STUDY ON APPROACHING THE COMPOSITIONAL CRITERION IN GROUP RHYTHMIC GYMNASTICS FOR JUNIOR REPRESENTATIVE TEAMS

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Abstract. *The increased level of sports performance in rhythmic gymnastics due to fiercer and better and better organised competitions is obvious for any critic. National and international sports bodies and public opinion stimulated by media coverage eager for sensational have created an obsession with the prioritisation of values. Obtaining exceptional results, medals, points and titles, with all the deriving moral effects of pride but especially related to material aspects, is of interest to both athletes and the countries represented by sports delegations in official international competitions. Competition analysis provides highly valuable information on the level reached in terms of qualitative and quantitative gains and the impact of regulations on a team's performance at a certain time in relation to the ideal model imposed by the requirements of the FIG Code of Points. Romania's position in the team ranking for the group event in two major competitions generated a number of questions that formed the core of the current study. In this context, we aimed to perform an objective analysis of the way in which coaches approached the compositional criterion in designing the competition routines and identify possibly strategic elements that made the difference in team ranking. The study was conducted on the first 8 junior teams ranked at the 2019 European Rhythmic Gymnastics Championships (Baku) and the 2019 Rhythmic Gymnastics Junior World Championships (Moscow). Video analysis allowed us to identify the vectors that directly or indirectly influenced the mechanisms involved in the creation of compositions for the group event.*

Keywords: *Code of Points, specific requirements, compositional vectors, group event.*

Introduction

The Code of Points has been substantially changed over time in terms of compositional requirements and evaluation criteria for Body Difficulty and Apparatus Difficulty (Toledo & Antalupa, 2016; Kovalenko & Boloban, 2017; Hashimoto et al., 2017). These changes have differently influenced the final score, depending on the apparatus. However, Sierra-Palmeiro et al. (2019) believe that the relationship between the number of technical elements and the final score preserves the specificity of the apparatus.

The interest shown by Ávila-Carvalho et al. (2012), Leandro et al. (2017), Hökelmann et al. (2012) or Massidda and Calò (2012) in identifying the effects induced by changes in the content of the Code of Points on some performance indicators in rhythmic gymnastics or in identifying evaluation methods for the Artistic component based on scoring rules reflects the importance given to the in-depth study of these issues, in the context in which the struggle for world supremacy is obviously fiercer.

The synchronisation of a wide range of technical actions with those specific to each apparatus in order to avoid compositional monotony and not to compromise the artistic value

of difficulties (Ávila-Carvalho et al., 2012; Ávila-Carvalho et al., 2011) is another topic of interest to several specialists in the field.

The congruence between music and movement acquires a major importance in the compositional context (Loo et al., 2019). Musical accompaniment ensures precision, cohesion, spatiotemporal organisation and especially expressiveness to the motor act as a result of the consistency between the means of expression of music and movement.

Technically, the issues related to the floor area are briefly addressed in the Code of Points, although its choreographic importance is crucial, given that space is a factor that influences and models any artistic movement. As an intrinsic component of composition, space becomes an environment where the compositional idea is developed.

Research purpose

The study aims to identify variants of approaching the compositional criterion and the possible strategic elements, which ultimately make the difference in the team ranking.

Research tasks

- Establishing the compositional benchmarks that can lead to creating an effective composition in compliance with the requirements of the Code of Points.
- Making a comparative analysis of the scores obtained by the Romanian team and the teams at the top of the ranking.
- Identifying the possibilities of intervention from the perspective of a strategic approach to composition.

Methodology

The research methods used were: video analysis, mathematical and statistical method (arithmetic mean, standard deviation, coefficient of variation), tabular and graphical methods. Video analysis was performed using the YouTube platform and allowed us to identify the vectors that directly or indirectly influenced the mechanisms involved in the creation of artistic compositions for the group event.

Information technology enabled us to record data and facilitated the identification and subsequent analysis of the compositional elements investigated in our study.

The research was conducted on the 8 top-ranked teams in the group event at two major competitions, namely the 35th European Rhythmic Gymnastics Championships of 2019 held in Baku (Azerbaijan) and the 1st FIG Rhythmic Gymnastics Junior World Championships (FIG, 2019) held in Moscow (Russia), and the Romanian team.

Ethical standards in sport and exercise science research were met, using only publicly available data (Harris & Atkinson 2009).

Study design

Scoring system in the 2017-2020 Code of Points

For official FIG competitions, each Jury consists of two groups of judges: D-Panel (Difficulty) and E-Panel (Execution) (Table 1).

Table 1. Functions of the two panels according to the 2017-2020 Code of Points (FIG, 2018)

D-Panel Judges				E-Panel Judges					
D1	D2	D3	D4	E1	E2	E3	E4	E5	E6
Evaluate the number and technical value of Body Difficulties, Exchange Difficulties and Dance Steps Combinations and record them in symbol notation.		Evaluate the number and technical value of Dynamic elements with Rotation and Collaborations and record them in symbol notation.		2 judges evaluate the Artistic component and determine the Artistic penalties (one common score)		4 judges evaluate the Technical faults by deduction and determine the total deduction independently (average of the 2 middle scores)			
Body Difficulty (BD), Exchange Difficulty (ED), Dance Steps Combinations (S)		Dynamic elements with Rotation (R), Collaborations (C)		The E-score deductions will be the sum of the two partial E-score deductions.					
Difficulty judges identify and record Difficulties in order of their performance.				The sum of the Artistic and Technical deductions is subtracted from 10.00 points.					
The final score of an exercise will be established by the addition of the D-score and E-score.									

Evaluation criteria for the composition of group exercises in rhythmic gymnastics according to the 2017-2020 FIG Code of Points

To highlight the competitive performance of gymnasts in terms of rules imposed by the FIG Code of Points, a composition must meet the following requirements (Figures 1 and 2):

Figure 1. Technical Difficulty criterion for composition

Figure 2. Artistic criterion for composition (Manos & Popescu, 2020)

The choreographic composition must be indivisible, give meaning to the whole routine and represent a unitary motor discourse consisting of an introduction, a development of the theme and a coherent conclusion; moreover, a wide range of specific actions must be performed using Body Difficulties synchronised with those typical of each apparatus.

The music-movement relationship involves the manifestation of a good-quality rhythmic sense, a deep understanding of the piece of music, its melody, harmony, dynamics, style and emotional content. The coordination of movements with music requires the conscious subordination of the motor activity to the specific form and content of the musical piece used.

The composition must be an arrangement of defined shapes organised in an orderly, unitary, coherent structure able to attract through the harmony and beauty of the movements.

Movements must be organised in a certain sequence so as to ensure the continuity of the composition. Transitions from one movement to another have to be fluid, with a logical change of planes and/or directions.

The relationship between gymnasts and collaborative work, which is characteristic of the group exercise, derives from the congruent and cooperative participation of each gymnast in the group work. From this point of view, the composition must be designed so as to highlight the idea of collaboration throughout the routine because a group exercise that does not sufficiently express this principle loses its compositional value.

The originality of the choreography represents the qualitative pole of creativity. An original composition is the one that, besides the shapes known as traditional or classical, also includes new elements of choreography with appropriate musical accompaniment.

Operational approach

- Characteristics of group exercise compositions and scores recorded by the 8 top-ranked teams and the Romanian team at the 35th European Championships held in Baku (AZE) between 16 and 19 May 2019

The final scores as well as the Technical Difficulty and Execution values were recorded for the 8 top-ranked teams and the Romanian team for the exercise with 5 ribbons (Table 2) and the exercise with 5 hoops (Table 3).

The final score is established by the addition of the Difficulty score and Execution score, from which the penalty is deducted, where applicable. Difficulty is divided into Body Difficulty and Apparatus Difficulty, and Execution is divided into Artistic Execution and Technical Execution.

Table 2. *Scores recorded by the 8 top-ranked teams and the Romanian team at the European Championships for the exercise with 5 ribbons*

Ranking	Country	Difficulty score	Execution score	Penalties	Final score
1	Russian Federation	12.5	8.500		21.000
2	Israel	11.8	8.100		19.900
3	Belarus	11.9	7.100		19.000
4	Spain	10.7	7.500		18.200
5	Italy	10.2	6.100		16.300
6	Ukraine	9.4	6.150		15.550
7	Lithuania	9.9	4.950	-0.600	14.850
8	Switzerland	9.7	5.450		14.550
20	Romania	7.6	3.200		10.800

For the exercise with 5 ribbons, the score obtained by the Romanian team ranks it last in the qualification competition.

Table 3. Scores recorded by the 8 top-ranked teams and the Romanian team at the European Championships for the exercise with 5 hoops

Ranking	Country	Difficulty score	Execution score	Penalties	Final score
1	Russian Federation	16.1	8.350		24.450
2	Ukraine	15.8	7.600		23.400
3	Belarus	15.5	7.750		23.250
4	Italy	15.5	7.400		22.900
5	Estonia	15.5	7.050		22.550
6	Azerbaijan	14.8	6.700		21.500
7	Spain	12.9	7.075		19.975
8	Lithuania	11.9	6.200	-0.300	17.800
17	Romania	11.2	6.500		17.700

For the exercise with 5 hoops, Romania is only 0.100 points behind the team ranked 8th in the All-Around Finals. For Difficulty, the difference is 0.7 points, and for Execution, 0.300 points, in the conditions in which the team ranked 8th was penalised with -0.300 points.

- Characteristics of group exercise compositions and scores recorded by the 8 top-ranked teams and the Romanian national team at the 1st FIG Rhythmic Gymnastics Junior World Championships held in Moscow (RUS) between 19 and 21 July 2019

The final scores obtained by the 8 top-ranked teams and the Romanian team for the exercise with 5 ribbons (Table 4) and the exercise with 5 hoops were recorded (Table 5).

Table 4. Scores recorded by the 8 top-ranked teams and the Romanian team at the World Championships for the exercise with 5 ribbons

Ranking	Country	Difficulty score		Execution score		Penalties	Final score
		Body Difficulty	Apparatus Difficulty	Artistic Execution deductions	Technical Execution deductions		
1	Russian Federation	13.400		8.050			21.450
2	Belarus	5.4	8.000	-0.4	-1.550		19.550
3	Israel	5.1	7.3	-0.8	-2.050		19.000
4	Spain	11.600	4.0	7.6	-0.7	-1.900	19.000
5	Poland	9.800	3.8	6.0	-0.8	-2.900	-0.05
6	Lithuania	9.700	3.8	6.0	-0.8	-2.900	-0.60
7	Hungary	9.700	4.3	5.4	-1.2	-2.850	
8	Italy	9.700	3.0	6.7	-1.2	-3.450	
		10.100	4.3	5.8	-1.4	-3.950	
		10.100	3.5	6.6	-1.4	-3.900	
29	Romania	7.500	2.0	5.5	-1.8	-5.200	10.500

A difference of 4.00 points can be noted between the team ranked 8th and the 29th position obtained by the Romanian team for the exercise with 5 ribbons.

Table 5. Scores recorded by the 8 top-ranked teams and the Romanian team at the World Championships for the exercise with 5 hoops

Ranking	Country	Difficulty score		Execution score		Penalties	Final score
		Body Difficulty	Apparatus Difficulty	Artistic Execution deductions	Technical Execution deductions		
1	Russian Federation	17.600		8.650			26.250
		5.8	11.8	-0.4	-0.950		
2	Italy	17.200		7.900			25.100
		5.4	11.8	-0.6	-1.500		
3	Belarus	16.800		7.850			24.650
		5.4	11.4	-0.6	-1.550		
4	Israel	16.000		6.300			22.300
		5.1	10.9	-1.1	-2.600		
5	Spain	14.500		7.450			21.950
		5.2	9.3	-0.7	-1.850		
6	Estonia	14.700		6.750			21.450
		4.5	10.2	-1.2	-2.050		
7	Azerbaijan	13.400		6.550			19.950
		4.4	9.0	-1.0	-2.450		
8	Hungary	13.100		6.150		-0.30	18.950
		4.9	8.2	-1.1	-2.750		
17	Romania	12.200		5.500			17.700
		5.0	7.2	-2.0	-2.500		

The difference between the team ranked 8th and the 17th position obtained by the Romanian team for the exercise with 5 hoops is 1.25 points.

Results and Discussion

Table 6. Results obtained by the representative teams of Russia and Romania for the exercise with 5 ribbons at the European Championships, Baku (AZE)

Ranking	Country	Difficulty score	Execution score	Penalties	Final score
1	Russia	12.5	8.5		21
20	Romania	7.6	3.2		10.8

Table 7. Statistical analysis of the results obtained for the exercise with 5 ribbons

Statistical indicators	Difficulty	Execution	Final score
AVERAGE	10.05	5.85	15.9
STDEV	3.4648232	3.7476659	7.21248917
CV	34.475853	64.062666	45.3615671

Comparing the scores of the Russian and Romanian teams in the group event with 5 ribbons, the arithmetic mean for the Difficulty score is 10.05, for the Execution score, 5.85, and for the final score, 15.90. The standard deviation is 3.46 for the Difficulty score, 3.74 for the Execution score and 7.21 for the final score. The coefficient of variation for all the above scores exceeds the threshold of 20%, which means that the group is inhomogeneous. (Table 6, Table 7 and Figure 3)

Figure 3. Comparison between the scores obtained by the representative teams of Russia and Romania for the exercise with 5 ribbons

Table 8. Results obtained by the representative teams of Russia and Romania for the exercise with 5 hoops at the European Championships, Baku (AZE)

Ranking	Country	Difficulty score	Execution score	Penalties	Final score
1	Russia	16.1	8.35		24.45
17	Romania	11.2	6.5		17.8

Table 9. Statistical analysis of the results obtained for the exercise with 5 hoops

Statistical indicators	Difficulty	Execution	Final score
AVERAGE	13.65	7.425	21.125
STDEV	3.4648232	1.3081475	4.70226009
CV	25.38332	17.618149	22.2592194

Comparing the scores of the Russian and Romanian teams in the group event with 5 hoops, the coefficient of variation for the Difficulty criterion is 25.38%, for the Execution criterion, 17.61%, and for the final score, 22.25% (Table 8, Table 9 and Figure 4).

In terms of Difficulty and final score criteria, the group is inhomogeneous, while from the perspective of the Execution criterion, the group is relatively homogeneous.

Figure 4. Comparison between the scores obtained by the representative teams of Russia and Romania for the exercise with 5 hoops

Table 10. *Results obtained by the representative teams of Lithuania and Romania for the exercise with 5 ribbons at the European Championships, Baku (AZE)*

Ranking	Country	Difficulty score	Execution score	Penalties	Final score
7	Lithuania	9.9	4.95	-0.6	14.85
20	Romania	7.6	3.2		10.8

Table 11. *Statistical analysis of the results obtained for the exercise with 5 ribbons*

Statistical indicators	Difficulty	Execution	Final score
AVERAGE	8.75	4.075	12.825
STDEV	1.6263456	1.2374369	2.86378246
CV	18.586807	30.366549	22.3296878

The coefficient of variation for the final score exceeds the threshold of 20%, which means that the group is inhomogeneous, but in terms of the Difficulty score, it is relatively homogeneous (Table 10, Table 11 and Figure 5).

Figure 5. Comparison between the scores obtained by the representative teams of Lithuania and Romania for the exercise with 5 ribbons

Table 12. *Results obtained by the representative teams of Lithuania and Romania for the exercise with 5 hoops at the European Championships, Baku (AZE)*

Ranking	Country	Difficulty score	Execution score	Penalties	Final score
8	Lithuania	11.9	6.2	-0.3	17.8
17	Romania	11.2	6.5		17.7

Table 13. *Statistical analysis of the results obtained for the exercise with 5 hoops*

Statistical indicators	Difficulty	Execution	Final score
AVERAGE	11.55	6.35	17.75
STDEV	0.4949747	0.212132	0.07071068
CV	4.2854956	3.340662	0.39837002

Comparing the scores of the Lithuanian and Romanian teams in the group event with 5 hoops, it is noted that the threshold of 10% is not reached, which shows the homogeneity of the group (Table 12, Table 13 and Figure 6).

Figure 6. Comparison between the scores obtained by the representative teams of Lithuania and Romania for the exercise with 5 hoops

Table 14. Results obtained by the representative teams of Russia and Romania for the exercise with 5 ribbons at the World Championships, Moscow (RUS)

Ranking	Country	Body Difficulty	Apparatus Difficulty	Difficulty score	Artistic Execution deductions	Technical Execution deductions	Execution score	Penalties	Final score
1	Russia	5.4	8	13.4	-0.4	-1.55	8.05		21.45
29	Romania	2	5.5	7.5	-1.8	-5.2	3		10.5

Table 15. Statistical analysis of the results obtained for the exercise with 5 ribbons

Statistical indicators	Body Difficulty	Apparatus Difficulty	Difficulty score	Artistic Execution deductions	Technical Execution deductions	Execution score	Final score
AVERAGE	3.7	6.75	10.45	-1.1	-3.375	5.525	15.975
STDEV	2.4041631	1.767767	4.17193	0.9899495	2.5809398	3.5708892	7.7428193
CV	64.97738	26.18914	39.922775	-89.99541	-76.47229	64.63148	48.468352

The coefficient of variation is quite high for all evaluation criteria, the group being inhomogeneous because the threshold of 20% is exceeded (Table 14, Table 15 and Figure 7).

Figure 7. Comparison between the scores obtained by the representative teams of Russia and Romania for the exercise with 5 ribbons

Table 16. Results obtained by the representative teams of Russia and Romania for the exercise with 5 hoops at the World Championships, Moscow (RUS)

Ranking	Country	Body Difficulty	Apparatus Difficulty	Difficulty score	Artistic Execution deductions	Technical Execution deductions	Execution score	Penalties	Final score
1	Russia	5.8	11.8	17.6	-0.4	-0.95	8.65		26.25
17	Romania	5	7.2	12.2	-0.2	-2.5	5.5		17.7

Table 17. Statistical analysis of the results obtained for the exercise with 5 hoops

Statistical indicators	Body Difficulty	Apparatus Difficulty	Difficulty score	Artistic Execution deductions	Technical Execution deductions	Execution score	Final score
AVERAGE	5.4	9.5	14.9	-0.3	-1.725	7.075	21.975
STDEV	0.5656854	3.2526912	3.8183766	0.1414214	1.0960155	2.2273864	6.045763
CV	10.475656	34.238855	25.626689	-47.14045	-63.53713	31.482493	27.512004

Comparing the scores of the Russian and Romanian teams in the group event with 5 hoops, the coefficient of variation for the Apparatus Difficulty, Execution and final scores exceeds the threshold of 20%, which means that the group is inhomogeneous. A 10.4% coefficient of variation is obtained for Body Difficulty, which indicates that the homogeneity is relative and the Body Difficulty level has been evaluated as being close to that of the Russian team (Table 16, Table 17 and Figure 8).

Figure 8. Comparison between the scores obtained by the representative teams of Russia and Romania for the exercise with 5 hoops

Table 18. Results obtained by the representative teams of Lithuania and Romania for the exercise with 5 ribbons at the World Championships, Moscow (RUS)

Ranking	Country	Body Difficulty	Apparatus Difficulty	Difficulty score	Artistic Execution deductions	Technical Execution deductions	Execution score	Penalties	Final score
6	Lithuania	3	6.7	9.7	-1.2	-3.45	5.35		15.05
29	Romania	2	5.5	7.5	-1.8	-5.2	3		10.5

Table 19. Statistical analysis of the results obtained for the exercise with 5 ribbons

Statistical indicators	Body Difficulty	Apparatus Difficulty	Difficulty score	Artistic Execution deductions	Technical Execution deductions	Execution score	Final score
AVERAGE	2.5	6.1	8.6	-1.5	-4.325	4.175	12.775
STDEV	0.7071068	0.8485281	1.5556349	0.4242641	1.2374369	1.6617009	3.2173359
CV	28.284271	13.910297	18.088778	-28.28427	-28.61126	39.80122	25.184625

Comparing the scores of the Lithuanian and Romanian teams in the group event with 5 ribbons, the arithmetic mean for the Difficulty score is 8.6, for the Execution score, 4.1, and for the final score, 12.7. The standard deviation is 1.55 for the Difficulty score, 1.66 for the Execution score and 3.21 for the final score. The coefficient of variation obtained for the Difficulty criterion is 18.08%, for the Execution criterion, 39.80%, and for the final score, 25.18%. If only the final score is taken into account, the group is inhomogeneous. However, it is noticed that the coefficient of variation is 13.91% for Apparatus Difficulty, which means a relatively homogeneous group. For Body Difficulty, the threshold of 28.28% indicates inhomogeneity, although the total score obtained for Difficulty shows that the group has a relative homogeneity. (Table 18, Table 19 and Figure 9)

Figure 9. Comparison between the scores obtained by the representative teams of Lithuania and Romania for the exercise with 5 ribbons

Lithuania did not rank among the first 8 teams in the All-Around group event finals with 5 hoops.

Comparative analysis of the exercise content in compositional terms for the 8 top-ranked teams and the Romanian team

The analysis is focused on two compositional aspects, Collaborations and Formations, which are found in the content of the ribbon and hoop group exercises (Table 20).

Table 20. *Current European and global levels in organising the competition exercise content for the group event*

Country	Group/Apparatus	Collaborations	Formations	Travelling Formations
RUSSIA	5 ribbons	18	11	10
	5 hoops	22	12	9
ITALY	5 ribbons	17	10	13
	5 hoops	20	11	10
BELARUS	5 ribbons	16	10	12
	5 hoops	19	11	14
ISRAEL	5 ribbons	18	8	11
	5 hoops	20	8	8
SPAIN	5 ribbons	15	10	9
	5 hoops	20	11	8
ESTONIA	5 ribbons	15		
	5 hoops	20	9	8
AZERBAIJAN	5 ribbons			
	5 hoops	20	9	7
HUNGARY	5 ribbons	15	8	10
	5 hoops	18	11	10
ROMANIA	5 ribbons	14	9	11
	5 hoops	20	12	10

LITHUANIA	5 ribbons	17	12	8
	5 hoops	20	12	8
POLAND	5 ribbons	16	9	10
	5 hoops			
UKRAINE	5 ribbons	14	11	12
	5 hoops	19	9	8
SWEDEN	5 ribbons	15	12	10
	5 hoops			

Compositionally, in terms of Collaborations and Formations, the routines performed by the Romanian team in the two competitions complied with the regulatory requirements. However, this is not enough to rank in the top eight. In both competitive events, the number of values by Difficulty evaluation sub-criterion is lower, which affects the final score.

Conclusion

The comparative analysis of the scores obtained by the Romanian team in the two competitions, namely the 2019 European Rhythmic Gymnastics Championships and the 2019 Rhythmic Gymnastics Junior World Championships, highlighted the compositional vectors on which to act in order to reduce the gap between our team and top teams.

To reach a better position in the ranking, a greater importance should be given to synchronisation in the group work, with a focus on both the body and the apparatus.

The execution of Body Difficulties should be safe and based on a correct technique, which would facilitate the use of other high-value Difficulties.

From a compositional point of view, the issues related to Collaborations, variety in apparatus handling actions and Dynamic elements with Rotation should be highlighted more.

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