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Relationship between Logical Ability and Tactical Understanding in Women's Soccer

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Abstract In soccer, techniques, followed by situational judgment, heavily influences victory or defeat. Logical ability in sports is thought to be associated with situational judgment, coupled with the judgment of individual players and the general manager's tactical understanding. This study aims to examine the factors related to understanding the coach's tactical strategies from the perspective of logical ability. The study surveyed 52 university students and 16 high school students belonging to soccer clubs for women. We evaluated players' level of understanding regarding the coach's tactics through video tasks. The students were then classified into high-, middle-, and low rank groups in depending on their scores. Further, the study examined the difference in factor scores among the groups by using an evaluation scale designed to measure logical ability in sports. The results highlighted that the factor scores for logical ability in terms of analysis, discovery, explanation, and communication were significantly higher for the high- and middle rank groups compared. Moreover, the low rank group exhibited low levels for "speed of judgment on the flow of the game" and "willingness to share ideas with teammates," suggesting that these aspects significantly influence tactical understanding.

Keywords: *psychological approach, video task, coaching, judgement, communication*

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1. Introduction

In modern soccer, team tactics have considerably evolved with the dissemination of competition and environmental improvements [1]. To focus on the average total score of both FIFA World Cup teams per game from 1930 to 2018, it was 3.9 in the 1930 Uruguay Games, under 3 in the 1962 Chile Games, and dropped to a score of 2.6 in the Russia Games [2]. These statistics demonstrate the difficulty of scoring in modern soccer due to fewer shots on the goal compared against sports with high scores. Strategically, it is prudent to take the ball into the area close to the opposing goal and increase the number of shots with improved accuracy [3]. In general, the number of goals and shots and penetration into the attacking side, are considered indicators of the attack's effectiveness [4]. In soccer, competitions consist of open skills, where players are required to anticipate rapidly changing conditions and select best play strategies [5]. Specifically, tactics and strategies are factors that are strongly associated with the team's performance and accomplishments [6], and a high level of tactical understanding is indispensable if the players wish to perform well.

Therefore, to raise scores, in addition to individual acumen, players need a shared understanding of tactics as a group, and all players need to understand their coach's intentions and tactics. When it comes to tactical understanding, game performance analysis and investigation of gaze behavior provide an objective understanding of tactical phenomena. In recent years, however, psychological approaches have been employed to improve player mindset and resilience. For example, if the coach and the player do not agree with each other during the game, there may be a decrease in the player's participation opportunity, excessive guidance to make the player understand, and criticism of the player against the coach. For this reason, psychological support to enhance the ability to think and improve player tactical understanding will positively impact team victory and build solid team relationships. Clarifying the factors associated with the superiority or inferiority of tactical understanding can help support players psychologically.

This study examines the factors affecting soccer players' understanding of coaching tactics.

2. Method

2.1. Subject

The study surveyed 68 players including those from the top team (Team-T; n = 31, 19.3± 1.5 yr), second team (Team-S; n = 21, 18.1± 2.1 yr), and students in high school belonging to subordinate organizations, i.e., "Youth team" (Team-Y; n = 16, 17.3± 2.0 yr). A coach with 15 years of experience, who also served as the overall club general manager for Team-T, was additionally requested to participate in the questionnaire survey. Before undergoing the following survey, each subject or their parent received an adequate explanation about the contents and purpose of the study and then provided written consent. The experimental protocol of this study was approved by the Research Ethics Review Committee for human subjects at the Fukui University of Technology (2021-4).

2.2. Level of Tactical Understanding

The survey presented 37 scenarios (Table 1) that the general manager regarded as future challenges. Each scenario lead to three options, with each option assigned a score from 3 ("highest") to 1 ("lowest"), corresponding to the order of the options that were closest to the tactics sought by the general manager. Each scenario refers to items presented by the Japan Football Association for coaches (Table 2). Furthermore, sufficient time was given to respond to the challenges and the final scores were checked for incomplete responses. The total score (range: 37-111 points) was calculated, where a higher value connoted to a greater understanding of the general manager's tactics.

Table 1. Video Task

Question				Options		
ID	Time	Score	Scene	A	B	C
1	First	0-0	a	FW (10) approaches opponent DF	FW (7) approaches opponent DF	Don't move from the spot
2	First	0-0	c	Approaches Opponent WG (13)	Don't move from the spot	Down while the kick
3	First	0-0	d	FW (10) approaches opponent DF	FW (9) approaches opponent DF	Don't move from the spot
4	First	0-0	d	Pass to MF (14)	Pass to the front of DF (11)	Pass to the foot of the DF (11)
5	First	0-0	d	Through pass to FW (9)	Back pass to DF (4)	Pass to FW (10)
6	First	0-0	a	DF (11) approaches opponent SB	FW (7) approaches opponent SB	Don't approach
7	First	0-0	f	Dribble into the penalty area	Kick the cross ball	Switch back and back pass
8	First	0-0	h	Short corner	Far side	Near side
9	First	0-0	c	Two Defenses go down	DF (6) approaches opponent MF	Don't move from the spot
10	First	0-0	b	Pass to DF (6)	Pass to DF (5)	Long pass to FW (10)
11	First	0-0	e	DF (6) approaches opponent MF	FW (9) approaches opponent MF	Don't approach
12	First	0-0	g	Dribble	Through pass to FW (9)	Switch back and back pass
13	First	0-0	b	Pass to FW (7)	Turn forward	Through pass to RMF
14	First	0-0	d	Through pass to FW (10)	Put a pass in the vertical space	Pass to the foot of the FW (9)
15	First	0-0	i	Through pass to FW (7)	Dribble	Through pass to FW (10)
16	First	0-0	f	Shoot	Pass to MF (8)	Pass to FW (10)
17	First	0-0	d	Switch back and back pass	Pass to MF (8)	Pass to FW (7)
18	First	0-0	f	Shoot	Cross ball to the center	Switch back
19	First	0-0	d	Back pass	Long pass to FW (9)	Side change to the right
20	First	0-0	f	Switch back and back pass to CB	Trough pass to LWG (11)	Pass to FW (10)
21	First	0-0	d	Switch back and pass to CB	Pass to DF (5)	Long pass to RMF (14)
22	First	0-0	f	Pass to FW (7)	Pass to FW (10)	Pass to MF (23)
23	First	0-0	a	MF (23) approaches opponent MF	FW (10) approaches opponent MF	Don't approach
24	First	0-0	c	FW (7) approaches opponent MF	FW (10) approaches opponent MF	MF (8) approaches opponent MF
25	First	0-0	f	Switch back and back pass	Side change to the Left	Dribble
26	First	0-0	i	Switch back and back pass	Dribble	Long shoot
27	Second	0-0	d	Pass to MF (14)	Pass to DF (4)	Long pass to SB (11)
28	Second	0-0	c	Go down diagonally	Approaches opponent FW	Don't approach
29	Second	0-0	c	Through pass to MF (14)	Dribble	Pass to FW (10)
30	Second	0-0	e	Approach while watching the movement of opponent FW	Go to Approach the ball	Don't approach
31	Second	0-0	b	Return pass	Pass to CB	Side change to the Left
32	Second	0-0	j	Go steal the ball	Steal the ball by sliding	Delay the attack
33	Second	0-0	a	FW (10) approaches opponent DF	FW (9) approaches opponent DF	Don't approach
34	Second	0-0	h	Pass to MF (23) quickly	Pass to DF (6)	Long kick
35	Second	0-0	f	Pass to (13)	MF (14) Through pass to FW	Pass to MF (23)
36	Second	0-0	f	Pass to FW (10)	Pass to FW (7)	Switch back and back pass
37	Second	0-0	c	MF (14) approaches opponent DF	FW (9) approaches opponent DF	Don't approach

Table 2. Video classification

ID	Scene
a	Improvement in defending from a high position
b	Improvement in build up (against defense from a high position)
c	Improvement in defense in seizing the ball in midfield
d	Improvement in attack with respect to defense in which the ball is seized in midfield
e	Improvement in retreat to a defensive position
f	Improvement in attack with respect to retreat to a defensive position
g	Improvement in counter attack (after withdrawing into your own team)
h	Set play
i	Short counter
j	Counter measure

Note) H, I, J: Created by the author.

Table 3. The mean difference among groups for age, Video point and career

	A: Superior				B: Middle				C: Inferior				ANOVA		
	M	SD	MAX	MIN	M	SD	MAX	MIN	M	SD	MAX	MIN	F	p	Post-hoc
Age	19.3	1.5	21	18	18.1	2.11	22	15	17.1	2.0	22	15	7.86*	0.001	B, C < A
Video point	97.2	2.1	102	95	91.5	1.9	94	88	79.2	5.5	87	71	159.8*	0.001	C < B < A
Career	11.5	2.9	15	5	10.9	3.8	16	2	9.9	3.2	15	3	1.22	0.30	

Note) *: $p < 0.05$.

Table 4. Evaluation Scale for Logical Ability in Sports

Factors	ID	Items
Analysis and discovery	1	Can find areas in need of improvement in one's own performance.
	2	Can compare and self-analyze personal performance with others.
	3	Can analyze and understand the strengths and weaknesses of other players.
	4	Can think about the causes of failure and connect them to success.
	5	Can analyze reasons mistakes were made in personal or others' performance.
	6	Can apply one's strengths to the benefit of the team.
	7	When working with teammates, finds ways of cooperating according to one's role.
	8	Can find areas needing improvement as a team.
	9	Can take the advice of others and incorporate it in practice.
	10	Can think of the differences between personal and top player performance and use them to improve personal practice.
	11	Can choose the appropriate practice method from multiple practice choices per personal and team priorities.
Thinking and judgment	12	Can judge calmly even in difficult situations.
	13	Can quickly determine the flow of the game.
	14	Can make accurate decisions where important.
	15	Can minutely think about things.
	16	Can systematically think about complex issues.
	17	Communicates thoughts and feelings in an easy-to-understand manner.
Explanation and communication	18	Can verbalize emotions clearly and effectively.
	19	Can think and discuss with teammates until they are convinced.
	20	Can deepen teammates' understanding and motivate them to follow a course of direction.
	21	Can discuss and share thoughts with teammates.
	22	Can explain with conviction to convince teammates.

2.3. Scale for Evaluation of Logical Ability in Sports

This study used the evaluation scale for logical ability in sports created by Suzuki and Kikkawa [7] to assess player thinking ability. This scale consists of 22 items for three factors (Table 4): the ability for analysis and discovery (11 items), thinking and judgment ability (5 items), and explanation and communication ability (6 items). All responses were recorded on a 5-point Likert scale of "not applicable," "not very applicable," "neither," "somewhat applicable," and "applicable." The evaluation variables were the total score and each factor score, and the higher the value, the greater the logical ability in sports activities. Furthermore, as Lie Scale, the same item was set for one question, and the data of one person (top team) who gave different answers for both questions were excluded.

2.4. Statistics Analysis

The unpaired one-factor ANOVA was used to examine the difference in the scores and Tukey's HSD method was used to test for significant differences.

The study investigated the difference among groups in terms of the median values of each item in the aforementioned scale using the Kruskal–Wallis H-test, whereas the Mann–Whitney U-test was used to determine

significant differences. The significance level was set to 5%, which was tested using the Bonferroni method.

3. Results

Table 5 presents the total scores for the three groups, the basic statistics for each factor score, and the analysis results. The study observed significant differences in the total score and the scores for analysis, discovery, explanation, and communication. For all abilities, the scores for the high and middle rank groups were significantly higher.

Table 6 illustrates the frequency, relative and median values, and results for each item in the three groups. We noted significant differences between ID 13 and ID 21, whereas the median values for both were significantly higher for the high and middle rank groups.

4. Discussion

Team-T and Team-S comprised of university students and were categorized according to their comprehensive abilities. Alternatively, Team-Y was made up of high school students under the age of 18. The coach for each team-taught tactics, whereas the coach for Team-T was involved in teaching tactics as the general manager. As a result of evaluating the level of tactical understanding used by the general manager, based on the score of the video task (maximum 111 points), the target persons were classified into three groups. The average score values for each group and the standard deviation for the high rank group (97.2 ± 2.1 points), middle rank group (91.5 ± 1.9 points), and low rank group (79.2 ± 5.5 points The rate of correct responses for the high- and middle rank groups was more than 80% (87.6% and 82.5%, respectively), which can be interpreted as an exhibition of high levels of tactical understanding of the general manager (low rank group:71.2%). Furthermore, in terms of the breakdown of teams belonging to each group, the high rank group displayed a large percentage of Team-T players (T: 63.0%, S: 50.0%, Y: 15.8%), whereas the middle rank group (T: 25.9%, S: 27.3%, Y: 42.1%) and low rank group (T: 11.1%, S: 22.7%, Y: 42.1%) had a large percentage of Team-Y player. In other words, Team-T, which was frequently involved with the general manager, tended to have a high level of understanding of tactics.

This study hypothesized that differences exist in the knowledge of soccer and daily efforts between players with and without high levels of tactical understanding of the general manager. However, no significant difference was observed between the high- and middle rank groups. Thus, the hypothesis was partially rejected. Ericsson et al [8] stated that many experts with excellent techniques have practiced zealously for 10,000 h across 10 years until the age of 20. In other words, a certain level of competitive experience is required to acquire a certain level of expertise. The competitive history of the high- and middle rank groups is at the same level (Table 3) with an average value of 10 years or more. Furthermore, Team-S showed signs of progression toward becoming Team-T; thus, many players are motivated to improve their performance as well as their tactical understanding. Alternatively, improving the level of tactical understanding designed by their general managers is essential for Team-T players to achieve goals, such as acquiring and increasing opportunities to play in matches and winning championships. Therefore, the study proposed that the level of understanding of the tactics of the general manager reached more than 80% for the high and middle rank groups, which were composed of several Team-T and Team-S players.

Petiot et al. [9] reported that athletes with extensive competitive experiences exhibit more effective tactical knowledge (e.g., the ability to judge what elements to include in practice and how to respond to specific situations) compared with those without such knowledge. David et al. [10], who focused on soccer players under the age of 15, argued that players with good performance assume right positions near those in possession of the ball and take subsequent actions after attack and defense. Conversely, players who do not perform well typically assume positions and take actions away from those in possession of the ball. Furthermore, Joao et al. [11] conducted a study on youth soccer players and found that players with excellent decision-making ability comprehend the information necessary for tactics and select accurate tactics within a shorter time than those without this ability. Vaeyens et al. [12] mentioned that players with good decision-making skills emphasize strategies to create scoring opportunities; thus, they shorten tactical decision-making time and demonstrate excellent performance. Therefore, the current study infers that in terms of logical ability in sports, the low rank group displayed an inferior ability for analysis, discovery, explanation, and communication due to its low levels of expertise and understanding of positioning and movement.

Regarding the median value of ID 21 for explanation and communication (sharing ideas with teammates after discussion), the high and middle rank group obtained a 4 (relatively applicable), whereas the low rank group reached a 3 (cannot say which). Furthermore, the ratio of players who responded with 4 or 5 (applicable) was more than 58% for the high and middle rank groups, but less than 38% for the low rank group. Conversely, despite the lack of a significant difference among groups in terms of the factor scores for cognition and judgment, no significant differences were noted for ID 13 (the flow of the game can be judged quickly) associated with it. ID 13 and ID 21 exhibited the same median value of 4 for the high and middle rank groups in contrast with a score of 3 for the low rank group. Furthermore, the ratio of players who responded with 4 or 5 was more than 83% for the high and middle rank groups but less than 25% for the low rank group. These results indicate that the low rank group exhibited slower judgment in regard to the flow of the game and the members were less willing to share ideas with their teammates. Mental fatigue in soccer players can lead to poor technical and tactical performance [13], whereas negative thinking before performance reduces the ability to properly judge the play [14]. In addition, communication within the team influences motivation, concentration, and tactics, among others [15]. On the basis of these discussions, the study suggests that psychological factors influence the aforementioned cognition and

judgment (ID 13) and explanation and communication (ID 21). As such, continuous psychological support is required to improve these capabilities.

The video tasks created by the study can be used for post-match feedback. Thus, they are considered an effective means for increasing tactical understanding designed by the general manager. This information is also valuable for players who are frequently less involved with the general manager. Furthermore, video tasks can assist in the tactical understanding of teams for universities and high schools, where entrance and graduation events occur annually.

Table 5. Basic statistical values of each score in the Logical ability in sports, and analysis results

	A: Superior				B: Middle				C: Inferior				ANOVA	
	M	SD	MAX	MIN	M	SD	MAX	MIN	M	SD	MAX	MIN	F	p
Total	79.4	12	103.0	41.0	80.1	10.2	96.0	64.0	69.1	8.7	85.0	55.0	5.90*	0.15
Analysis and discovery	43.0	6.03	55.0	25.0	42.8	4.73	50.0	34.0	37.1	5.8	50.0	25.0	6.66†	0.17
Thinking and judgment	19.0	3.68	25.0	9.0	19.8	4.14	27.0	13.0	17.6	1.9	22.0	15.0	1.88	0.05
Explanation and communication	17.4	3.4	230	7.0	17.5	3.08	22.0	11.0	14.5	2.8	19.0	8.0	5.33†	0.14

Note) *: $p < 0.05$, †: $p < 0.05/3 = 0.017$.

Table 6. Frequency and relative value, median value, and test result of each item in the Logical ability in sports evaluation scale

		A: Superior						B: Middle						C: Inferior						H-test	
ID		1	2	3	4	5	M	1	2	3	4	5	M	1	2	3	4	5		χ^2	p
1	n	1	1	5	18	6	4	0	1	5	12	3	4	0	2	7	7	0	3	6.77	0.034
	%	3.2	3.2	16.1	58.1	19.4		0.0	4.8	23.8	57.1	14.3		0.0	12.5	43.8	43.8	0.0			
2	n	0	4	9	16	2	4	0	3	4	12	2	4	0	3	6	6	1	3	1.49	0.474
	%	0.0	12.9	29.0	51.6	6.5		0.0	14.3	19.0	57.1	9.5		0.0	18.8	37.5	37.5	6.3			
3	n	1	8	15	7	0	3	1	5	5	9	1	3	2	5	8	1	0	3	5.14	0.077
	%	3.2	25.8	48.4	22.6	0.0		4.8	23.8	23.8	42.9	4.8		12.5	31.3	50.0	6.3	0.0			
4	n	0	6	16	8	1	3	1	4	7	8	1	3	0	4	10	2	0	3	1.87	0.393
	%	0.0	19.4	51.6	25.8	3.2		4.8	19.0	33.3	38.1	4.8		0.0	25.0	62.5	12.5	0.0			
5	n	1	7	13	9	1	3	2	1	9	7	2	3	0	5	10	1	0	3	4.48	0.106
	%	3.2	22.6	41.9	29.0	3.2		9.5	4.8	42.9	33.3	9.5		0.0	31.3	62.5	6.3	0.0			
6	n	1	12	13	5	0	3	1	5	8	6	1	3	0	6	10	0	0	3	2.80	0.246
	%	3.2	38.7	41.9	16.1	0.0		4.8	23.8	38.1	28.6	4.8		0.0	37.5	62.5	0.0	0.0			
7	n	1	5	12	12	1	3	0	6	4	8	3	4	0	3	10	3	0	3	1.80	0.406
	%	4.0	16.1	38.7	38.7	3.2		0.0	28.6	19.0	38.1	14.3		0.0	18.8	62.5	18.8	0.0			
8	n	2	2	12	13	2	3	0	4	8	8	1	3	0	4	8	4	0	3	2.51	0.285
	%	6.5	6.5	38.7	41.9	6.5		0.0	19.0	38.1	38.1	4.8		0.0	25.0	50.0	25.0	0.0			
9	n	2	8	12	8	1	3	1	4	8	7	1	3	1	5	10	0	0	3	4.04	0.133
	%	6.5	25.8	38.7	25.8	3.2		4.8	19.0	38.1	33.3	4.8		6.3	31.3	62.5	0.0	0.0			
10	n	0	2	5	15	9	4	0	0	2	14	5	4	0	2	5	5	4	4	2.12	0.346
	%	0.0	6.5	16.1	48.4	29.0		0.0	0.0	9.5	66.7	23.8		0.0	12.5	31.3	31.3	25.0			
11	n	0	3	10	15	3	4	0	2	6	10	3	4	0	4	5	7	0	3	2.88	0.237
	%	0.0	9.7	32.3	48.4	9.7		0.0	9.5	28.6	47.6	14.3		0.0	25.0	31.3	43.8	0.0			
12	n	1	1	13	14	2	4	0	2	9	10	0	3	0	4	10	2	0	3	8.32	0.016
	%	3.2	3.2	41.9	45.2	6.5		0.0	9.5	42.9	47.6	0.0		0.0	25.0	62.5	12.5	0.0			
13	n	1	0	4	18	8	4	0	0	3	13	5	4	0	3	9	4	0	3	19.22‡	0.000
	%	3.2	0.0	12.9	58.1	25.8		0.0	0.0	14.3	61.9	23.8		0.0	18.8	56.3	25.0	0.0			
14	n	0	1	5	17	8	4	0	1	4	14	2	4	0	0	8	7	1	4	5.63	0.060
	%	0.0	3.2	16.1	54.8	25.8		0.0	4.8	19.0	66.7	9.5		0.0	0.0	50.0	43.8	6.3			
15	n	0	0	3	21	7	4	0	0	2	13	6	4	0	2	6	5	3	4	6.40	0.041
	%	0.0	0.0	9.7	67.7	22.6		0.0	0.0	9.5	61.9	28.6		0.0	12.5	37.5	31.3	18.8			
16	n	0	2	8	15	6	4	0	0	8	10	3	4	0	1	8	6	1	3	2.78	0.249
	%	0.0	6.5	25.8	48.4	19.4		0.0	0.0	38.1	47.6	14.3		0.0	6.3	50.0	37.5	6.3			
17	n	0	1	8	15	7	4	0	1	6	11	3	4	0	2	7	6	1	3	4.46	0.108
	%	0.0	3.2	25.8	48.4	22.6		0.0	4.8	28.6	52.4	14.3		0.0	12.5	43.8	37.5	6.3			
18	n	0	1	7	17	7	4	0	0	5	13	3	4	0	0	9	5	2	3	3.36	0.187
	%	0.0	3.2	22.6	54.8	22.6		0.0	0.0	23.8	61.9	14.3		0.0	0.0	56.3	31.3	12.5			
19	n	0	0	7	17	7	4	0	0	4	12	4	4	1	0	9	5	1	3	9.30	0.010
	%	0.0	0.0	22.6	54.8	22.6		0.0	0.0	19.0	57.1	19.0		6.3	0.0	56.3	31.3	6.3			
20	n	0	4	8	15	4	4	0	4	6	6	5	4	1	3	9	2	1	3	5.65	0.059
	%	0.0	12.9	25.8	48.4	12.9		0.0	19.0	28.6	28.6	23.8		6.3	18.8	56.3	12.5	6.3			
21	n	1	0	3	18	9	4	0	1	5	12	3	4	0	4	6	5	1	3	12.25‡	0.002
	%	3.2	0.0	9.7	58.1	29.0		0.0	4.8	23.8	57.1	14.3		0.0	25.0	37.5	31.3	6.3			
22	n	1	0	2	18	10	4	0	1	3	12	5	4	0	2	5	9	0	4	10.57	0.005
	%	3.2	0.0	6.5	58.1	32.3		0.0	4.8	14.3	57.1	23.8		0.0	12.5	31.3	56.3	0.0			

Note) ‡: $p < 0.05/22 = 0.0023$, M = Median.

5. Conclusion

Players with low levels of understanding about the tactics of general managers lack the following abilities: analysis, discovery, explanation, and communication. In addition, they tend to exhibit slow judgment on the flow of the game and experience issues with sharing ideas with teammates.

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None.

Conflict of Interest Statement

The authors declare no conflicts of interest associated with manuscript.

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