

Operationalizing the tactical thought processes and competitive activity parameters among junior female handball players through the utilization of basic game roles

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Abstract

The objective of this study is to convey the findings from an empirical investigation into the tactical thinking and competitive activity parameters of junior female handball players, followed by their operationalization based on fundamental game roles. The study entails a comparison and operationalization of empirical results pertaining to key content parameters, intended for integration into the educational and training processes, as well as competitive engagements of handball players. The research involved junior female athletes aged 15 to 19, regardless of their qualification level, representing women's handball clubs in the Ukrainian Championship (the Junior League). **Methods.** The method "Examination of the profile of athletes' thinking" (Hanzen et al., 2001) was applied; the key content parameters of competitive activity: intensity, activeness, preciseness, fault, efficiency and reliability were determined by a proprietary complex of tested indicators of handball players' attack/defense given in the studies by L. Latyshkevich & L. Manevich (1990); F. Terzy et al. (2009); I. Turchyn (1988). **Results.** Statistically significant differences ($p < .050$; $p < .010$; $p < .001$) were registered using the Kruskal–Wallis H test by all the types of thinking: subject thinking (SbTh), symbolic thinking (SmTh), logical thinking (LgTh), visual thinking (VsTh) and creative thinking (CrTh) of junior handball players by the basic game roles. Statistically significant differences ($p < .050$; $p < .010$; $p < .001$) were found using the Kruskal–Wallis H test by all the parameters of junior handball players' competitiveness by the basic game roles. It was found and substantiated that the most important types of handball players' thinking in the context of competitive activity are: logical thinking – four statistically significant correlations ($p < .050$) with the parameters of competitiveness (the coefficient of precise passes; the coefficient of a player's efficiency; the coefficient of a player's reliability; a complex indicator of competitive activity); creative thinking – three statistically significant correlations ($p < .050$; $p < .010$) with the parameters of competitiveness (the coefficient of precise passes; the coefficient of a player's efficiency; a complex indicator of competitive activity) and subject thinking – two statistically significant correlations ($p < .050$) with the parameters of competitiveness (the coefficient of precise passes; the coefficient of a player's reliability). **Discussion and conclusions.** The study explains that the obtained high indices of subject and logical thinking of team center players (fullbacks, centers, center-halves) are determined by educational-training process. The study regards a high level of development of the above types of thinking as a technological game construct of a team. Attention is paid to high levels of visual and creative thinking of line players which are determined by a situation of development which encourages them to play in attack through achieving a desirable image and scoring a goal unconventionally. The study found a considerable number of scientific facts which should be introduced into educational-professional activity of women's handball teams.

Key words: tactical training, tactical and technical actions, game roles, competitiveness, motivation, adolescence.

Introduction

Handball is one of spectacular, contact and speed team sports. Due to female players, handball gained expression, uniqueness, hardiness, flexible thinking, high indices of carefulness and obligation to follow certain rules and game elements. Female athletes who dedicated themselves to handball gave all intentions of female psychology to this kind of sport. At the current stage of professional sport development, processes of intensification, pragmatization, modelling and forecasting of a future sport result have become an indispensable

part of educational-training, competitive, restorative and rehabilitative activities (Frolova et al., 2013; Staude & Radzyshevska, 2021; Staude et al., 2023a; 2023b; Suprunovych, 2008).

Handball players' competitive activity requires not only timely and precise statistical data, but also consideration of complex evaluation of indices against a background of such parameters of competitiveness as activeness, intensity, preciseness, fault, efficiency and reliability. The following statistical data of competitiveness are well-known: female handball players with a great number of passes in a similar game span can have different coefficients of reliability; attack players partly dislike to return to defense and work in tackling or in positional defense. The issue of operationalizing tactical thinking and parameters of junior handball players' competitive activity by the basic game roles becomes highly topical in the outlined dimensions. The intention to introduce the obtained results into educational-training process of sports schools and Olympic Reserve Schools is specificity of the research on a junior sample. The researchers Ye. Strykalenko et al. (2020) made a successful attempt to find a correlation between intelligence and competitive activity of elite female handball players. The intelligence data obtained by the method Culture Free Intellect Test (CFIT) have the following distribution: defense players – 95 points; center players – 92 points; winger players – 89 points. Consequently, the average of the team was 92 points. The computer test of intelligence INTEST showed a similar distribution of the values. It was generalized that, by the results, wingers (9.5 points), pivots (9.4 балів), centers (7.8 points) and goalkeepers (7.5 points) are the most efficient players. The strongest statistically significant correlation ($p \leq 0.05$; $p \leq 0.10$) was registered between IQ and defenders' efficiency; centers and indicators of associative and operational thinking; in goalkeepers – between efficiency and abstract thinking (Strykalenko et al., 2020). The obtained results are important for performing statistical analysis of handball players' competitive activity. Despite the things done, we should state that the parameters of handball players' competitive activity lack clarity in differentiation.

The collection of works by I. Turchyn (1988) is of special scientific interest in the context of operationalization and measurement of tactical-technical actions in handball. The author proposed and tested a complex system for measuring efficiency of competitive activity in handball which has not lost its topicality. The analysis of content features of competitive activity in women's handball was divided into operations of attack and defense to measure quantitative indicators. The main indicators of handball players' attack by I. Turchyn (1988) are as follows: 1) a quantitative indicator of team attacks; 2) a quantitative indicator of resultful attacks; 3) a quantitative indicator of attacks against positional defense; 4) a quantitative indicator of resultful attacks against positional defense; 5) a quantitative indicator of transition attacks or counterattacks; 6) a quantitative indicator of resultful transition attacks; 7) a quantitative indicator of throws from a 6-meter zone; 8) a quantitative indicator of resultful throws from a 6-meter zone; 9) a quantitative indicator of throws from a 7–9-meter zone; 10) a quantitative indicator of resultful throws from a 7–9-meter zone; 11) the number of tackles; 12) the number of mistakes made by team players; 13) the number of penalties awarded in attacks; 14) a quantitative indicator of 7-meter penalty throws; 15) a quantitative indicator of resultful 7-meter penalty throws. The main indicators of handball players' defense by I. Turchyn (1988) are given below: 1) a quantitative indicator of catches; 2) a quantitative indicator of tackles; 3) a quantitative indicator of players' blocking the ball; 4) a quantitative indicator of throws-off; 5) a quantitative indicator of fights in a 6-meter zone of defense; 6) a quantitative indicator of fights in a 7–9-meter zone of defense; 7) a quantitative indicator of fights beyond a 9-meter zone of defense; 8) the total number of fights; 9) the number of mistakes made by team players in defense against positional attack; 10) the number of mistakes made by players in defense under conditions of competitors' counterattacks; 11) the total number of mistakes made by players in defense; 12) the number of penalties awarded in defense. Such operationalization of actions on the playing court allows dividing the game into components and noticing strengths and weaknesses of a team. The authors of another study F. Terzy, V. Orlovskiy, S. Belous (2009) give arguments for the generalized indicator of an athlete's actions, the so-called integral evaluation of attack efficiency. Its value is a sum of four coefficients: activeness, preciseness, versatility and aggressiveness (Terzy et al., 2009).

Statistical data which can be obtained after each game can confirm or disprove a coach's intention, plan and tasks for a game. The dimensions of our empirical research imply the attempt to find a correlation between basic parameters of competitiveness identified by the listed basic operations of attack/defense by the basic game roles. Moreover, it is necessary to add operations of a goalkeeper who can not only increase confidence of defense players, but also affect successful performance of attack players, due to a timely and precise first throw. Under these conditions, it is important to determine which type of tactical thinking is important. The research on operationalization of tactical thinking by the basic football players' roles (Popovych et al., 2021e) are of scientific interest in this context. The study on operationalization of emotional intelligence in the dimensions of motivational orientation by the basic game roles (Popovych et al., 2023b) is not less interesting in the context of developing a strategy. The research data showed that implementation of operationalization in a confirmatory research strategy can activate a latent resource and assist in realizing it in competitive activity. Modern technologies which involve using artificial intelligence for forecasting competitive activity of junior athletes (Nagovitsyn et al., 2023) are worth special attention in this context. The experience of using artificial intelligence in other areas of activity containing a prognostic component (Nosov et al., 2021; Solovey et al.,

2020), a component of creating an optimal safe trajectory (Zinchenko et al., 2022; 2023), in an educational-professional area (Gumennykova et al., 2021; Kobets et al., 2021a; 2021b) confirmed efficiency of such technologies in working with large databases, in selecting optimal scenarios of events, in creating optimal routes and schedules. Using the above parameters, databases and technologies of artificial intelligence, it is possible to develop a step-by-step program for complex development of physical characteristics. V. Kostyukevich (2007) thinks that, while developing such a program, it is necessary to consider handball players' speed-power preparedness. The current tendencies of sport development show that teams with effective technical training can achieve a desirable result in a contest with more renowned competitors unexpectedly, but understandably. Under conditions of a cup system, such an advantage can ensure a good promotion for a team in competitions. We emphasize that a psychological component occupies an important place in tactical training. The researchers I. Popovych (2022b) developed an effective method for identifying dominant, dependent, independent and harmful/dangerous mental states of junior athletes' self-actualization. Attention was focused on a combination of procedural and resulting components of educational-training activity of handball players that motivates for achieving permanent excellent results. It was proved that coaching staff capable of identifying dominant mental states of handball players, who are on the playing court, can make timely corrections in the course of the game. It is a latent resource and competitive advantage over rivals. Technologies for examining different types of athletes' dominant states (Popovych & Blynova, 2019a; 2019b; Popovych et al., 2019; 2022a; 2022f; 2023a; Prokhorenko et al., 2023), the mental state of burnout (Popovych et al., 2021c) and health-saving technologies (Popovych et al., 2022c; 2020b) are of scientific interest.

Operationalization of tactical thinking and parameters of competitive activity of junior female handball players is considered to be identification of statistically significant differences in the types of tactical thinking by the basic game roles depending on the parameters of competitive activity. Development of the indicators of tactical thinking can increase efficiency of managing handball players sporting activities.

Hypothesis. 1. The parameters of tactical thinking will have statistically significant differences by the basic game roles. 2. The parameters of competitiveness will have statistically significant differences by the basic game roles. 3. Operationalization of the obtained empirical results of tactical thinking and competitive activity of junior female handball players by the basic game roles will allow finding scientific facts possessing novelty and practical value.

Purpose. To conduct empirical research on the parameters of tactical thinking and the key measurements of competitive activity of junior female handball players with further operationalization by the basic game roles.

Methods

Methodology. The key methodological dimensions of the research involved scientific studies devoted to competitive activity of female handball players. Tested and time-proved complex systems for measuring efficiency of competitive activity in handball were used as a basis (Latyshkevich & Manevich, 1990; Popovych et al., 2021b; Terzy et al., 2009; Turchyn, 1988). We examined a number of studies aimed at identifying dependent variables of efficiency in team sports (Blynova et al., 2022b; Halian, 2022; Kalenchuk et al., 2023). The studies on adaptation (Blynova et al., 2019; 2022a; Plokhikh, & Yanovska, 2022), psycho-emotional potential (Chebykin, 2023; Kuzikova et al., 2023; Plokhikh, 2023; Popovych et al., 2022d; 2022e; Stelmashchuk et al., 2023), regularities of adolescence (Hulias & Hoian, 2022; Karpenko & Klympush, 2023; Plokhikh, 2022; Popovych et al., 2021a; 2021d; Nazarenko, 2023) and topical research on educational-professional training as a main type of respondents' mental activity (Fomych, 2023; Los et al., 2023; Shevchenko et al., 2023; Strykalenko et al., 2019; 2021; Vavryniv & Yaremko, 2022; Zarichanskyi et al., 2023) were analyzed. We also considered studies revealing and proving the importance of physiological (Cretu et al., 2021; Kozina et al., 2019) and functional components in competitive activity (Marques et al., 2011).

Participants. The research involved junior athletes aged 15–19 years ($Me=17$; $M=16.91$; $SD=\pm 1.89$), irrespective of a qualification level, representing women's handball clubs of Ukrainian Championship (the Junior League). In terms of qualification, among the research participants there were athletes with the 1st and 2nd adult categories, Candidate Masters of Sports and Masters of Sports. A considerable portion of the participants had not only training experience with a qualifier, but also regularly came off the substitutes' bench and some of them were players of the handball clubs of Ukrainian Championship (the Professional League). The total number of participants was $n=65$ (all female).

Procedures and Instruments. The studies mentioned in the section "Methodology" were analyzed and used to develop a confirmatory strategy of the research with elements of comparison. Such logic of the research contributed to selection of relevant psycho-diagnostic instruments and statistically appropriate and sensitive methods of measurement. In order to identify the parameters of handball players' tactical thinking, we used the valid method "Examination of the profile of athletes' thinking" (EPAT) (Hanzen et al., 2001) tested in studies on sports. This method allows obtaining dispositional measurements of tactical thinking used to create a profile of an athlete's tactical thinking that is one of the advantages of application of this instrument in studies on sports. The profile of tactical thinking was used as an individual component for analysis. The method by V. Hanzen et al. (2001) allowed finding dominant types of tactical thinking. It consisted of seventy-five

statements and five basic scales. The scales were used to measure the following types of thinking: subject thinking (SbTh), symbolic thinking (SmTh), logical thinking (LgTh), visual thinking (VsTh) and creative thinking (CrTh). Cronbach alpha coefficient (homogeneity of responses) evidenced a high level of homogeneity (.912).

In order to examine the content parameters of the respondents' competitive activity, we used a proprietary complex of tested indicators of handball players' attack/defense given in the studies by L. Latyshkevich & L. Manevich, (1990); F. Terzy et al., (2009); I. Turchyn, (1988). This list included: the coefficient of a player's intensity (CPI), evaluation of a player's activeness (EPA), the coefficient of passing accuracy (CPA), fault of tactical-technical actions (FTTA), the coefficient of a player's efficiency (CPE), the coefficient of a player's reliability (CPR) and a complex indicator of competitive activity (CICA). A considerable portion of the parameters was in a mutual consistent relationship. In particular, CPI and EPA, CPA and FTTA are complementary. The complex indicator is a generalized scale which was used only in certain cases of analysis.

Organization of Research. Scientific literature contains a number of variants for naming the basic game roles of handball players. We chose the following terms of the basic game roles of handball players: a goalkeeper, fullback, center, center-half and line. The research was organized using a confirmatory strategy and comparison of the data by the basic game roles. Such organization of the research can be considered complex. A confirmatory stage of empirical data collection lasted in 2022 and 2023 covering a few games of Ukrainian Championship (the Junior League). There were cases when the handball players played in several positions. It was determined by traumas or a coach's decision, experimenting with an athlete playing in this or that position. Such changes usually occurred when athletes were involved for playing with a qualifier. The main position of the respondents by the basic game role was taken into consideration. All the doubtful aspects were specified and eliminated. We maintained a high level of ecological validity and accuracy of the experimental research. The respondents participated in the research voluntarily. All the participants were informed about the collection of empirical data in advance. The research was organized confidentially. Each respondent was given, apart from the role code, an ordinal number and a letter code, for instance, G1AB. The key requirements of the Ethical Standards of Helsinki Declaration (2013) were met.

Statistical Analysis. The obtained empirical data were processed by means of "IBM SPSS Statistics" version 29.0.0.0 (241). In order to ensure replication of the experiment, the empirical data were given by the main descriptive frequency characteristics. Statistically significant levels were determined and compared by the Student's t-test, the Kruskal-Wallis H-test, the Mann-Whitney U-test. The data at the level $p \leq 0.05$; $p \leq 0.01$ and $p \leq 0.001$ were considered to be significant.

Results

Tabl. 1 gives the content parameters of tactical thinking by the main descriptive characteristics. It was approved that the median of distribution (*Me*), the minimum (min) and maximum (max) values of distribution completely characterize the empirical dataset. The results are presented by the method "EPAT" (Hanzen et al., 2001). All the main method scales were presented. Statistically significant differences of the parameters of tactical thinking in the basic game roles were found by means of the non-parametric Kruskal-Wallis H-test.

Table 1. Descriptive frequency characteristics and statistically significant differences of the parameters of the respondents' tactical thinking by basic game roles (n = 65)

Basic game roles	DFC	Scales "EPAT" (Hanzen et al., 2001)				
		SbTh	SmTh	LgTh	VsTh	CrTh
Goalkeepers	<i>Me</i>	8.00	6.50	7.00	7.00	5.00
	min	6.00	5.00	5.00	5.00	4.00
	max	10.00	7.00	10.00	9.00	9.00
Fullbacks	<i>Me</i>	9.00	7.00	7.50	5.50	7.00
	min	5.00	5.00	6.00	4.00	5.00
	max	11.00	9.00	11.00	8.00	9.00
Centers	<i>Me</i>	9.00	7.50	9.00	6.00	6.50
	min	6.00	5.00	6.00	4.00	5.00
	max	10.00	10.00	10.00	9.00	10.00
Center-halves	<i>Me</i>	9.00	7.00	9.50	7.00	7.00
	min	6.00	6.00	6.00	5.00	5.00
	max	12.00	10.00	12.00	9.00	10.00
Lines	<i>Me</i>	7.00	7.00	8.50	9.00	9.00
	min	6.00	5.00	5.00	5.00	5.00
	max	9.00	9.00	10.00	12.00	11.00
The Kruskal-Wallis H-test	H	12.234	8.435	9.975	20.262	23.678
	p	.009	.034	.024	<.001	<.001

Note: DFC – descriptive frequency characteristic; *Me* – the median (*in italics*); min – the minimum of distribution; max – the maximum of distribution; SbTh – subject thinking; SmTh – symbolic thinking; LgTh – logical thinking; VsTh – visual thinking; CrTh – creative thinking.

The empirical data collected and processed by the parameters of tactical thinking confirmed even distribution which has statistically significant differences by the Kruskal-Wallis H-test. There were differences at the levels ($p < .050$; $p < .010$; $p < .001$). Comparison of the descriptive frequency characteristics with another sports sample (Popovych et al., 2021e) did not show statistically significant differences ($p > .050$).

Tabl. 2, by the same algorithm, gives the content parameters of handball players' parameters of competitive activity by the main descriptive characteristics: the median of distribution (*Me*), the minimum (min) and maximum (max) values of distribution. All the measurements by the proprietary complex of handball players' parameters of competitiveness were used. Seven scales are presented. Statistically significant differences of the respondents' parameters of competitiveness by the basic game roles were determined by the non-parametrical the Kruskal-Wallis H-test.

Table 2. Descriptive frequency characteristics and statistically significant differences of the respondents' parameters of competitiveness by the basic game roles (n = 65)

Basic game roles	DFC	Proprietary complex of the parameters of handball players' competitiveness						
		CPI	EPA	CPA	FTTA	CPE	CPR	CICA
Goalkeepers	<i>Me</i>	.55	.55	.85	.20	.55	.60	.65
	min	.33	.34	.65	.12	.45	.26	.35
	max	.61	.62	.96	.45	.78	.85	.78
Fullbacks	<i>Me</i>	.80	.80	.70	.30	.70	.65	.70
	min	.65	.66	.55	.18	.41	.51	.41
	max	.95	.95	.81	.37	.85	.78	.78
Centers	<i>Me</i>	.70	.70	.70	.25	.65	.70	.75
	min	.51	.51	.54	.14	.39	.58	.43
	max	.84	.84	.82	.32	.82	.85	.82
Center-halves	<i>Me</i>	.80	.80	.65	.30	.65	.60	.65
	min	.61	.61	.50	.17	.34	.44	.38
	max	.94	.94	.76	.42	.81	.69	.81
Lines	<i>Me</i>	.60	.60	.45	.40	.50	.60	.60
	min	.39	.39	.34	.31	.41	.31	.33
	max	.72	.72	.66	.55	.64	.68	.73
The Kruskal-Wallis H-test	H	17.342	16.879	25.458	29.098	7.567	10.045	9.956
	p	<.001	<.001	<.001	<.001	.038	.012	.024

Note: DFC – descriptive frequency characteristic; *Me* – the median (in italics); min – the minimum of distribution; max – the maximum of distribution; CPI – coefficient of a player's intensity; EPA – evaluation of a player's activeness; CPA – coefficient of passing accuracy; FTFA – fault of tactical-technical actions; CPE – coefficient of a player's efficiency; CPR – coefficient of a player's reliability; CICA – complex indicator of competitive activity.

The presented empirical data by the parameters of competitiveness confirmed even distribution which has statistically significant differences by the Kruskal-Wallis H-test. The significant levels of differences ranged from $p < .050$ to $p < .001$. The obtained values of descriptive frequency characteristics were compared to the recommended average data of the indicators of handball players' attack/defense given in the studies by L. Latyshkevich & L. Manevich (1990); F. Terzy et al. (2009); I. Turchyn (1988).

No significant differences were registered. There are insignificant tendencies which can be explained by uniqueness of a junior sample (high expressiveness, high activeness and decisiveness, low flexibility and moderateness). According to the strategy of the empirical research, all possible pairs by the basic game roles were created. Ten pairs were obtained: G&F, G&C, G&C-H, G&L, F&C, F&C-H, F&L, C&C-H, C&L, C-H&L. Statistically significant differences were found by the Mann-Whitney U-test.

It is logical that handball players playing in different positions will have different indexes by the parameters of competitiveness. It is also determined by the function of the basic game role. Comparison by the parameters of tactical thinking seems to be appropriate. Tabl. 3 gives the results of comparison of the examined pairs by the method "EPAT" (Hanzen et al., 2001).

Table 3. Comparison of the examined pairs by the method “EPAT” (Hanzen et al., 2001)

Basic game roles	Statistical parameter	Mann-Whitney U-test				
		IIM	CM	JIM	OM	KM
G&F	U	9.500	10.500	7.000	6.500	6.000
	p	.074	.086	.021	.014	.012
G&C	U	9.500	10.000	5.500	7.500	7.500
	p	.074	.096	.009	.032	.032
G&C-H	U	9.500	10.500	18.500	16.000	6.000
	p	.074	.086	.145	.115	.012
G&L	U	10.500	10.500	11.500	6.500	6.000
	p	.086	.086	.074	.014	.012
F&C	U	13.000	10.500	10.000	9.500	8.500
	p	.110	.086	.041	.074	.036
F&C-H	U	18.500	16.500	7.000	7.500	15.000
	p	.143	.119	.029	.019	.111
F&L	U	6.500	15.500	11.500	6.000	7.500
	p	.013	.112	.076	.012	.038
C&C-H	U	10.500	9.500	16.000	11.500	14.500
	p	.086	.078	.114	.086	.094
C&L	U	6.500	14.000	11.500	6.000	7.500
	p	.012	.105	.074	.012	.032
C-H&L	U	7.500	15.500	8.500	6.500	6.500
	p	.037	.112	.036	.014	.014

Note: SbTh – subject thinking; SmTh – symbolic thinking; LgTh – logical thinking; VsTh – visual thinking; CrTh – creative thinking; G – goalkeepers; F – fullbacks; C – centers; C-H – center-halves; L – lines; Mann-Whitney U-test; p – level of significance (p≤.050 and p≤.010 – given in bold type).

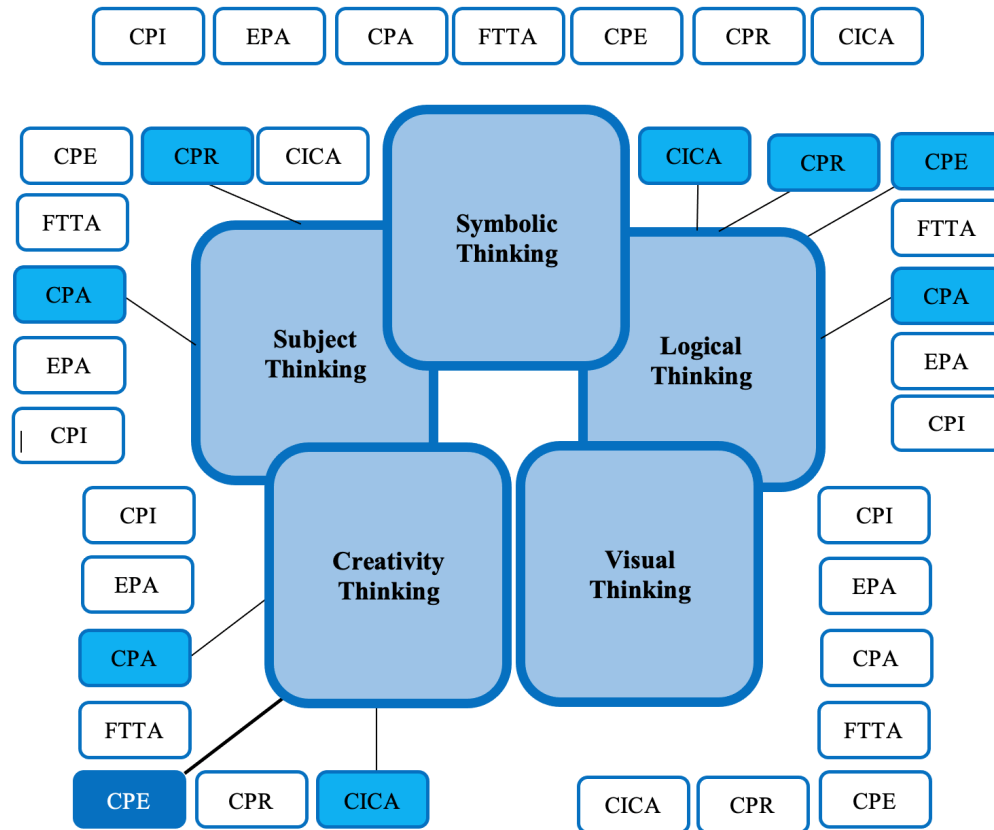
Comparison of all fifty pairs of parameters of tactical thinking by the basic game role was performed. We obtained twenty-three pairs with statistically significant differences by the types of tactical thinking (p<.050; p<.010). It is interesting that there are no statistically significant differences by symbolic thinking in the obtained pairs; differences by subject thinking were registered in three pairs (F&L, C&L, C-H&L); there were differences by logical thinking in five pairs (G&F, G&C, F&C, F&C-H, C-H&L) and the greatest number – eight – by creative thinking (G&F, G&C, G&C-H, G&L, F&C, F&L, C&L, C-H&L). Obviously, the play of center players encourages the development of logical, visual and creative thinking more than the play of the goalkeeper or the line. However, such assumptions require additional testing. In the context of our research, it was important to find correlations between the respondents’ parameters of tactical thinking and competitiveness. Tabl. 4 presents statistical significance of correlations tested by the non-parametrical Spearman’s rank correlation coefficient (r_s).

Table 4. Matrix of correlations of the proprietary complex of the parameters of the handball players’ competitiveness with the parameters of tactical thinking (n=65)

Scale	Parameter	Proprietary complex of the parameters of the handball players’ competitiveness						
		CPI	EPA	CPA	FTTA	CPE	CPR	CICA
SbTh	r_s	.072	.076	.120*	.049	.087	.117*	.079
	p	.812	.806	.034	.837	.699	.040	.712
SmTh	r_s	.099	.096	.089	.079	.095	.042	.089
	p	.342	.382	.571	.743	.379	.856	.363
LgTh	r_s	.016	.017	.153*	-.046	.148*	.123*	.132*
	p	.913	.911	.021	.347	.018	.033	.017
VsTh	r_s	.037	.042	.046	-.031	.082	.048	.078
	p	.877	.856	.856	.564	.324	.789	.299
CrTh	r_s	-.022	-.024	.118*	-.022	.267**	.084	.151*
	p	.612	.609	.039	.701	.009	.769	.023

Note: SbTh – subject thinking; SmTh – symbolic thinking; LgTh – logical thinking; VsTh – visual thinking; CrTh – creative thinking; CPI – coefficient of a player’s intensity; EPA – evaluation of a player’s activeness; CPA – coefficient of passing accuracy; FTFA – fault of tactical-technical actions; CPE – coefficient of a player’s efficiency; CPR – coefficient of a player’s reliability; CICA – complex indicator of competitive activity; p – level of significance (in bold type); * – p ≤ .050; ** – p ≤ .010.

Fig. 1 gives the pleiade of correlations between the parameters of competitiveness and the types of tactical thinking that allowed for visual presentation of important correlations and their location in a collective profile of the sample's tactical thinking.



Note: ——— positive correlations with $p \leq 0.050$; - - - - - positive correlations with $p \leq 0.10$; CPI – coefficient of a player's intensity; EPA – evaluation of a player's activeness; CPA – coefficient of passing accuracy; FTTA – fault of tactical-technical actions; CPE – coefficient of a player's efficiency; CPR – coefficient of a player's reliability; CICA – complex indicator of competitive activity.

Figure 1. Pleiade of correlations between the handball players' parameters of competitiveness and types of tactical thinking ($n=65$)

It is highlighted that those types of handball players' thinking which have statistically significant correlations are important in the context of competitive activity: logical thinking – four correlations (CPR; CPE; CICA; CPA); creative thinking – three correlations (CPR; CPE; CICA) and subject thinking – two correlations (CPR; CPE). It is obvious that the indicators and the level of development of symbolic and visual thinking of the respondents have no statistically significant impact on the parameters of competitive activity. Correlations were registered at the level of positive tendencies. Thus, logical thinking in competitive activity is the most dependent variable which affects the parameters of handball players' competitions. Logical thinking is also the most loaded and dependent parameter. At the same time, the strongest correlation was registered in the pair of creative thinking and the coefficient of a player's efficiency ($r_s=0.267$; $p \leq 0.010$). The coefficient of passing accuracy (CPA) is the most dependent in the context of the parameters of competitiveness, since it has three statistically significant correlations with subject ($r_s=0.120$; $p \leq 0.050$), logical ($r_s=0.153$; $p \leq 0.050$) and creative thinking ($r_s=0.118$; $p \leq 0.050$).

Discussion

In sports science literature there are empirical studies examining handball players' tactical thinking (Frolova et al., 2013; Suprunovych, 2008). The results obtained by researchers emphasize the importance of the development of tactical and game thinking and the correlation with athletes' efficient growth. Timely registration of the measurements of tactical thinking and collection of analytical information about each athlete allow discussing efficient management of training process, the choice of a suitable game role, schemes and a game plan. The use of the proprietary specialized program "Balltest" (Suprunovych, 2008) allowed researchers

to look at the game situations of attack/defense and determine the level of game thinking. Comprehensive determination of the level of game thinking allowed drawing parallels with our research and confirming the appropriateness of the research strategy. Unlike the computer research “Balltest” (Frolova et al., 2013; Suprunovych, 2008), our study presents an efficient attempt to operationalize tactical thinking as a dispositional component through differentiation of five types of thinking: subject thinking (SbTh), symbolic thinking (SmTh), logical thinking (LgTh), visual thinking (VsTh) and creative thinking (CrTh). The focus on operationalization in other empirical studies (Popovych et al., 2021e; 2023b) related to the given research allowed obtaining a sufficient number of pairs of comparisons by the basic game role. Such specification of the research subject incentivized us to establish important scientific facts. The obtained fifty pairs of comparisons (see Tabl. 3) showed that the play of fullbacks, centers and half-centers encourages the development of logical, visual and subject thinking more than the game of goalkeepers and lines. On the premise that the goalkeeper should play reliably, clearly and understandably for the players in defense, and the line should have an advantage over the competitor’s defense in anthropometry and aggressive decisiveness to achieve results, the center players should be a technological construct which will bind “reliable defense” and “efficient attack”. It can be ensured by an advantage in logical, visual, subject and creative thinking. A considerable number of statistically significant correlations between the parameters of competitiveness and logical thinking of juniors shows that the formed logical constructs are the results of training. Another study proves that respondents construct a model of the expected victory result through probable scenarios of events (Popovych et al., 2020a). In particular, theoretical preparedness, practicing prepared variations, analysis of the competitor’s play, practicing the game by the plan “A” and “B” and working with standards encourages creation of quality training-educational space which is efficient and sensitive in the context of developing juniors’ intelligence.

It is worth emphasizing that the obtained results of the parameters of tactical thinking show that the fullbacks, centers and center-halves have that the highest indexes by subject thinking ($Me=9.00$). The centers have the highest indexes by symbolic thinking ($Me=7.50$). The center-halves have the highest indexes by logical thinking ($Me=9.50$). The lines have the highest indexes by visual thinking ($Me=9.00$). The lines also have the highest indexes by creative thinking ($Me=9.00$). The obtained results can be explained by the fact high indexes of subject and logical thinking in the fullbacks, centers and center-halves are determined by educational-training process. A high level of the development of the above types of thinking is a technological construct of a team game. The fact that high levels of visual and creative thinking of lines are determined by the situation of development which encourages athletes to play in attack through achievement of a desirable image and unconventional creative thinking is of special scientific interest. Achievement of a desirable image encourages the development of visual thinking through differentiation, operationalization and construction of an achievement algorithm. Other scientists, having a similar opinion, think that handball players’ inclination to abstraction contributes to realization of complex tactical combinations (Strykalenko et al., 2020). The obtained empirical results allow stating that there are statistically significant differences by the basic game roles in the parameters of tactical thinking and the parameters of the handball players’ competitiveness. The juniors have a well-formed and differentiated style of tactical thinking and indexes by the parameters of competitiveness, at the same time it can be interpreted as a zone of the near development. We think that operationalization of the obtained empirical results of tactical thinking and competitive activity of junior female handball players by the basic game roles possess scientific novelty. The study found a considerable number of scientific facts which should be introduced into educational-professional activity of women’s handball teams.

Conclusions

1. Operationalization of tactical thinking and the parameters of competitive activity of junior female handball players demonstrates an efficient solution to game situations with regard to the basic game roles. The development of indicators of tactical thinking can increase efficiency of managing handball players’ sporting activities.

2. Statistically significant differences ($p<.050$; $p<.010$; $p<.001$) by the Kruskal–Wallis H-test by all the types of tactical thinking were registered: subject thinking (SbTh), symbolic thinking (SmTh), logical thinking (LgTh), visual thinking (VsTh) and creative thinking (CrTh) of junior handball players by the basic game roles.

3. Statistically significant differences ($p<.050$; $p<.010$; $p<.001$) by the Kruskal–Wallis H-test by all the parameters of competitiveness were found: the coefficient of a player’s intensity (CPI), evaluation of a player’s activeness (EPA), the coefficient of passing accuracy (CPA), fault of tactical-technical actions (FTTA), the coefficient of a player’s efficiency (CPE), the coefficient of a player’s reliability (CPR) and a complex indicator of competitive activity (CICA) of junior female handball players by the basic game roles.

4. It was found and substantiated that the most important types of handball players’ thinking in the context of competitive activity are: logical thinking – four statistically significant correlations ($p<.050$) with the parameters of competitiveness (CPA; CPE; CPR; CICA); creative thinking – three statistically significant correlations ($p<.050$; $p<.010$) with the parameters of competitiveness (CPA; CPE; CICA) and subject thinking – two statistically significant correlations ($p<.050$) with the parameters of competitiveness (CPA; CPR).

5. We think that the obtained high indexes of subject and logical thinking of fullbacks, centers and center-halves are determined by educational-training process. A high level of the development of the above types of thinking is considered to be a technological construct of a team game. Attention was paid to high levels of visual and creative thinking of lines which are determined by the situation of development that encourages athletes to play in attack through achievement of a desirable image and unconventional goals.
6. It was generalized that the obtained empirical results of tactical thinking and competitive activity of junior handball players by the basic game roles possess scientific novelty. The study found a considerable number of scientific facts which should be introduced into educational-professional activity of women's handball teams.

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