

# Student Performance Analysis in Volleyball Learning: The Use of a Modified Volleyball Information System Application

Yunyun Yudiana\*, Sucipto, Yusuf Hidayat, Burhan Hambali

Physical Education, Health and Recreation Study Program, Faculty of Sport and Health Education,  
Universitas Pendidikan Indonesia, Bandung, Indonesia

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**Abstract** This study aimed to analyze the performance of students in volleyball learning by using the Modified Volleyball Information System assessment. This research used the quantitative descriptive method. A total of 99 male students with an age range of 15-18 years (Mean=17.04, SD=0.67) were involved in learning the game of volleyball at the high school level (SMA) in Bandung, Indonesia. The research instrument was a Modified Volleyball Information System application that measures six basic volleyball skills in the playing process, namely service, receive, set, spike, block, and dig. The results of the analysis prove that the student's performance in performing volleyball skills can be described by the percentage of success ranging from 36% to 90%, while the percentage of failure ranges from 10% to 64%. In addition, there was a positive correlation between basic skill scores and the overall score obtained by students after completing the game. Based on the analysis results, it can be concluded that using the Modified Volleyball Information System application in volleyball learning can be one of the parameters to see students' abilities in carrying out movement tasks. The use of a Modified Volleyball Information System in the context of volleyball learning in schools can be an alternative assessment used by teachers, so that teachers can provide direct feedback to students about the learning outcomes that have been implemented.

**Keywords** Volleyball Information System, Volleyball

Learning, Volleyball Basic Skills, Performance Assessment

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## 1. Introduction

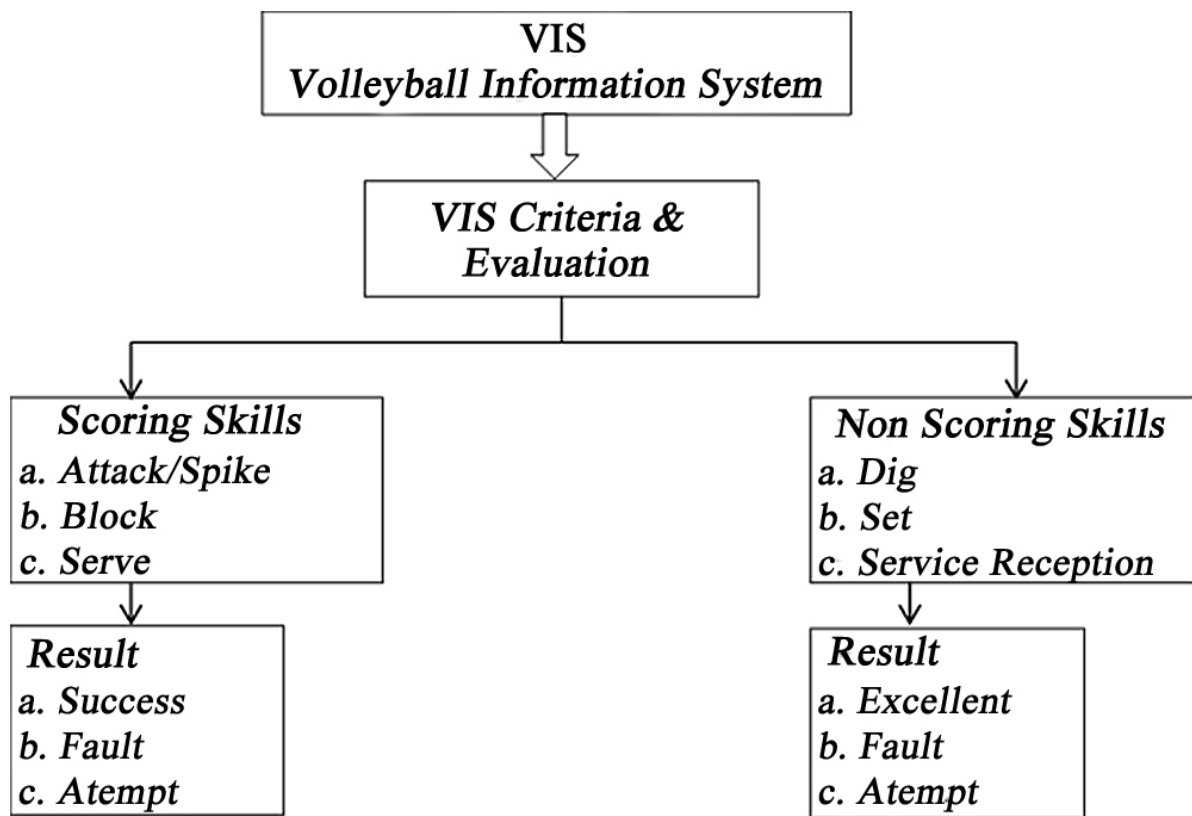
Volleyball is one of the most popular sports in the world [1]. This is evidenced by the number of championships held both multi-event and single-event in various countries, one of which is the Olympics [2]. At a practical level, volleyball is assumed to be a complex sport [3], involving various basic technical skills such as service, receive, set, spike, and block, as well as team tactics developed through attack and defense strategies while playing to score points [4-6]. Therefore, the athlete's ability to master basic volleyball skills is one of the indicators to achieve the best results when playing [7,8].

To achieve maximum performance in training and games, it is necessary to carry out an in-depth analysis process related to athlete skills [9,10]. Likewise in volleyball, the analysis of the athlete's performance in playing is one of the most important indicators in the game [11,12]. One of those indicators is by analyzing the success and failure in performing skills through the Volleyball Information System (VIS) program. VIS is an information system built to be used to support the implementation of

volleyball matches [13], including statistics for each individual player and team [14]. The VIS program was developed with the aim of providing an assessment of the athlete's performance while playing. At the implementation level, VIS has six assessment criteria, namely evaluation of the attack, evaluation of the block, evaluation of the serve, evaluation of the dig, evaluation of the set, and evaluation of the service reception [14]. The six assessment criteria are based on the actual volleyball game criteria and are stated in the software that has been developed. The scoring technique uses a checklist with three categories of scoring results, namely success, fault, and attempt [14]. The Success category is given when the athlete succeeds in hitting the punch technique, the fault category is given when the athlete does not succeed in the punch technique, while the attempt is given when the athlete succeeds in the punch technique and manages to defeat his opponent so that points are gained for his team. The following basic VIS concepts are outlined in Figure 1.

Analysis of volleyball matches using VIS in volleyball matches has become an interesting issue in recent years.

This is evidenced by several previous research results. [15] conducted an analysis of performances in scoring points at the 2005 World Championships, and correlated the results of the performance analysis with the team's final ranking in the championship. Valladares, García-Tormo & João [16] analyzed the skills that can influence the losses and wins in women's volleyball matches at the world championships. Costa et al. [17] analyzed the relationship between the effect of attacks carried out, as well as the effect of serving reception, attack tempo, and type of attack in the 2014-2015 Super League volleyball match in Brazil. Apriyanto & Ilham [18] analyzed the relationship between the opponent's mistakes and the victory of the national volleyball team in the 2019 Peace Cup Participants. Sopa & Szabo [19] analyzed the attack and defense parameters in volleyball games for elite athletes in the Final Four Women CEV Champions League. In addition, Apriyanto, Asmaw, & Hanif [20] analyzed the direct effect of scores on service skills, spikes, blocks, and the opponent's mistakes on the team's victory in the final round of 2019 Proliga Volleyball Championships.



Source: Yudiana, at al. 2020

Figure 1. VIS Conceptual Framework

Based on the results of previous studies, the global issue of volleyball athlete performance analysis is an interesting issue to be further studied. In general, the research that has been done refers to the analysis of skills in supporting the game and scoring points for the team. The analysis refers to the FIVB VIS assessment using the software during the implementation of the championship, both at the national and international levels, on elite athletes in various countries. Therefore, the analysis study became a void found by the researchers, because basically the researchers had not found research results related to the analysis of volleyball performances using VIS modifications in the volleyball learning process at school. This is assumed because basically, volleyball is one of the compulsory subjects contained in Physical Education learning in schools [21], especially in Indonesia. On this basis, in this study, the researcher wanted to see how the percentage of students' skills in playing volleyball is, as well as how much the success of playing skills contributes to the results of playing volleyball in the learning process. Therefore, the main objective of this study is to analyze the student's performance in volleyball learning by using a modified VIS assessment.

## 2. Materials and Methods

### 2.1. Participants

The method used in this research is descriptive quantitative. A total of 99 male high school students (SMA) grade 11 in a school in the city of Bandung, Indonesia, were involved as participants in this study. The age range of the participants was between 15-18 years (Mean=17.04, SD=0.67), with inclusive criteria, they have learned and can play volleyball. All participants were given informed consent before carrying out the research process in the learning process. This is done so that students know that the data generated in the assessment process will be analyzed for research purposes and can be used as direct feedback for teachers and students.

### 2.2. Measures

The instrument used in this study was an observation sheet modified from the VIS instrument. The instrument was developed by Yudiana, Hidayat, Hambali, & Slamet in 2016, measuring six basic skills in playing volleyball by referring to the standard assessment indicators in the VIS program, namely: 1) Service, 2) Receive, 3) Set, 4) Spike, 5) Block and 6) Dig (14,22). The analysis was used to estimate the content validity ratio (CVR) [23,24] based on the judgment of the seven subject meter experts (SME) of academics and 12 of the practitioners. Here's the formula that is applied in the analysis of the CVR.

$$CVR = \frac{M_p - \frac{M}{2}}{\frac{M}{2}} = \frac{2M_p}{M} - 1$$

Note:  $M_p$  = The number of experts who said it was important;  $M$  = number of experts who validate; With the index ranged ratio  $\leq CVR \leq -1 + 1$

Based on the results of the CVR analysis, the values of the content validity ratios of the seven SMEs range from 0.71 to 1.00. The ratio value of 0.71 is obtained for service, reception, attack, block, and dig items, while for item sets, the ratio value is 1.00. In addition, the assessment of 12 of the practitioners obtained a validity ratio value ranging from 0.50 to 1.00 [23]. The rating scale developed using the Guttman scale type with the checklist technique was successfully given a score of 1, while the unsuccessful was given a score of 0. The VIS observation sheet instrument is presented in Tables 1 and 2 below.

Table 1. VIS Observation Sheet

Variable	Skill Indicator	Scoring	
		Successful (1)	Unsuccessful (0)
Skill in Volleyball Playing	Service		
	Receive		
	Set		
	Spike		
	Block		
	Dig		

**Table 2.** VIS Assessment Rubric

Skills Indicator	Assessment criteria	Score
Service	Students are unable to perform skill techniques and are unsuccessful in carrying out their movement tasks when playing	0
	Students are able to perform skill techniques and are successful in carrying out their movement tasks when playing	1
Receive	Students are unable to perform skill techniques and are unsuccessful in carrying out their movement tasks when playing	0
	Students are able to perform skill techniques and are successful in carrying out their movement tasks when playing	1
Set	Students are unable to perform skill techniques and are unsuccessful in carrying out their movement tasks when playing	0
	Students are able to perform skill techniques and are successful in carrying out their movement tasks when playing	1
Spike	Students are unable to perform skill techniques and are unsuccessful in carrying out their movement tasks when playing	0
	Students are able to perform skill techniques and are successful in carrying out their movement tasks when playing	1
Block	Students are unable to perform skill techniques and are unsuccessful in carrying out their movement tasks when playing	0
	Students are able to perform skill techniques and are successful in carrying out their movement tasks when playing	1
Dig	Students are unable to perform skill techniques and are unsuccessful in carrying out their movement tasks when playing	0
	Students are able to perform skill techniques and are successful in carrying out their movement tasks when playing	1

**2.3. Procedures**

Data were collected through the VIS observation sheet instrument in the volleyball learning process at school. The learning scenario is directed at the game learning process or Team Game Tournament [25,26] with the hope that students can focus more on the actual practice of playing volleyball and aim to assess students' abilities in performing basic volleyball skills. Students are divided into six groups or teams facing each other in a match or tournament. The assessment was carried out by four observers who are experts in the field of volleyball. Observations are carried out both directly and through video recordings when students carry out the playing process and display some basic volleyball skills. Before conducting observations, the observers were given training through a workshop to gain some knowledge related to the assessment procedures [27]. The score obtained by students is a combined score from the assessment results during the game process from the beginning to the end of the game during the tournament taking place in one learning meeting.

**2.4. Statistical Analysis**

The data obtained from the observation results are of the type of interval scale. Therefore, the resulting data is analyzed through two techniques, namely 1) descriptive

analysis and 2) correlational analysis [28]. Descriptive analysis was carried out with the aim of seeing the percentage of students' success in displaying basic volleyball skills (Mean and Standard Deviation). In contrast, correlation analysis was used to see the contribution of students' success in displaying basic volleyball skills to overall playing results [16,20], with the type of correlation used in the analysis being the person product moment (PPM). All data obtained from the measurement results were processed and analyzed using IBM SPSS software for windows version 21. The following formulation of PPM correlation analysis is presented as follows:

$$r = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 \sum(y_i - \bar{y})^2}}$$

Note:

r = correlation coefficient

$x_i$  = values of the x-variable in a sample

$\bar{x}$  = mean of the values of the x-variable

$y_i$  = values of the y-variable in a sample

$\bar{y}$  = mean of the values of the y-variable

**3. Results**

There are two main questions set forth in this study, 1)

What is the description of the percentage of students' skills in playing volleyball? and 2) How big is the contribution of success in performing basic skills of volleyball on the results of playing volleyball? Based on these questions, the explanation of the results of this study is divided into two parts: the percentage description of students' performance abilities in playing volleyball and the contribution of skills to the overall results of playing volleyball.

**3.1. Percentage of the Description of Students' Performance Abilities in Playing Volleyball**

To see the description of students' performance ability in playing volleyball, the analysis used is descriptive statistics using the percentage technique. The results of the analysis are presented in table 3.

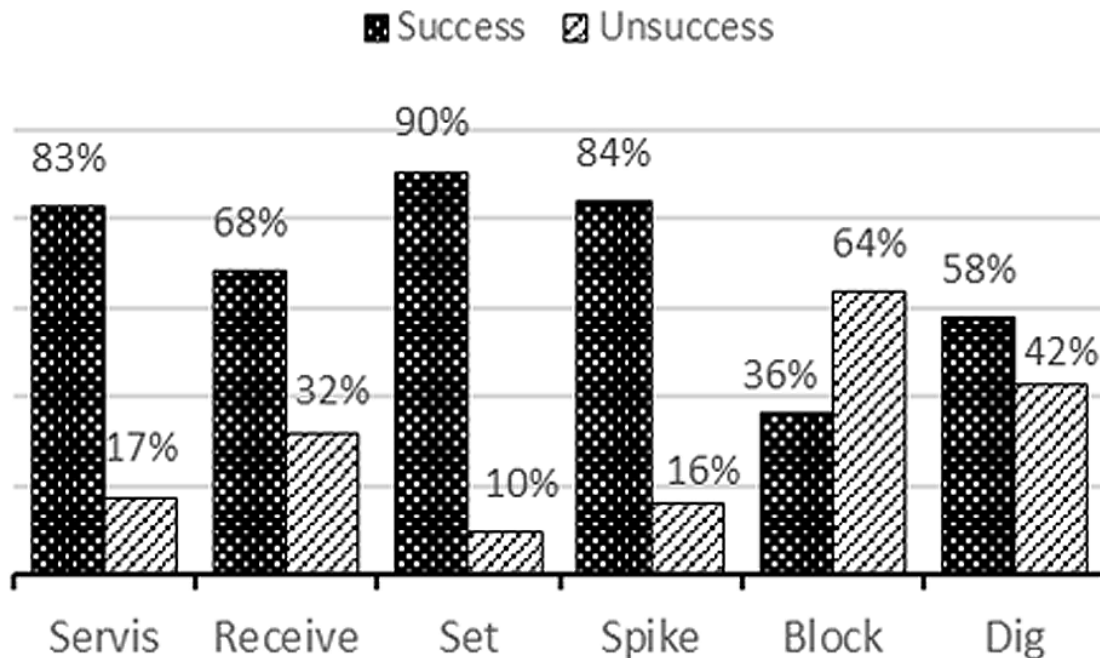
Based on the results of descriptive statistical analysis of skills assessments that were successfully carried out by students, the average score ranged from 0.62 to 3.28. The lowest average score was obtained for block skill (M=0.29; SD=0.67), while the highest average score was obtained for receive skill (M=3.28; SD=2.27). Then, on the results of the statistical analysis of the failure assessment results, the average value ranged from 0.65 to 1.59. The lowest score was obtained in the set skill (M=0.22; SD=1.59),

while the highest score was obtained in the receiving skill (M=1.53; SD=1.59).

The results of the analysis in Figure 1 show the percentage of students' overall performance results. For the six skills measured through the observation sheet, the percentage of success values ranged from 36% to 90%, while the percentage of failures ranged from 10% to 64%. 90% of student success is obtained from set skills and 64% of student failure is obtained from block skills. This means that in the game process, set is one of the skills that many students have successfully done, while block is one of the skills that many students fail to do. The graph of the results of the percentage analysis is presented in Figure 2 below.

**Table 3.** Statistic Description of Scoring Results

Skills	N	Successful		Unsuccessful	
		Mean	SD	Mean	SD
Service	99	3.08	3.10	0.65	0.84
Receive	99	3.28	2.72	1.53	1.59
Set	99	2.11	4.79	0.22	0.53
Spike	99	1.88	2.45	0.36	0.72
Block	99	0.29	0.67	0.52	1.14
Dig	99	0.62	1.31	0.45	0.79



**Figure 2.** Percentage of Students' Performance Analysis Results

### 3.2. Contribution of Skills in Volleyball on the Whole Results of Volleyball Playing

To identify the contribution of service, receive, set, spike, block, and dig skills to the overall success of volleyball playing, the researchers tried to work on multiple correlation analysis. This analysis aimed to examine the relationship between the six basic skills with the overall score generated by students. The results of the analysis are presented in table 4.

**Table 4.** Correlation Analysis Results on Basic Volleyball Skills and Learning Outcomes

Skills		<i>r</i>	<i>p-value</i>	<i>R</i>	<i>R</i> <sup>2</sup>
Service	Playing result	0.50	0.00	0.25	25%
Receive	Playing result	0.42	0.00	0.17	17%
Set	Playing result	0.55	0.00	0.31	31%
Spike	Playing result	0.53	0.00	0.28	28%
Block	Playing result	0.36	0.00	0.13	13%
Dig	Playing result	0.51	0.00	0.26	26%

*r* = Coefficient Correlation; *R*<sup>2</sup> = Coefficient Determination

The results of the analysis in table 4 show the magnitude of the correlation coefficient between basic skills and playing results. All skills have a positive and significant relationship with the results of playing volleyball. The estimated correlation coefficient obtained ranges between *r*=0.36 to *r*=0.55 and is significant at *p*-value 0.00. The magnitude of the determination coefficient obtained ranges between *R* = 0.17 to *R* = 0.31. The lowest coefficient of determination is obtained on the block skill of 13.31% while the highest coefficient of determination is obtained on the set skill of 30.52%.

## 4. Discussion

One of the strategies used in the volleyball learning process is leading to interesting, comfortable and effective learning [29], as well as helping to develop competence in aspects of motor skills and student movement patterns in the learning process through game activities or Team Games Tournament [25,30–32]. This study was conducted to analyze student performance in volleyball learning using VIS assessment.

The results of the analysis of the description of students' skills in playing volleyball show the percentage of success between 36% to 90%, meaning that the achievement of these scores proves that students can implement the six skills assessed in general. Meanwhile, the percentage of failure in performing skills ranges from 16% to 64%. The results of the analysis show that the percentage of success and failure in each skill assessed is varied. This means that the level of difficulty of basic volleyball skills assessed in the game process has different difficulties [31]. In addition,

the set skill or attack pattern in both overhand and underhand passing is one of the most successful skills performed by students, with a percentage of 90% compared to other skills, while the block skill is the skill with the highest percentage of failure, which is 64%.

The achievement of the results obtained by students is one of the interesting findings to study, because basically the six indicator items assessed in the VIS are basic skills in volleyball games that are often measured, namely serving, underhand passing, overhand passing, spikes, and blocks [22,33]. Likewise, in the volleyball learning process, basic skills become one of the indicators of assessment as the achievement of learning objectives in the psychomotor aspect or skills. This refers to the view of [30] which states that learning volleyball in schools can help students develop motor skill competencies and basic movement patterns. In addition, student involvement in volleyball learning is expected to optimize student development and components of physical fitness, as well as motor coordination [21].

The great success of students in performing set skills, both in the underhand pass and overhead pass skills, is assumed because these skills are two of the skills that are widely learned during the learning process [34,35]. In addition, the implementation of this research is directed at learning Team Game Tournament, namely how students are directed to the implementation of the real volleyball game in the context of learning, so that in the implementation, students feel happy to perform better skills when they are playing [25,26,31].

The results of this study support the studies related to the analysis of playing volleyball performances in the context of research using the VIS instrument [28,36–40]. However, the results of the achievement of skills success in this study are not in line with the research conducted by Valladares, García-Tormo, & João [16], which proves that service skill is one of the skills with the highest percentage of success. The difference in the results is based on the assumption of differences in the participants involved in the study, because Valladares et al. [16] conducted research on female athletes who competed at the 2014 FIVB World Championship in Italy. Even in the context of the development of modern volleyball, service is one of the skills that possibly start a team's attacking move in the competition [41]. Meanwhile, this research was conducted on 11th-grade male students in the context of learning at school. Students' success in performing set skills is assumed because these skills are widely taught in learning contexts [34,35]. Whereas, in the context of the actual match, the success of players in doing service is the most important part of creating a rally in a game and scoring points for the team's victory [16].

The results of the correlation coefficient analysis between basic skills and overall play results show a positive and significant relationship. This proves that the basic skills performed by students have an impact on the results of playing volleyball. The contribution of skills to

the results of playing volleyball is evidenced by the value of the correlation coefficient ranging from 0.13 to 0.31, meaning that the success of the basic skills produced by students has an impact on the results of playing volleyball. The magnitude of the correlation coefficient is strengthened by the value of R Square or the amount of the percentage contribution, which is between 3.31% and 30.52%, with an average contribution of 23% for all skill items. This shows that the six skills are assessed to provide a significant contribution of 23% to the overall results of playing volleyball, while the remaining 77% of the results of playing volleyball in the learning process are influenced by other factors. Based on these results, it can be assumed that volleyball is a complex game sport and requires technical and tactical skills to support the course of the game [4].

These findings are part of the findings that support the research of Drikos, Kountouris, Laios, & Laios [42], which analyzed the relationship between service and attack skills on the winning points. In general, the findings of this study illustrate that service and attack are the most important parts to win the match, as well as good predictors to win the match and earn points. It is similar to the research conducted by Pridal, Toporova, & Priklerova [43], which proves that there is a relationship between the success of serving with the victory of the rally in the match. The magnitude of the correlation relationship generated statistically obtained the value of  $r = 0.66230$ ;  $p < 0.05$ . The results of research that have been carried out previously illustrate that a series of skills in playing volleyball contributes to every condition of playing volleyball, both during the attack process and the defense process [2]. Set and spike are skills that contribute to the creation of points when carrying out an attack, while block and dig are skills that contribute to making points during a state of defense pattern [44].

## 5. Conclusions

The Modified VIS application in volleyball learning is one of the parameters to see the student's ability to carry out the assigned motion task. This is evidenced by the achievements produced by students through an analysis of the success of doing service, receive, set, spike, block, and dig skills which show a significant level of success and contribute to success in playing volleyball. Therefore, the use of VIS modifications in the context of volleyball learning at school can be an alternative assessment used by teachers, so that they can provide direct feedback to students about the learning outcomes that have been implemented.

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## REFERENCES

- [1] Verhagen EALM, Van Der Beek AJ, Bouter LM, Bahr RM, Van Mechelen W. A one season prospective cohort study of volleyball injuries. *Br J Sports Med.* 2004;38(4):477–81. DOI:10.1136/bjism.2003.005785.
- [2] Yiannis L, Panagiotis K. Evolution in men's volleyball skills and tactics as evidenced in the Athens 2004 Olympic Games. *Int J Perform Anal Sport.* 2005;5(2):1–8. DOI:10.1080/24748668.2005.11868322.
- [3] Wasser JG, Tripp B, Bruner ML, Bailey DR, Leitz RS, Zaremski JL, et al. Volleyball-related injuries in adolescent female players: an initial report. *Phys Sportsmed [Internet].* 2020;00(00):1–8. Available from: <https://doi.org/10.1080/00913847.2020.1826284>.
- [4] Zırhioğlu G. Evaluation of Volleyball Statistics with Multidimensional Scaling Analysis. *Int J Sport Sci Eng.* 2013;07(01):21–5.
- [5] Chiou CC, Lin TM, Liu YT, Su TY, Tsai JC, Pi CL. The effects of volleyball attacking on score points: a case study of 2014 TVL in Taiwan. *34th Int Conf Biomech Sport.* 2016;553–5.
- [6] Pena J, Guerra JR, Busca B, Serra N. Which Skills and Factors Better Predict Winning and Losing in High-Level Men's Volleyball? *J of Strength Cond Res.* 2013;27(9):2487–93. DOI:10.1519/JSC.0b013e31827f4dbe.
- [7] Boichuk R, Iermakov S, Nosko M, Kovtsun V. Special aspects of female volleyball players' coordination training at the stage of specialized preparation. *J Phys Educ Sport.* 2017;17(2):884–91. DOI: 10.7752/jpes.2017.02135.
- [8] Boichuk R, Iermakov S, Nosko M. Pedagogical conditions of motor training of junior volleyball players during the initial stage. *J Phys Educ Sport.* 2017;17(1):327–34. DOI:10.7752/jpes.2017.01048.
- [9] Francis J, Jones G. Elite rugby union players perceptions of performance analysis. *Int J Perform Anal Sport.* 2014;14(1):188–207. DOI:10.1080/24748668.2014.11868714.
- [10] Afonso J, Mesquita I. Determinants of block cohesiveness and attack efficacy in high-level women's volleyball. *Eur J Sport Sci.* 2011;11(1):69–75. DOI:10.1080/17461391.2010.487114.
- [11] Faizrakhmanov IM, Allanina LM, Talantuly NE. Study of special endurance of young volleyball players of different age groups and its impact on the effectiveness of the performance of certain game actions. *J Phys Educ Sport.* 2017;17(4):2526–30. DOI:10.7752/jpes.2017.04285.
- [12] Lames M, McGarry T. On the search for reliable performance indicators in game sports. *Int J Perform Anal Sport.* 2007;7(1):62–79. DOI:10.1080/24748668.2007.11868388.
- [13] Humski L, Skocir Z. Volleyball Information System. In:

- Proceedings of the 11th International Conference on Telecommunications 2011 (117-124) IE. 2011. p. 2011.
- [14] FIVB. Volleyball Information System. In 2015. Available from: <http://www.fivb.org/en/volleyball/VIS.asp>.
- [15] Marcelino R, Mesquita I, Afonso J. The weight of terminal actions in Volleyball. Contributions of the spike, serve and block for the teams' rankings in the World League 2005. *Int J Perform Anal Sport*. 2008;8(2):1–7. DOI:10.1080/24748668.2008.11868430.
- [16] Valladares N, García-Tormo JV, João PV. Analysis of variables affecting performance in senior female volleyball world championship 2014. *Int J Perform Anal Sport*. 2016;16(1):401–11. DOI:10.1080/24748668.2016.11868895.
- [17] Costa GC, Castro HO, Evangelista BF, Malheiros LM, Greco PJ, Ugrinowitsch H. Predicting Factors of Zone 4 Attack in Volleyball. *Perceptual and Motor Skills*. 2017;124(3):621–33. DOI:10.1177/0031512517697070.
- [18] Apriyanto T, Ilham M. The Correlation between the Opponent's Error with the Team Victory of the Volleyball National Team on 2019 Peace Cup Participants. 2020;407(Sbicsse 2019):158–60. DOI:10.2991/assehr.k.200219.046.
- [19] Sopa IS, Szabo DA. Comparison between Statistical Parameters of Attack and Defence in High Volleyball Performance (Csm Volei Alba Blaj in the Cev Champions League Final Four 2018). *Ser IX Sci Hum Kinet*. 2020;13(62)(1):93–102. DOI:10.31926/but.shk.2020.13.62.1.12.
- [20] Apriyanto T, Asmaw M, Hanif S. The Effect of Scoring Skill and Opponent Errors on the Team Wins of the Final Four Proliga Volleyball Team Participants 2019. *KnE Soc Sci*. 2020;2020:398–415. DOI:10.18502/kss.v4i14.7897.
- [21] Ajayati T. The Learning Model of Forearm Passing In Volleyball for Junior High School. *JETL (Journal of Education, Teaching and Learning)*. 2017;2(2):218. DOI:10.26737/jetl.v2i2.289.
- [22] Marszałek J, Gómez MÁ, Molik B. Game performance differences between winning and losing sitting volleyball teams regarding teams' ability. *Int J Perform Anal Sport [Internet]*. 2018;18(2):367–79. Available from: <https://doi.org/10.1080/24748668.2018.1477027>.
- [23] Y Yudiana, Y Hidayat, B Hambali, S Slamet. Content Validity Estimation of Assessment Instrument Based VIS. *J Phys Conf Ser [Internet]*. 2016;755(1):6–12. Available from: <https://iopscience.iop.org/article/10.1088/1757-899X/180/1/012230/pdf>.
- [24] Yudiana Y, Hidayat Y, Hambali B, Gumilar A, Mudjihartono. Volleyball information system for volleyball performance assessment. *International Journal of Human Movement and Sport Science*. 2021;9(4):94–99. DOI:10.13189/saj.2021.091316.
- [25] Wyk MM van. The Effects of Teams-Games-Tournaments on Achievement, Retention, and Attitudes of Economics Education Students. *J Soc Sci*. 2011;26(3):183–93. DOI:10.1080/09718923.2011.11892895.
- [26] Sgrò F, Barca M, Schembri R, Lipoma M. Assessing the effect of different teaching strategies on students' affective learning outcomes during volleyball lessons. *J Phys Educ Sport*. 2020;20(August):2136–42. DOI:10.7752/jpes.2020.s3287.
- [27] Yudiana Y, Slamet S, Hambali B. Education and Training of Volleyball Information System (VIS FIVB) Based Volleyball Playing Performance Assessment Program for Volleyball Coaches in West Java, Indonesia. 2020;21(Icsshpe 2019):327–9. DOI:10.2991/ahsr.k.200214.087.
- [28] Palao JM, Manzanares P, Ortega E. Techniques used and efficacy of volleyball skills in relation to gender. *Int J Perform Anal Sport*. 2009;9(2):281–93. DOI:10.1080/24748668.2009.11868484.
- [29] Fani RA, Sukoco P. Volleyball learning media using method of teaching games for understanding adobe flash-based. *Psychol Eval Technol Educ Res [Internet]*. 2019;2(1):34. Available from: <http://dx.doi.org/10.33292/petier.v2i1.6>.
- [30] Kim I. Exploring changes to a teacher's teaching practices and student learning through a volleyball content knowledge workshop. *Eur Phys Educ Rev*. 2016;22(2):225–42. DOI:10.1177/1356336X15599009.
- [31] Correia da Silva D, Teoldo da Costa V, Casanova F, Manuel Clemente F, Teoldo I. Comparison between teams of different ranks in small-sided and conditioned games tournaments. *Int J Perform Anal Sport [Internet]*. 2019;19(4):608–23. Available from: <https://doi.org/10.1080/24748668.2019.1643598>.
- [32] Wodarski JS, Feit MD. Adolescent preventive health and team-games-tournaments: Five decades of evidence for an empirically based paradigm. *Soc Work Public Health*. 2011;26(5):482–512. DOI:10.1080/19371918.2011.533561.
- [33] Gabbett TJ, Georgieff B. The Development of a Standardized Skill Assessment for Junior Volleyball Players. *Int J Sports Physiol Perform [Internet]*. 2006;1(2):95–107. Available from: <https://doi.org/10.1123/ijspp.1.2.95>.
- [34] Wibisono R, Kartiko DC, Hartoto S. Improve the Motivation of Learning and Learning Outcomes Passing Down volleyball Through Cooperative Learning Model. *J Phys Educ Heal Sport*. 2018;5(2):39–45. DOI:10.15294/jpehs.v5i2.14954
- [35] Pamungkas WPA, Rahayu T, Rahayu S. The Influence of Learning Approach and Eye-Hand Coordination on the Learning Outcomes of Mini Volleyball Passing Skill. *J Phys Educ Sport*. 2019;8(1):39–43.
- [36] Muhammad, Faruk M, Bambang S. TECHNICAL PERFORMANCE ANALYSES OF VOLLEYBALL. 2020;9(2):101–12. Available from: <http://dspace.unimap.edu.my:80/xmlui/handle/123456789/67426>.
- [37] Palao JM, Santos JA, Ureña A. Effect of team level on skill performance in volleyball. *Int J Perform Anal Sport*. 2004;4(2):50–60. DOI:10.1080/24748668.2004.11868304.
- [38] Waluyo, Soegiyanto, Setijono H, Sulaiman. Analisis on Players' Playing Skills During the National Volleyball League ( Proliga ) 2016. 2018;247(Iset):583–7. Available from: <https://doi.org/10.2991/iset-18.2018.118>.
- [39] Sanjib G, Mahesh S. Analysis of The Dominating Power of



- Service Reception in Volleyball in Different Levels of Competitions. *Int J Res Pedagog Technol Eduvation Mov Sci* [Internet]. 2017;06:15–9. Available from: <https://doi.org/10.2991/iset-18.2018.118>.
- [40] George G, Panagiotis Z. Statistical Analysis of Men's FIVB Beach Volleyball Team Performance. *Int J Perform Anal Sport*. 2008;8(1):31–43. DOI:10.1080/24748668.2008.11868420.
- [41] Imas Y, Borysova O, Shlonska O, Kogut I, Marynych V, Kostyukevich V. Technical and tactical training of qualified volleyball players by improving attacking actions of players in different roles. *J Phys Educ Sport*. 2017;17(1):441–6. DOI:10.7752/jpes.2017.01066.
- [42] Drikos S, Kountouris P, Laios A, Laios Y. Correlates of Team Performance in Volleyball. *Int J Perform Anal Sport*. 2009;9(2):149–56. DOI: 10.1080/24748668.2009.11868472.
- [43] Pridal V, Toporova K, Priklerova S. Effect of serve quality on the rally outcome and course in women's top volleyball. 2021;21(May):1361–6. DOI:10.7752/jpes.2021.03173.
- [44] Eom HJ, Schutz RW. Statistical analyses of volleyball team performance. *Research Quarterly for Exercise and Sport*. 2013;63(1):11–8. DOI: 10.1080/02701367.1992.10607551