on circles. Analyzing the technique of performance of these three elements of circles it could be noted that the technique of sway in hang is a requirement

Table 1. Matrics of structure of rotate factors and communalities on gymnastic elements.

Variables Motor tsest	h²	F1	F 2	F3
KRUG1S	.680790	.210268	.235942	-.060458
KRUG2S	.687643	**.336107**	.179014	-.143172
KRUG3S	.692520	.122078	.233944	.039711
KRUG4S	.765438	.245481	.173972	-.004034
KRUG5S	.800207	.214647	.114897	.093717
KONJ1S	.655873	-.031962	**.399775**	.049085
KONJ2S	.612363	-.079241	**.553653**	-.047472
KONJ3S	.707214	-.015187	**.549945**	-.062935
KONJ4S	.736740	-.062845	**.488917**	.051345
KONJ5S	.656355	-.115964	**.616631**	-.036991
KONJ6S	.687955	.042285	**.504322**	-.096434
KONJ7S	.671301	-.038354	**.574951**	-.077207
KONJ8S	.721805	.078642	**.411480**	-.042488
PART1S	.707367	-.048050	.044701	**.378096**
PART2S	.700124	-.023823	-.043826	**.420173**
PART3S	.733598	-.064048	-.042946	**.478879**
PART4S	.751777	-.028119	.060105	**.367621**
PART5S	.754640	-.018772	-.052160	**.449603**
PART6S	.768160	-.052676	-.018921	**.465386**
PART7S	.763968	-.012293	.017161	**.391831**
PART8S	.746126	-.069355	-.024427	**.475989**
PART9S	.839672	.055519	.123777	.273825
PART10S	.760707	.047742	.137585	.230282
RAZ1S	.780600	**.374047**	.011348	-.000305
RAZ2S	.734049	**.325276**	.102394	-.046311
RAZ3S	.745914	**.365680**	.087337	-.070491
RAZ4S	.782908	**.375382**	.101054	-.072688
RAZ5S	.763344	**.416230**	.031670	-.069785
RAZ6S	.789589	**.412976**	-.029596	-.003590
RAZ7S	.762427	**.414653**	-.069021	.012404
RAZ8S	.782980	**.365455**	.127590	-.083583
RAZ9S	.754140	**.420992**	.056362	-.099379
PRE1S	.580431	**.315039**	**-.318490**	.224062
PRE2S	.575171	.291056	**-.306935**	.237226
PRE3S	.714859	.250843	-.024455	.123973
PRE4S	.682949	**.324301**	-.124897	.111300
PRE5S	.722289	.272411	-.104900	.169881
PRE6S	.680114	.141347	.025676	.180669

LAMBDA	21.91		2.73	1.99
Lamda (cum)	21.91		24.64	**26.64**
Varijansa %	57.68		7.18	5.25
Varijansa (cum)	.57.68		64.86	**70.12**

for successful performance of other two elements.

Projections of gymnastic elements performed on vault - skip over vault without swinging back (.31) and skip over vault with swinging back (.32) are at the boundary of significance. In the performance of mentioned elements on parallel bars, circles and vault in position of hanging, support on hands and support on palms with strength arms, opening and closing in the pelvic ankle are composed part of technical performance. Knowing the structure of technical performance of gymnasts elements with significant projections, the first iso-

lated factor could be defined as a factor responsible for performance of gymnastic elements from swing in hang, swing with support on hands and support on palms with strength arms in sagittal axis, lifting the body from lower to higher position with opening and closing in the pelvic ankle.

Significant projections of the second isolated factor have all gymnastic elements that are performed on the pommel horse (from .41 to .61). Other gymnastic elements do not have significant projections on this factor, except skips over vault with banded and spread legs that have values at the bound of significance (.31 and .30).

Analyzing the structure of the technical performance of elements performed on pommel horse it could be noticed that movements are realized in frontal and sagittal axis, by lifting the legs and the trunk from lower to higher position. During the performance is could be noticed opening and folding the legs in the pelvic joint in frontal and sagittal axis when body is in position of support on arms. Curling and lifting of the upper leg in position of support in the technical performance of the elements skip over vault with banded and spread legs is identical with performance of the gymnastic elements on pommel horse.

The second factor isolated could be define as a factor responsible for performance of gymnastic elements in frontal and sagittal axis, supporting on arms and lifting on certain body parts or the entire body from lower to a higher position, with opening and closing of the legs and trunk.

From ten gymnastic elements performed on floor, nine elements have significant projection (36 до .47) on the third isolated factor. Projections of the other gymnastic elements of the third factor are insignificant. Gymnastic elements with significant projections of the third isolated factor are performed in sagittal axis when certain body parts or moves from higher to lower positions supporting on arms. Analyzing the technique of performance of the elements, it could be notice a certain body parts or the whole body. The variable moving backward with jump does not have significant projections, mainly because of the structure of the movements. These movements have an opposite direction from other elements. This conclusion could be confirmed in the matrix of correlations. Based on this assumption it could be isolated by other factor. Obtained latent structure is almost identical with classification of the gymnastic elements proposed by the Russian and authors Petrivic and Vagnner. Larger number of variables could lead to different structure. Determination of classification of gymnastic elements according their latent structure could result with fast and effective methodological procedures in the learning process, where gymnastic elements are component part school curricula or treeing programs.

CONCLUSION

Based on obtained and interpreted results in this study it could be concluded as follows:
Three factors were isolated in the latent space of gymnastic elements:

Factor 1 – gymnastic elements performed is sagittal axis in position of swing in hang and support on the arm.

Factor 2 - gymnastic elements performed with support on the arms with simultaneously lifting and lowering of certain body parts in frontal axis.

Factor 3 – gymnastic elements performed in sagittal axis with support on arms.

Knowing the structure of the movements, common characteristics for all gymnastics elements with significant projection on isolated factors is performance of the elements in sagittal in frontal axis with swing in hang, support on arms, opening and closing in pelvic and shoulder ankle.

Using more gymnastic elements with different structure of the movements will result with different latent structure.

Classification of gymnastics elements based at latent structure as a criterion, would allow fast and effective process of learning of gymnastics elements, with adequate selection of exercises.

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ПРИЛОГ КОН КЛАСИФИКАЦИЈАТА НА ГИМНАСТИЧКИТЕ ЕЛЕМЕНТИ

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Апстракт
Со примена на факторска анализа во коса проекција од 38 гимнастички елементи на 5 гимнастички справи изолирани се 3 фактори. Првиот фактор е одговорен за изведување на гимнастичките елементи во сагитална рамнина од нишање во вис, потпор и упор. Вториот е одговорен за изведување на гимнастички елементи во фронтална и сагитална рамнина со потпирање на раце. Третиот фактор е одговорен за изведувањето на гимнастички елементи во сагитална рамнина со потпирање на раце.Заедничка карактеристика на гимнастичките елементи со значајни проекции на изолираните фактори е изведување на елементи во сагитална и фронтална рамнина со нишање во вис, потпор и упор, со отварање и склопување во карличниот и раменскиот зглоб.

Клучни зборови: *гимнастички елементи, класификација, висови, упори, факторска анализа.*