

Empirical Verification of the Weighted System of Criteria for the Elite Water Polo Players Quality Evaluation

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ABSTRACT

The aim of this research was to check the validity of the weighed system of criteria for evaluating the actual quality of water polo players proposed by Hraste, Dizdar and Trninić^{1,3}. The authors have determined the attributes of the measurement instrument for assessment of the overall performance efficiency of elite water polo players. Based on the determined descriptive indicators, on the coefficients of the relative importance of criteria, and on the degree of the objectivity level (interobservers' agreement) of the expert evaluations, it can be concluded that the measuring attributes (objectivity and sensitivity) for most of the criteria are in accordance with their relative importance coefficients for a particular position in the game. Consequently, a structure of relevant criteria is proposed for each play action position in the water polo game. The established instrument for evaluation the actual quality of the elite water polo players is a precondition to establish the professional system orientation, but it would also mean and a hypotheses for adequate design tactic model of play and a process of sports preparation. In succeeding steps of developing the system of criteria and its applicability, the latent structure of the criteria variables should be determined as well as overall importance of criteria with respect to the game of water polo.

Key words: *empirical verification, system of criteria, water polo players, actual quality, expert*

Introduction

In sports kinesiology different theoretical models for assessment of real quality of players in team sports have been so far suggested in order to clarify players' efficiency¹⁻⁵. Also, many earlier researches have been focused on making expert system of overall players' performance efficiency⁶⁻⁹. Dežman¹⁰ outlines that players' efficiency depends on numerous factors which are interdependent, so that changes in another one and indirectly reflect on players' efficiency. All factors are not equally relevant and they don't equally influence players' efficiency in team sports. In this manner each positions and role in each specific game requires certain abilities, characteristics, knowledge, skills and habits.

In keeping accordance with that it is possible to apply metric instruments for observing and evaluating individual and team efficiency aspect in play of the elite water

polo players in order to use that given date in scientific research project and in the process of sport preparation. In former research^{11,12} the relation between anthropological status variables (morphological, motor-functional and psychosocial features) and players' efficiency in team sports have been designated. But, in team sports the main problem was the impossibility of objective efficiency measurements in competitive conditions i.e. determining total and reliable criterion variable as indicator of player efficiency. Besides, adequate measurement instruments for assessments of the real quality of the players in team sports would enable coaches to efficiently analyze and compare the real quality of sportsman with his/her potential. Thereby it is possible to conduct the process of sport preparation rationally and efficiently, directing and specializing players in adequate positions

and roles in play, following the development of real quality of sportsman and selecting players and model of play tactics. Hence, this article represents the logical continuation research focused on final design of the instrument of measurement for expert assessment of the real quality of elite water polo players initially suggested by Hraste, Trninić and Dizdar¹³.

Afore mentioned authors defined criteria for total player quality evaluation in competitive condition and have determined the importance coefficients of criteria according to certain positions in play. The main aim of this research is empirical verification of the weighted system of criteria for elite water polo players quality evaluation i.e. determining its metric characteristic (objectivity and sensibility) and define relative contribution of each criteria in overall quality of the player in certain position in play in order to eventually design optimal criteria system for assessment of actual quality of elite water polo players.

Materials and Methods

Population and sample of entities

The sample of entities consists of 104 players from 8 water polo clubs (Jadran, Jug, Medveščak, Mladost, Mornar, POŠK, Primorje, Šibenik) from the Croatian First Division League that played at least a minute in the season 2006/07. For this research authors selected 80 players (20 wings, 18 outside players, 13 centers forward, 17 centers defender and 12 goalkeepers). All selected players were from the entire group who played at least 8 minutes in at least 10 games for more objective assessment.

Sample of variables

In this research for the sample of variables was used the weighed system of criteria for the assessment of water polo players' actual quality who primarily play on all playing positions in the game (wing, center defender, center forward and outside) set by Hraste, Dizdar and Trninić¹³.

The mentioned system of criteria consists the six criteria for evaluating the performance on defense:

- Level of defensive pressure (LDP)
- Defensive help (DH)
- Steal (regaining the ball possession) (S)
- Transition defense efficiency (TDE)
- Playing multiple positions on defense (PMD)
- Blocking shots (BS)

the thirteen criteria for evaluating the performance on offense:

- Ball handling and control (BHC)
- Passing skill (PS)
- Perimeter shooting skill (PSS)
- Close range shooting skill (CS)
- Wing shooting skill (WS)
- Man-up perimeter shooting skill (MPS)

- Man-up close range shooting skill (MCS)
- Man-up wing shooting skill (MWS)
- Feinting (F)
- Forcing exclusion fouls (FEF)
- Offense without the ball (OWB)
- Transition attack efficiency (TAE)
- Playing multiple positions on attack (PMA)

and the eight criteria for evaluating the performance of water polo goalkeepers:

- Perimeter shot saving skill (PSA)
- Wing's shot saving skill (WSA)
- Hole set's shot saving skill (HSA)
- Close range shot saving skill (CSA)
- Penalty shot saving skill (PNS)
- Defensive help (DH)
- Steal (S)
- Passing skill (PS).

Date collection and processing methods

The actual quality of water polo players was executed by the 8 water polo coaches who were coaching the mentioned teams in the season 2006/07. Each coach used the following grades to evaluate performance quality of the players according to the six criteria for defense, thirteen for offense and eight for evaluating the performance of water polo goalkeepers:

1. very poor (far below average quality)
2. poor (below average quality)
3. good (average quality)
4. very good (above average quality)
5. excellent (far above average quality)

Since there are significant differences in the importance of each criteria for evaluation of quality with respect to the position a player primarily played, authors¹³ weighted grades in each criteria with respect to the position. Based on such a calculation the basic descriptive parameters were determined arithmetic mean, standard deviation, correlation of each criterion with the overall results was calculated as an average weighted grade (the procedure of weighting of grades is explained in afore mention article¹³), while the degree of uniformity (objectivity) among evaluators was assessed by the Cronbach reliability method. Data were processed by the statistical – graphic software Statistic for Windows, release 7.0, at the Faculty of Kinesiology, Zagreb University.

Results and Discussion

Analysis of measuring attributes of criteria for evaluating the water polo players performance on defense

From the results showed on the Figure 1 can be seen the highest values of arithmetic mean (0.74) and standard deviation (0.13) with weight of 0.21 of criterion

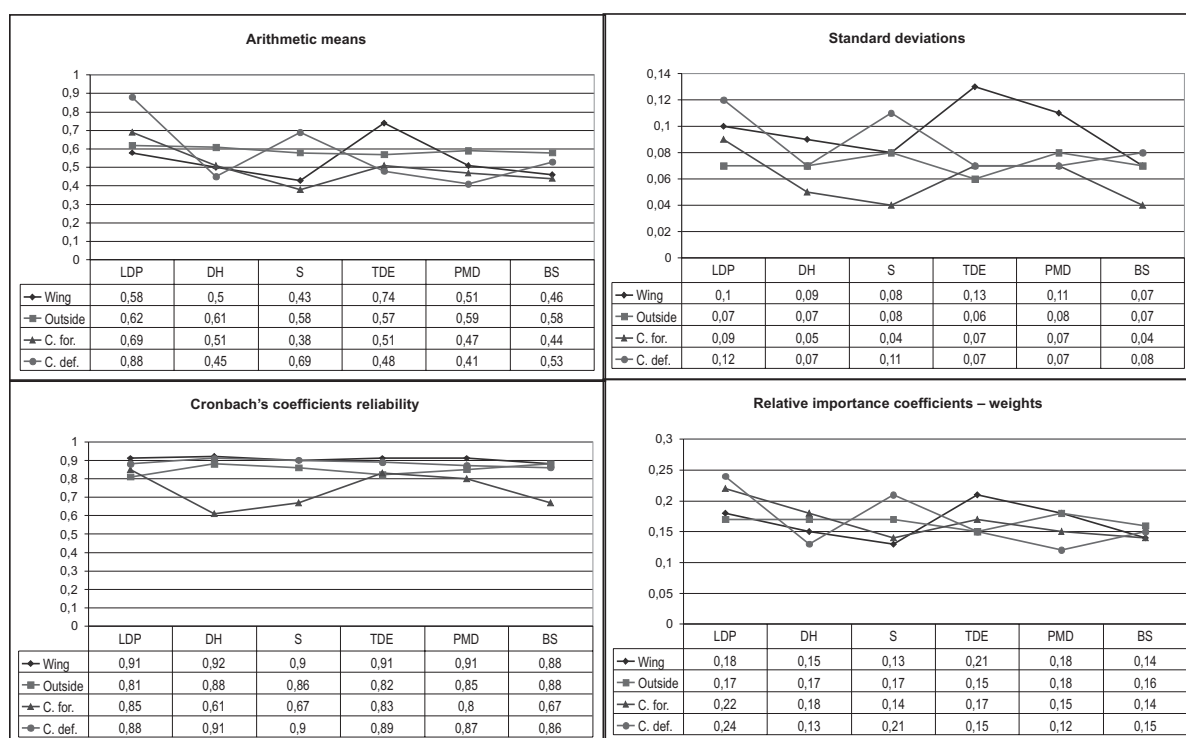


Fig. 1. Arithmetic means, Standard deviations and Cronbach's coefficients reliability of the weight grades given by 8 water polo experts for the 6 criteria for the defensive performance quality evaluation and the relative importance coefficients - weights for each play position in the water polo.

transition defense efficiency (TDE) for players who primarily play on position 1 – wing, and consequently it is going to have the greatest effect in determining the position of a player in the variable which account the overall play quality on defense. The probable reason might be the fact that in a defensive activity a wing has a prime task to anticipate the conclusion of own collective attack and assume space advantage over the opponent in order to interfere with, or even to prevent the development of the opponent's fast break actions. In the overall quality of players on defense level of defensive pressure (LDP) (arithmetic mean 0.58 and weight 0.18), playing multiple positions on defense (PMD) (arithmetic mean 0.51 and weight 0.15) and defensive help (DH) (arithmetic mean 0.50 and weight 0.15) are the criteria distinguished by their equivalent and a same higher influence. For all criteria objectivity coefficients are higher than value 0.90 except criteria blocking shots (BS) (0.88), which is satisfactory.

The values of arithmetic means, standard deviations and impact coefficients are balanced for all criteria on the overall quality of defensive performance for players who primarily play on position 2 – outside. Undoubtedly, it means that outside players need to qualitatively perform all duty in defense. Objectivity coefficients of all criteria are also equivalent in range from 0.81 to 0.88, which is acceptable.

The importance coefficient of the criterion level of defensive pressure (LDP) (arithmetic mean 0.69 and wei-

ght 0.22) is very high and that implies rise of the arithmetic mean and standard deviation of this criterion, giving it a predominate role in determination of the overall quality of performance on defense for players who primarily play on position 3 – center forward. Objectivity coefficient of this criterion is also the highest. The probable reason might be the fact that a defensive player at position 3 pressures the opponent's players (the most usual central outside player or wing) and regulates intensity of entire defensive pressure of his team. Also, defensive help (DH) (arithmetic mean 0.51 and weight 0.18), transition defense efficiency (TDE) (arithmetic mean 0.51 and weight 0.17) and playing multiple positions on defense (PMD) (arithmetic mean 0.47 and weight 0.15) are the criteria with great influence and can be considered important for evaluation of quality of water polo players in this position on defense. Transition defense efficiency (TDE) and playing multiple positions on defense (PMD) are the criteria with acceptable objectivity coefficients in range from 0.80 to 0.85. While, level of defensive help (DH), steal (S), and blocking shots (BS) are the criteria with unacceptable objectivity coefficients in range from 0.61 to 0.67.

Criteria level of defensive pressure (LDP) (arithmetic mean 0.88 and weight 0.24) and steal (S) (arithmetic mean 0.69 and weight 0.21) have a greater impact on the overall quality of players in defense for players who primarily play on position 4 – center defender. Beside this criteria, more significant weight in evaluation of the overall

quality performance in defense have criteria blocking shots (BS) (arithmetic mean 0.53 and weight 0.15) and transition defense efficiency (TDE) (arithmetic mean 0.48 and weight 0.15). The reasons of domination named criteria probably is in the fact that center defender has to be the teams best defending player. It is manifested in his high level of defense pressure on opposite players (the most usual opposite center forward), successful steals, blocking shots and transition defense efficiency. Objectivity coefficients for all criteria are in range from 0.86 to 0.91, which can be considered satisfactory.

Analysis of measuring attributes of criteria for evaluating the water polo players performance on offense

From the results of descriptive values (Figure 2) can be noticed high arithmetic means and standard deviations for the criteria of man-up wing shooting skill (MWS) (arithmetic mean 0.50 and weight 0.14) and wing shooting skill (WS) (arithmetic mean 0.39 and weight 0.11), while a bit less arithmetic means and standard deviations can be noticed for criteria transition attack efficiency (TAE) (arithmetic mean 0.33 and weight 0.09), passing skill (PS) (arithmetic mean 0.31 and weight 0.09), and man-up perimeter shooting skill (MPS) (arithmetic mean 0.30 and weight 0.09). That is in accordance with the role of players who primarily play this position, as is seen in their ability to score from his position in the

player-up situations as well as in positional attack. Also, he should be characterized by success in the transition offense, ball passing and in their ability to score from outside position in the player-up situations. Objectivity coefficients for all criteria are in range from 0.90 to 0.94, which can be considered satisfactory except the criteria for close range shooting skill (CS) and man-up close range shooting skill (MCS) with unacceptable objectivity coefficients in range from 0.68 to 0.78.

Based on the descriptive indicators of the criteria for evaluation of quality of water polo players on offense for position 2 – outside, it can be concluded that criteria man-up perimeter shooting skill (MPS) (arithmetic mean 0.52 and weight 0.14) and perimeter shooting skill (PSS) (arithmetic mean 0.46 and weight 0.12) have the dominate values in the arithmetic means and standard deviations. The lowest values of the arithmetic means and standard deviations have the criteria of man-up wing shooting skill (MWS) (arithmetic mean 0.35 and weight 0.09) transition attack efficiency (TAE) (arithmetic mean 0.29 and weight 0.08), passing skill (PS) (arithmetic mean 0.28 and weight 0.08) and wing shooting skill (WS) (arithmetic mean 0.27 and weight 0.07), but also those criteria can be considered important for evaluation of quality of water polo players in this position. For all other criteria can be said that they have insufficient role in forming a structure of the relevant criteria. The given results show the quality of the outside player for the most part comes from the ability of successful shooting

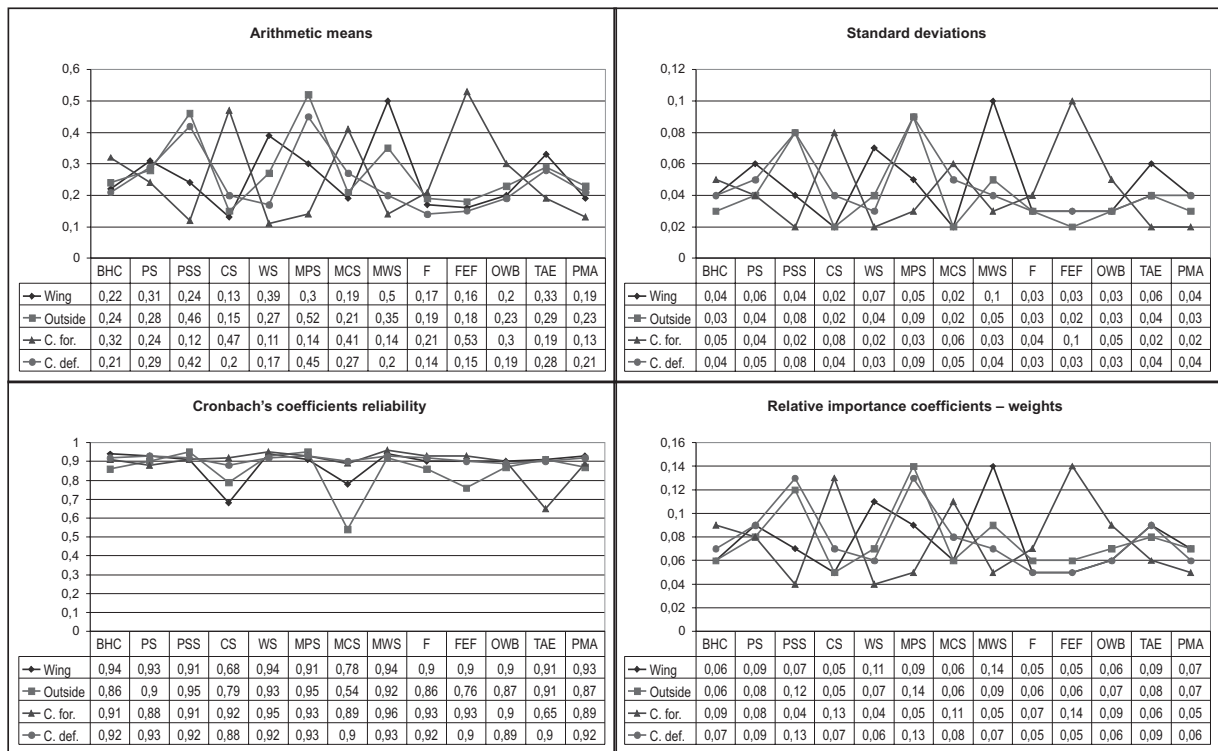


Fig. 2. Arithmetic means, standard deviations and Cronbach's coefficients reliability of the weight grades given by 8 water polo experts for the 13 criteria for the offensive performance quality evaluation and the relative importance coefficients – weights for each play position in the water polo.

performance primarily from all perimeter positions but also from all wing positions. The outside player also has important role in the transition attack and he should also be characterized by ball passing. With all this attributes outside players can ensure a greater number of tactical solutions in offense and a greater possibilities in forming a different models tactic on offense. Objectivity coefficients have satisfactory values and are in range from 0.86 to 0.95 except criteria man-up close range shooting skill (MCS) (0.54), forcing exclusion fouls (FEF) (0.76) and close range shooting skill (CS) (0.79). It is in accordance with those relative importance coefficients.

Greatest values of arithmetic means and standard derivations of weighted grades for evaluation of quality of water polo players on offense for position 3 – center forward are represented by criteria of forcing exclusion fouls (FEF) (arithmetic mean 0.53 and weight 0.14), close range shooting skill (CS) (arithmetic mean 0.47 and weight 0.13), man-up close range shooting skill (MCS) (arithmetic mean 0.42 and weight 0.11), ball handling and control (BHC) (arithmetic mean 0.32 and weight 0.09) and offense without the ball (OWB) (arithmetic mean 0.30 and weight 0.09). This result is consequence a greatest values of their importance coefficients for this position. The giving results probably coming from the main role of center forward on offense: close-range scores, abilities to win man-up situations and to force penalty foul. That considered his the hardest playing role because the player must be powerful and yet skilful and

quick to force penalty foul and thus force the man-up situation (the opponent exclusion), as is close-range realization. His role is also to score from close range in the man-up situations. Due to the fact that the center forward receives ball under hard conditions with only small space and time advantage, he must be success to occupy free space on offense for the ball reception and excellent ball handler. The center forward's role thus appears to be the most important on offense since he determines the whole team attack performance with his close-range scores and abilities to win man-up situations. All criteria have high values of objectivity coefficients, except criteria transition attack efficiency (TAE) (0.65).

Dominate values of arithmetic means and standard deviations of weighted grades for evaluation of quality of water polo players on offense for position 4 – center defense have criteria: man-up perimeter shooting skill (MPS) (arithmetic mean 0.45 and weight 0.13), perimeter shooting skill (PSS) (arithmetic mean 0.42 and weight 0.13), passing skill (PS) (arithmetic mean 0.29 and weight 0.09), transition attack efficiency (TAE) (arithmetic mean 0.28 and weight 0.09) and man-up close range shooting skill (MCS) (arithmetic mean 0.27 and weight 0.08). Those results are in accordance with the center defense's role on offense. That means his high scoring perimeter and close range performance in man-up situations and in positional attack with equal number of players. Center defender must be successful in the transition offense and execute good passes to his team mates. All criteria have

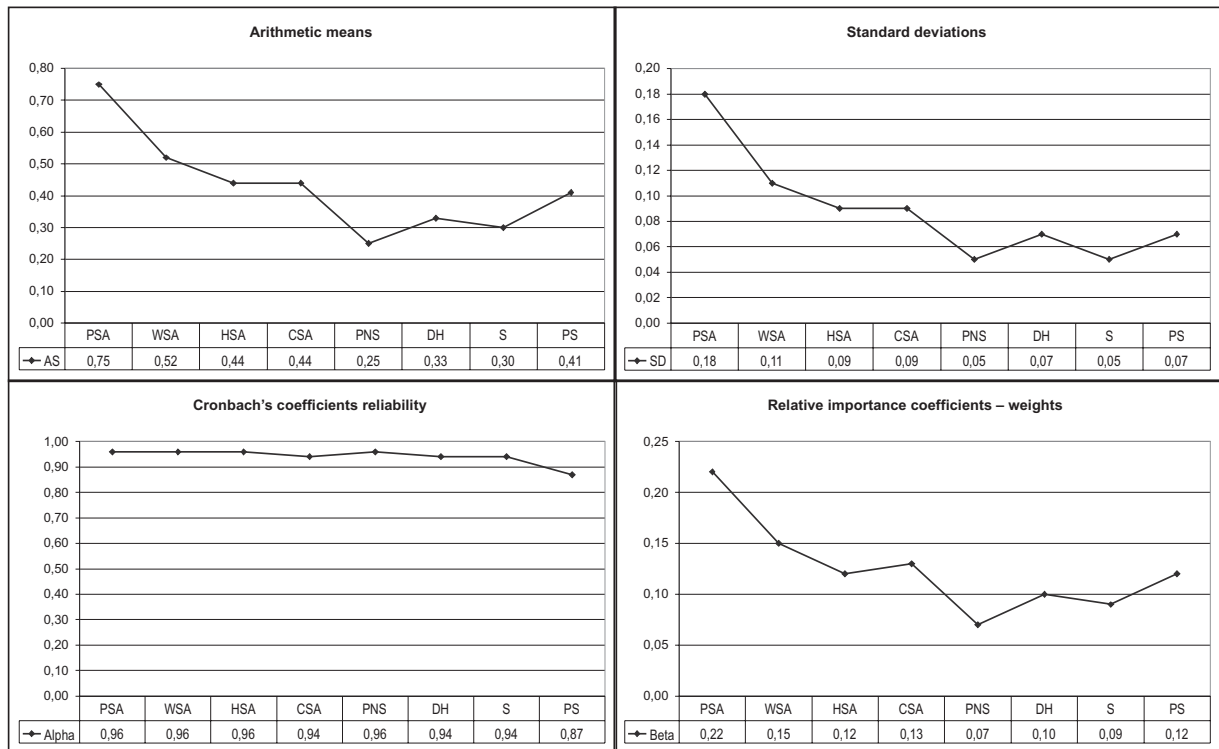


Fig. 3. Arithmetic means (AS), standard deviations (SD) and Cronbach's coefficients reliability of the weight grades given by 8 water polo experts for the 8 criteria for the goalkeepers' performance quality evaluation and the relative importance coefficients – weights for goalkeeper play position in the water polo.

very good objectivity coefficients in range from 0.88 to 0.93.

Analysis of measuring attributes of criteria for evaluating the water polo goalkeeper performance

With regard to the relative importance coefficients of weighted results of water polo goalkeeper, it is understandable that perimeter shot save skills (PSA) (arithmetic mean 0.75 and weight 0.22) and wing shot save skills (WSA) (arithmetic mean 0.52 and weight 0.15) have the greatest arithmetic means and standard derivation (Figure 3) and consequently, the greatest influence in evaluation of the overall quality of the goalkeeper. Beside this criteria, the following criteria have more significant weight in evaluation of the overall quality performance of the goalkeeper: close range shot save skills (CSA) (arithmetic mean 0.44 and weight 0.13), hole set's shot save skills (HSA) (arithmetic mean 0.44 and weight 0.12) and passing skills (PS) (arithmetic mean 0.41 and weight 0.12), and it is necessary that this be included in the optimal system of criteria. In order to reduce number of criteria for this position defensive help (DH) (arithmetic mean 0.33 and weight 0.10), steals (S) (arithmetic mean 0.30 and weight 0.09) and penalty shot save skills (PNS) (arithmetic mean 0.25 and weight 0.07) are criteria suggested to be excluded because those criteria have the smallest arithmetic means and standard deviation. Consequently, it has the smallest impact on the evaluation of the overall quality of goalkeeper. These results are in accordance with the primary role of position of water polo goalkeeper and that means the goalkeeper's efficiency shots from these playing positions. A goalkeeper has to be skillful in passing shots because with his/her passing shot very often starts an attack of own team. A realization of counterattack and time needed for organization of a position attack depends on timely and precise goalkeepers' passing shot. All criteria have very high objectivity (in range from 0.94 to 0.96), except the criterion of passing skills (PS) (0.87).

The results of this paper are in very high congruence with the results from the previous research¹³.

There are certain limitations that can be attributed to this study. The first limitation is reflected in the low level of objectivity of a certain, small number of variables for assessing the quality of the game in defense and attack. This happened, probably, as a consequence of the different understanding of the criteria among the expert – evaluators because of its insufficiently explicit definition and complex manifestations in the game. To increase the diagnostic and prognostic usefulness of the measuring instrument, it is necessary to improve the main metric characteristics and the results obtained by its application. The second limitation is reflected in the high level of expertise required. Namely, the experts can not adequately use all aspects of the set criteria without systematic observations of the team of experts. Each expert would be able to respond for specific criteria based on observed and recorded performances in the match and analysis of video recordings that cover the entire length

of the field. A third limitation relates to the representativeness of the sample. Players who did not have enough playing time in the water polo championship (played less than 8 minutes in at least 10 games), were excluded from the sample.

Additionally the assessment of the actual quality of water polo players could be useful to the water polo practitioners to efficiently analyze and compare differences between the actual quality of water polo players and his potential, which is a precondition for rational conducting of the training process programming, directing and the specialization of players in adequate positions and roles in the game, selection and the effect of transformational control.

Determined, explained and empirically verified weighted system of criteria enables expert coaches a diagnostic »picture« on what each player can and has to improve in order to perfect his own total quality of play. That enables expert coaches to minimize possible mistakes, i.e. it increases successful prediction of future development in performance and competitive efficiency of certain player.

Conclusion

In this research has been implemented the weighed system of criteria for evaluating the actual quality of water polo players proposed by Hraste, Dizdar and Trninić¹³. Based on the determined descriptive indicators, the coefficients of the relative importance of criteria, and on the degree of the objectivity level of the expert evaluations, it can be concluded that the measuring attributes (objectivity and sensitivity) for most of the criteria are in accordance with their relative importance coefficients for a particular position in the game. Consequently, a structure of relevant criteria for each play position in the water polo is proposed:

Position 1 – wing:

- defense: transition defense efficiency (TDE), level of defensive pressure (LDP), playing multiple positions on defense (PMD) and defensive help (DH).
- offense: man-up wing shooting skill (MWS), wing shooting skill (WS), transition attack efficiency (TAE), passing skill (PS) and man-up perimeter shooting skill (MPS).

Position 2 – outside:

- defense: level of defensive pressure (LDP), defensive help (DH), playing multiple positions on defense (PMD), steal (S), blocking shots (BS) and transition defense efficiency (TDE).
- offense: man-up perimeter shooting skill (MPS), perimeter shooting skill (PSS), man-up wing shooting skill (MWS), transition attack efficiency (TAE), passing skill (PS) and wing shooting skill (WS).

Position 3 – center forward:

- defense: level of defensive pressure (LDP), defensive help (DH), transition defense efficiency (TDE) and playing multiple positions on defense (PMD).
- offense: forcing exclusion fouls (FEF), close range shooting skill (CS), man-up close range shooting skill (MCS), ball handling and control (BHC) and offense without the ball (OWB).

Position 4 – center defender:

- defense: level of defensive pressure (LDP), steal (S), transition defense efficiency (TDE) and blocking shots (BS).
- offense: man-up perimeter shooting skill (MPS), perimeter shooting skill (PSS), passing skill (PS), transition attack efficiency (TAE) and man-up close range shooting skill (MCS).

Position 5 – goalkeeper: perimeter shot saving skill (PSA), wing's shot saving skill (WSA), close range shot saving skill (CSA), hole set's shot saving skill (HSA) and passing skill (PS).

One of the main problems in former research in water polo was the impossibility to measure the overall players'

efficiency in a game condition. Applying this system of criteria for the assessment of actual quality new possibilities are realized for new scientific researches in team sports.

In the succeeding steps of developing the system of criteria and its applicability, the latent structure of the criteria variables should be determined as well as overall importance of criteria with respect to the game of water polo. In the future, it would be interesting to test and verify this model of criteria for guidance of players toward different playing positions and roles in the game.

Acknowledgements

The paper is a result of the research conducted within the scientific research programme number 034–2607 »Anthropological determinants of competition performance in sports games«, approved and granted by the Ministry of Science, Education and Sports of the Republic of Croatia.

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EMPIRIJSKA PROVJERA PONDERIRANOG SUSTAVA KRITERIJA ZA PROCJENU STVARNE KVALITETE VRHUNSKIH VATERPOLISTA

SAŽETAK

Cilj ovog istraživanja je potvrđivanje utemeljenosti ponderiranog sustava kriterija za procjenu stvarne kvalitete vaterpolista koji su predložili Hraste, Dizdar i Trninić¹³. Autori su utvrdili svojstva mjernog instrumenta za procjenu cjelokupne uspješnosti vrhunskih vaterpolista. Na temelju utvrđenih deskriptivnih pokazatelja te stupnja objektivnosti (intersubjektivnih slaganja) ekspertnih ocjena moguće je zaključiti kako se za većinu kriterija metrijska svojstva (objektivnost i osjetljivost) podudaraju s njihovim koeficijentima važnosti za pojedinu poziciju, te je u skladu s time i predložena struktura relevantnih kriterija za svaku poziciju. Utemeljeni instrument za procjenjivanje stvarne kvalitete vrhunskih vaterpolista preduvjet je za utemeljivanje sustava rigorozne profesionalne orijentacije i selekcije, ali i pretpostavka za adekvatno oblikovanje modela taktike igre i procesa sportske priprema. U slijedećim koracima razvoja sustava kriterija i njegove primjene trebalo bi utvrditi latentnu strukturu kriterijskih varijabli te ukupnu važnost kriterija na cjelokupnu vaterpolsku igru.