Chapter II
Review of Related Literature

2.1. Introduction
Reviews play an important role to give feedback of literature related work and also help as a guideline for new search. To justify the research problem undertaken in this piece of research, various researches found pertinent to this study from the field of physical education and sports, were reviewed.

Volleyball is a power game which is played within the 9x9 meters area with high perfection and coordination. In such case evaluation of a player’s performance during the match is a very challenging task. To develop such a performance evaluation system in volleyball investigator went through the detailed study of literature, which was reviewed from various libraries, web sites, and video etc, however, only some of the relevant studies gained from other sources have been presented in this chapter to support the problem. The abstract of the reviewed studies are given below. The review in this chapter is divided into the following major area.

Reviews related to performance evaluation in volleyball

Reviews related to performance evaluation in other sports

Reviews related to Content Validity

Reviews related to observation method

Reviews related to Reliability

Review related to Objectivity

2.2 Reviews related to performance evaluation in volleyball

Yiannis studied Evolution in men's volleyball skills and tactics as evidenced in the Athens 2004 Olympic Games. The study compares the effectiveness of the five principal skills in men's Volleyball (serve, reception, attack, block and dig) between the Sydney 2000 and the Athens 2004 Olympic Games and examines to what extent the observed changes are connected with the implementation of the new rules in Volleyball. The findings revealed a universal tendency of the elite men's volleyball
teams to enhance their defence by reducing their block and dig faults. On the contrary, there was an increase of the reception faults as a result of the improvement of the service effectiveness. The above changes reflect the teams' shift of tactics to win more points from their own serve. This tactical development became more imperative after the introduction of the rally-point system, which reduced the number of points played per set, and hence the teams' opportunities of gaining the minimum two-point advantage in order to win the set. Nonetheless, the Athens gold-medallist team of Brazil showed, in addition to the above, remarkable reception effectiveness, which led to an outstanding attack capability, thus reestablishing the attack as the most important skill in volleyball (Yiannis, 2005).

Tsivika evaluated the technical and tactical offensive elements of the National Teams participating in the Men's European Volleyball Championship 2005. The study sample included 15 games between the teams of Serbia-Montenegro, Spain, Greece, Checz Republic, Holland and France. In total, 2667 serves and 3280 spikes were examined. The study was conducted with the use of the Sport scout monitoring and video-analysis program and for the analysis of the result the statistical software package SPSS v.s. 12.0 was applied. The variables examined for each serve were, the serve type, effectiveness, direction and net contact, while the variables examined for each attack were the attack type, effectiveness, direction and execution zone. The results presented significant differences among the teams in the serve type and direction, as well as in the attack type and execution zone (p<0.05). In all teams the predominant serve was the jump serve (72.9%), except for the Spanish team (47.8%) where there was predominance of the jump float serve (52.2%). The most common serve-direction zone was zone 6 (43.4%). Overall, most attacks were 2nd (41.6%) and 3rd tempo (21.6%). The highest rate of 1st and 3rd tempo attacks was executed by the Checz team (19.2% and 24.5% respectively) and the most 2nd tempo attacks were by the Greek team (46.1%). The predominant attack execution zone was zone 4 (35.2%), followed by zone 3 (23.9%). The Serbia-Montenegro National Team, which obtained the 1st position (Pool B'), was superior to the other teams in terms of attack. As a conclusion, the high significance of the technical and tactical offensive elements has been confirmed, particularly with reference to attack which was a substantial factor for distinction (Tsivika et.al.2008).
Florence studied Skill Evaluation in Women's Volleyball. The Brigham Young University Women's Volleyball Team recorded and rated all skills (pass, set, attack, etc.) and recorded rally outcomes (point for BYU, rally continues, point for opponent) for the entire 2006 home volleyball season. Only sequences of events occurring on BYU's side of the net were considered. Events followed one of these general patterns: serve-outcome, pass-set-attack-outcome, or block-dig-set-attack-outcome. These sequences of events were assumed to be first-order Markov chains where the quality of each contact depended only explicitly on the quality of the previous contact but not on contacts further removed in the sequence. They represented these sequences in an extensive matrix of transition probabilities where the elements of the matrix were the probabilities of moving from one state to another. The count matrix consisted of the number of times play moved from one transition state to another during the season. Data in the count matrix were assumed to have a multinomial distribution. A Dirichlet prior was formulated for each row of the count matrix, so posterior estimates of the transition probabilities were then available using Gibbs sampling. The different paths in the transition probability matrix were followed through the possible sequences of events at each step of the MCMC process to compute the posterior probability density that a perfect pass results in a point, a perfect set results in a point, and so forth. These posterior probability densities are used to address questions about skill performance in BYU women's volleyball (Florence, 2008).

Marcelino studied the weight of terminal actions in Volleyball. Contributions of the spike, serve and block for the teams’ rankings in the World League 2005. The purpose of this paper was to study performance levels in scoring skills in the Volleyball World League 2005, and to relate the results to the teams’ final ranking in the tournament. The sample consisted in 33745 actions, distributed by serve (n=12434), block (n=7200), and spike (n=14111), having been recorded during 72 World League 2005 matches. Both absolute (number of successful and unsuccessful executions) and relative (coefficient of performance, percentage of successful executions and percentage of unsuccessful executions) variables have been considered for the three dimensions (spike, serve, and block). Team ranking has been calculated for each variable. Also, each team’s final ranking in the tournament has been considered. The results permit us to conclude that the spike is the best indicator of success in high volleyball, but only when considering
relative measures. Simultaneously, the number of block points per game proved to be a good indicator of success in volleyball. Finally, the number of serve errors and the percentage of serve points are associated with the team’s tournament ranking. That is, the best teams fail a higher number of serves, but also win more points with this action (Marcelino, 2008).

Bergeles studied the Performance of male and female setters and attackers on Olympic-level volleyball. The purpose of this study was the examination and comparison of performance in attack in relationship with performance in set between Olympic-level volleyball male (M) and female (F) players. A 3-member group of expert coaches assessed the players’ actions in set and attack in 16 volleyball games (M=8, F=8) of teams competing in the final phase of the 2004 Olympic Games. Assessment was based on a 5-point rating scale (Eom and Schutz, 1992) and included actions that composed a set of 2 contacts in Complex I (M=1007, F=1248). A cross tabulation statistical procedure with level 4 x 5 calculated performance percentages and frequencies; X² criterion was used to examine possible differences in the distribution of performance assessment in attack for every performance assessment in set and Z criterion was used to compare percentages of performance assessment between genders. Results showed that the higher the performance of setters, the higher the performance of attackers in both genders. Significantly (P<0.05) lower percentages of male compared to female attackers’ average and very good performance were found after receiving good and excellent quality sets, whereas significantly (P<0.05) higher percentages of good performance were shown in favour of male attackers after receiving excellent quality sets (Bergeles, et al 2009)

Sotiris studied correlates of team performance in Volleyball. The overall performance of a Volleyball team depends on many factors, from which decisive are considered to be the execution of skills that lead immediately to winning or losing the rally. These were lost serves, aces, kill attacks, attack errors and kill-blocks. The analysis of these skills in relation to team performance, as expressed by the ratio of sets won to the total number of sets, lead to the formation of two new correlates. These were the serving efficiency ratio (SER), defined as the ratio of lost serves to aces, and the attack efficiency ratio (AER), defined as the number of kill attacks divided by the sum of attack errors and kill-blocks. Analysis of the data collected from all the matches of the
male A1 volleyball professional league of 2005-2006 in Greece proved that the two efficiency ratios were better predictors of the teams’ overall performance than the five original variables. The findings lead to clear-cut definitions of norms both for the serving and attack efficiency ratio. The leading teams had a SER of around two and an AER of around three. These criteria are valuable tools especially for Volleyball coaches in deciding for the appropriate tactics of their teams (Sotiris, 2009).

Hayrinen studied Serve Efficiency in Men’s Volleyball. The purpose of this study was to examine the efficiency of different serve techniques in men’s volleyball at three levels: boy’s youth national teams, Finnish men’s league teams and men’s national teams. The efficiency of different serves was evaluated from 19 matches played in 2007; 8 matches from YECQ Pool C (1089 serves), 5 matches from men’s Finnish league (1033 serves) and 6 matches from men’s WL (1016 serves): Boy’s youth national teams, G1 • n=49, age 17.2±0.6 years, height 194.3±5.9 cm. Men’s Finnish League teams, G2 • n=59, 25.8±5.4 years, 193.4±5.6 cm. Men’s national teams, G3 • n=38, 26.7±3.9 years, 196.7±5.2 cm A six-point assessment scale (0–5) was used to evaluate the efficiency of the serves: 5 = ace/point, 4 = no attack from the opponent team, 3 = opponent can use only high ball attack, 2 = opponent can use first tempo attack with a small risk , 1 = opponent can use all attack options, 0 = error. The serve technique distribution and the means and S.D. for serve efficiency for different serve techniques and groups were calculated. T-test for independent samples was used for statistical analysis. Also ace-error ratios, ace, positive (proportion of level 3-5 serves) and error percentages for every serve technique were calculated. In the men’s matches the jump serve was the most often used serve type (54–65%), whereas in the youth matches the jump float was the main serve technique (50%). Altogether jump serve and jump float were the most commonly used serve techniques in all groups G1: 92%, G2: 83% and G3: 88% and other serve types were used only rarely (12 %). Due to the small proportion short float serves were excluded from the additional analysis. The efficiency of jump float serve was significantly higher for G1 than for G2 (p<0.01) and G3 (p<0.01). In G1 jump float serve was significantly more efficient that jump serve (p<0.001) and short jump float p<0.05). The ace-error ratios were highest for G1 (1.00) and G2 (1.33) in float and for G3 (0.75) in short jump serve. The highest positive serve percentages were for G1 jump float 43% and jump serve 35%, for G2 float 35% and jump serve 31% and for G3 jump serve 36% and short jump serve 33%. For all three
groups jump serve and short jump serve had the highest error percentages. The study concluded as 1) in men’s volleyball the serve technique and efficiency differed according to the performance level. 2) At the men’s level jump serve and at the youth level jump float serve were the dominant serve techniques. 3) Jump float serve was the most effective serve technique at youth level and so it can be said that the high use of it is sensible. 4) The effective use of jump serve places high demands on the physical abilities and therefore it seems that it is easier for the younger players to use jump float serve. 5) At men’s level jump serve was quite effective, but it also had the highest error percentage. The high use of jump serve can be explained by the target to score direct points by ace serves, even if it also means a lot of directly lost points (Hayrinen, 2009).

Quiroga studied the relation between in-game role and service characteristics In elite women’s Volleyball. The aim of this study was to determine whether the in-game role of players (setter, outside, middle, or opposite player) in elite women’s volleyball is significantly related to the characteristics of their service. The sample consisted of 1,300 service deliveries (total serves for all matches) made by players in the 8 teams participating in 2 Final 4 stages of the Indesit European Champions League. The variables recorded were in-game role of the server, service type, speed of delivery, service area, target zone, and effectiveness of delivery. Results showed a significant relation between the server’s in-game role and service type (p<0.01), service speed (p # 0.01), service area (p # 0.01), and effectiveness of delivery (p # 0.001). The most significant relation observed was with the service area, primarily because of the server having to make a quick transition to the defense zone. Setters and opposite players most commonly served from behind zone 1 (100 and 80% of serves, respectively), which they defended after serving. Similarly, middle players served most frequently from behind zone 5 (47% of serves), the zone they subsequently defended (Quiroga, et.al. 2010).

Michelle studied the Importance of Skill in Women's Volleyball. The purpose of this paper was to demonstrate two methods to quantify skill importance for teams in general and women's volleyball in particular. A division I women's volleyball team rated each skill (serve, pass, set, etc.) and recorded rally outcomes during all home games in a competitive season. The skills were only rated when the ball was on the home team's side of the net. Events followed one of these three patterns: serve-outcome, pass-set-
attack outcome, or block-dig-set-attack-outcome. These sequences of events were assumed to be first-order Markov chains, meaning the quality of the performance of the current skill only depended on the quality of the performance of the previous skill. We analyze the volleyball data using two different techniques: one uses a Markovian transition matrix, while the other is an implementation of logistic regression. To estimate the Markovian transition matrix, they assumed a multinomial likelihood with a Dirichlet prior on the transition probabilities. The logistic regression model also uses a Bayesian approach. The posterior distributions of parameters associated with skill performance were used to calculate importance scores. Importance scores produced by the two methods are reasonably consistent across skills. The importance scores indicated, among other things, that the team would have been well rewarded by improving transition offense. It was concluded that important scores can be used to assist coaches in allocating practice time, developing new strategies, and optimizing team performance relative to player selection (Michelle et.al. 2010).

Bergeles studied Performance effectiveness in Complex II of Olympic-level male and female volleyball players. The purpose of this study was to examine the dependence of performance effectiveness in Complex II (CII) and to investigate possible differences in performance effectiveness between Olympic-level volleyball male (M) and female (F) players. Performance of sequential actions of set-to-counter-attack (M = 644, F = 947) from 16 volleyball games (M=8, F=8) of teams competing in the final phase of the 2004 Olympic Games was assessed based on a 5-point numerical rating scale (Eom, 1989) by a 3-member group of expert coaches. Statistics included cross tabulation procedure to calculate performance percentages and frequencies, X2 criterion to examine possible differences in the distribution of performance assessment in counter-attack for every performance assessment in set and Z criterion to compare performance effectiveness between genders (P<0.05). Results showed a significant (P<0.01) correlation between preceding and succeeding actions’ overall performance in both genders. The higher the performance effectiveness of M and F setters was, the higher the performance effectiveness of M and F attackers, accordingly. Performance effectiveness in CII was found to be similar between genders. Based upon these findings, it was concluded that training should focus on making attackers able to
counter-attack successfully against a solid team block under less favourable conditions, especially when they receive a low accuracy set (Bergeles, et.al. 2010).

Palao studied the Side-out Success in Relation to Setter's Position on Court in Women's College Volleyball. The setter's position on the court affects the attack and block capacity of the team. The purpose of this study was to assess the ways women's college teams construct their side-out in order to balance the rotations when the setter is in front and in back. A total of 2435 rallies from 48 sets of the Missouri Valley Conference of the United States Division I college volleyball league was analyzed. A descriptive observational study was done. The variables studied were: side-out phase, efficacy of the phase, set result, setter's position on the court (in front or in back), attack tempo, spike zone, type of set, and attack efficacy. The results show that: a) women's college teams won the set when they achieved balance between rotations when the setter was in front and those when the setter was in back; b) the setter's position did not clearly affect the tendencies of attack type and side-out success, except for the efficacy of high-attacks and out of system attacks when the setter was in front for teams that won the set, and for the use of second-contact attack (low level of occurrence); c) the use of outside hitters adjacent to the setter and the use of slide attacks are the means used by college women's teams to compensate the imbalance between rotations when the setter was in back versus those when the setter was in front; d) the back court attack is not used at the college women's level as a way to compensate the imbalance of front spikers when the setter is in front; and e) the use of the jump set at this level was 33%, and it was used more often when the setter was in front (Palao, 2011).

Bergeles study on Setter’s performance and attack tempo as determinants of attack efficacy in Olympic-level male volleyball teams. The purpose of the study was to analyze the probabilistic relationships that might predict attack efficacy relating to setter’s performance as a function of attack tempo in Complex I on Olympic-level male teams. Thirty matches (N=30) of sequential set-to-attack actions were evaluated to assess setter’s performance and attack efficacy based on a 5-point numerical rating scale (Eom, 1989). Statistics included cross-tabulation procedure to define “per-match” percentages, repeated measures ANOVA to examine possible differences among attack tempo in attack efficacy and multinomial logistic regression analysis to examine if variations in setter’s performance and attack tempo increased or decreased the
probabilities of achieving low (defined either as error or attack continuation) as compared to high attack efficacy (defined as gaining a direct point) (P<0.05). Results on odds ratios showed that when setter’s preceding performance was excellent so that attackers made 1st or 2nd tempo attacks, the probabilities of gaining a direct point were strongly increased. Therefore it was recommended that setters train to provide attackers with quick tempo attacks and attackers train to effectively attack against a double block (Bergeles, et.al. 2011).

Patsiaouras studied Technical Skills Leading in Winning or Losing Volleyball Matches During Beijing Olympic Games. Volleyball is included in sports where individual success of final efforts such as a successful attack or an effective block, is achieved by the harmonious collaboration of the preceded players’ efforts. The purpose of this present study was to evaluate the importance of technical skills that led to the success of the national teams that took part in the Olympic Games of Beijing 2008. The sample was constituted by all the matches of the volleyball men teams that participated in the Beijing Olympic Games. Overall, 29 games were videotaped and evaluated. Collection of data included the use of the statistical recording program Data Volley 2. The parameters that were evaluated were: a) service, b) service reception, c) attack, and d) attack blocked. The statistical treatment of data was realised through non parametric statistical analysis. The results showed that, service points, reception errors, and attacks blocked emerged as important factors that were decisive for winning or losing a match (Patsiaouras, et.al. 2011).

Afonso’s study on Tactical Determinants of Setting Zone in Elite Mean’s Volleyball. The purpose of this study was to examine predictors of the setting zone in elite-level men's volleyball. Thirty-one matches of the 2007 World Cup were analyzed, in total 5117 rallies. The dependent variable was the setting zone, and the independent variables were the server player, serve type, serve direction, serve depth, reception zone, receiver player and reception type. Multinomial logistic regression was applied, in order to obtain the estimated likelihood of occurrence of the dependent variable, based on the values of the independent variables (p < 0.05). Only the serve direction showed not to be predictive of the setting zone. Concerning the remaining variables, the tennis jump serve, serves from the middle-player, deep serves, reception near the endline or sidelines, reception by the zone 4 attackers when in defensive zone, and low
reception all proved to impair the quality of reception, demanding the setter to play more often in the not acceptable setting zone. Results suggest that, at this level, practice of serve-reception should preferably cover the deep tennis jump serve, and attempt to afford the Libero more opportunities to receive. By focusing on the variables with the most predictive power, performers may better allocate their attention towards the most pertinent cues at each moment. Knowledge of these interactive models provides valuable insights into the dynamics of the action sequences, affording coaches important information and guidance (Afonso, et.al, 2012).

Romero studied the Discriminatory Power of Final Game Actions Volleyball in Formative Stages. The aims of this study were (i) to compare final actions in game which differentiate winning and losing teams and (ii) to identify game actions which predict victory in female volleyball training categories. A total of 139 matches were analyzed in infantile category and 155 matches in cadet category in the national volleyball scholar age championship (12-16). The results showed that the winning teams in both categories had significantly a better performance in final game actions, mainly in positive serve and attack that predict victory in some matches. Results point out that the lack of continuity in the game favours that service was a decisive action on the final outcome in training categories, thus conditioning posterior actions (Romero, et. al. 2012).

Quiroga studied the characterisation of the main playing variables affecting the Service in high-level women’s Volleyball. This study sought to establish the most important factors affecting the service in high-level women’s volleyball and the relative weighting of such factors on this technical part of the sport. A total of 1300 services from eight matches played in two Final Fours of the Indesit European Champions League were analysed. The services were delivered by 58 players of 25 nationalities. Observation sheets and two video cameras located at both ends of the court were used. Service speed was measured by radar. The twelve variables studied enabled the service to be divided into four components. The most influential component (19.02% of total variance) comprised variables related to technical service characteristics (type of service and service speed). The second most influential component (15.16% of variance) was related to the opponents’ technique and tactics, and to their position on court at the time of the service. The service was also affected by the technical and
tactical movements that the servicer needed to perform in the subsequent play (12.20%). The stage of the match and the score (10.67%) also presented players with different levels of risk and helped to determine the type of service chosen and the power with which it was executed (Quiroga, et.al, 2012).

Costa studied the differences in game patterns between male and female youth volleyball. Volleyball presents diversified competitive demands according to age group and sex, namely concerning the efficacy of game actions, but few studies have compared male and female volleyball. Also, a great body of research has been conducted with adult teams, but only a few studies have been conducted with younger age groups. Hence, it is the purpose of this paper to analyze the differences between male and female youth volleyball, considering game complex, serve type, attack tempo, attack type, and attack effectiveness, as literature has suggested the existence of differences in these parameters. Nineteen volleyball matches of the Youth World Championships of 2007 were analyzed (11 male, 8 female), totaling 1,816 serve actions and 1,914 attack actions. Multinomial logistic regression was applied to analyze the game actions that could differentiate male and female game profiles. Three variables showed significant differences between male and female volleyball: serve type, attack tempo, and attack type. There was a predominance of ground serves, placed attacks and slower attack plays in women’s volleyball, therefore promoting a higher occurrence of counterattacks. Future research should consider additional variables, such as match status and the opponents’ level, both possibly influencing the attack tactics used by the teams, as well as their performance (Costa, et.al., 2012).

Fellingham studied the importance of attack speed in volleyball. The relationship of the speed of a set in volleyball with the outcome of the attack was examined. A total of 1777 sets of a single male university level volleyball team were photographed using high speed cameras so that the time the set was in the air could be measured with accuracy to 1/100th of a second. Data were analyzed using a logistic regression model implemented using the Bayesian paradigm. Using these methods the probability of a kill resulting from a set of a particular speed could be calculated. In general, sets that travelled a further distance had significant increases in the probability of success with a faster set. No trends were seen with sets that were delivered to hitters that were closer to the setter. Decreasing outside set time from 1.53 to 0.85 s, significantly increased
probability of a kill from 0.31 to 0.58 for the team studied. The speed of the set when the attacker is not near the setter appears to be an important component in the success of the attack in male collegiate volleyball (Fellingham, et.al, 2013).

Silva’s study on match analysis of discrimination skills according to the setter attack zone position in high level volleyball. The aim of this study focuses on analyzing and understanding what happens when the setter is in the attack zone (zones 4, 3 and 2), identifying the skills that best discriminate for victory or defeat. Twenty four matches (n=24) played during the Men’s Senior Volleyball World Championship – Italy 2010 were taken and analyzed with Data Volley Software. For the data analysis the discriminating function was used in order to identify the discriminating variables through the canonical structuring coefficient |SC| ≥ .30. This study revealed that the serve point, service error, excellent set, set error, attack error, excellent dig and side out error were discriminating variables that identify the final outcome of the match (win/lose) when the setter was in the attack zone (zones 4, 3 and 2). At the same time it showed us why teams can lose. Teams without attack, side-out, service and distribution skills can hardly win games because these skills are essential for offense building and winning (Silva, 2013).

Federation International de Volleyball had developed VIS. i.e. Volleyball Information System. Volleyball Information System is the statistical software. This system work for evaluation of all volleyball skills performed during the game, named, serve, serve reception, set, attack, block and dig. These skills are further classified under scoring and non scoring skills to properly understand the data interpretation in offensive and defensive skills dominance by the player during the game. The software used, evaluated every shot in three point scale, to generate statistics for FIVB based events. VIS helps to get statistics in the form of percentage of success, excellent and error for scoring skills and non scoring skills respectively. (FIVB, n.d.)

2.3. Reviews related to performance evaluation in other sports

Thomas developed notational analysis system for selected Soccer skills of a women's college Team. The purposes of this study were to develop a notational system to evaluate passing, dribbling, first touch, and individual defensive skills as they relate to success during women’s soccer games and to develop a statistical model to weigh the
importance of each skill on creating scoring opportunities. Sequences of skills in 10 Division I intercollegiate women’s soccer games were coded using well defined performance scores and outcomes. The notational analysis system was highly reliable as demonstrated by high test-retest Spearman’s correlations (>0.98) between the first and second notation of 3 games for all four skills. The importance scores calculated from a Bayesian model demonstrated that dribbling (0.0127) was the most important skill on creating scoring opportunities, followed by first touch (0.0079), passing (0.0075), and individual defence (0.0050). The notational system developed by this study provides coaches with reliable and objective information in order to improve the specificity of practices and to prepare individuals for optimal performance (Thomas, 2006).

Page studied the use of box-scores to determine a position's contribution to winning Basketball games. While it is generally recognized that the relative importance of different skills is not constant across different positions on a basketball team, quantification of the differences has not been well studied. 1163 box scores from games in the National Basketball Association during the 1996-97 season were used to study the relationship of skill performance by position and game outcome as measured by point differentials. A hierarchical Bayesian model was fit with individual players viewed as a draw from a population of players playing a particular position: point guard, shooting guard, small forward, power forward, center, and bench. Posterior distributions for parameters describing position characteristics were examined to (Page, Fellingham, & Reese, 2007) discover the relative importance of various skills as quantified in box scores across the positions. Results were consistent with expectations, although defensive rebounds from both point and shooting guards were found to be quite important (Page, et.al. 2007).

Michelle measured Skill Importance in Women's Soccer and Volleyball. The purpose of this study is to demonstrate how to measure skill importance for two sports: soccer and volleyball. A division I women's soccer team filmed each home game during a competitive season. Every defensive, dribbling, first touch, and passing skill was rated and recorded for each team. It was noted whether each sequence of plays led to a successful shot. A hierarchical Bayesian logistic regression model is implemented to determine how the performance of the skill affects the probability of a successful shot.
A division I women's volleyball team rated each skill (serve, pass, set, etc.) and recorded rally outcomes during home games in a competitive season. The skills were only rated when the ball was on the home team's side of the net. Events followed one of these three patterns: serve-outcome, pass-set-attack-outcome, or dig-set-attack-outcome. We analyze the volleyball data using two different techniques, Markov chains and Bayesian logistic regression. These sequences of events are assumed to be first-order Markov chains. This means the quality of the current skill only depends on the quality of the previous skill. The count matrix is assumed to follow a multinomial distribution, so a Dirichlet prior is used to estimate each row of the count matrix. Bayesian simulation is used to produce the unconditional posterior probability (e.g., a perfect serve results in a point). The volleyball logistic regression model uses a Bayesian approach to determine how the performance of the skill affects the probability of a successful outcome. The posterior distributions produced from each of the models are used to calculate importance scores. The soccer data importance scores revealed that passing, first touch, and dribbling skills are the most important to the primary team. The Markov chain model for the volleyball data indicates setting 3-5 feet off the net increases the probability of a successful outcome. The logistic regression model for the volleyball data reveals that serves have a high importance score because of their steep slope. Importance scores can be used to assist coaches in allocating practice time, developing new strategies, and analyzing each player's skill performance (Michelle, 2009).

Hazuan studies validation of match notation (A Coding System) in tennis. The aim of this study was to establish the reliability and validity of a coding system for measuring serve and return of serve locations in tennis. A notational analysis of men’s and women's singles matches at the 2008 Australian Open was undertaken. The results revealed that the inter-rater reports were highly similar on first or second serve (r=0.972), serve landing location (r=0.999), returner’s impact location (r=0.990) and return of serve landing location (r=0.995). Hawk-Eye data were used to validate the coding measures for ball location. When comparing the coded ball location data of the researcher (n=1) and tennis coaches (n=4) to Hawk-Eye data, high correlations for the landing location of the serve (r=0.998), the impact location of the return (r=0.993) and the landing location of the return of serve (r=0.997) were registered. The match notation system analysed was shown to be reliable and valid for the study of serve and
return of serve strategies and tactics in tennis. This system also provides a template for other researchers and coaches to evaluate game tactics in tennis (Hazuan et al. 2010). Daniel tested tactical performance in youth elite soccer. This is a twofold study with the goals of evaluating tactical oriented game test situations for 12-13-year old highly-talented soccer players and to analyze dynamic, intra-individual developments of the players. A cross-sectional design was carried in study 1, using game test situations to measure specific tactics and creative performance for 195 expert players. The results from five evaluation criteria show that both diagnostic instruments can be used for recording football-specific creativity and game intelligence in talented young players. They produced tactical indicators that can be described as objective and valid, exhibit a sufficient degree of differentiation and are easy to record. Study 2 uses a longitudinal design to present a dynamic performance diagnostic tool for analyzing intra-individual improvements of German Soccer Foundation talents according to football-specific creativity and game intelligence. The results with respect to divergent tactical thinking clearly show that very different change processes were observed in the German Soccer Foundation players. Finally, the practical implications for the training process are discussed on the basis of both studies (Daniel, 2010). Martin studied the use of video feedback as a performance analysis coaching tool in amateur level ice hockey. With the advancement of digital video and computer technology over the past ten years there has been a considerable increase noted in the use of video analysis as a coaching tool in ice hockey. This has been especially noted in the greater Montreal area of Canada, where coaches are often under pressure to develop emerging talented players who aspire to a pro hockey career. The purpose of this research was to investigate how much performance analysis through video was being used and what it was being used for. The focus area was on amateur teams from midget level through to college and junior pro, such as the QMJHL. To collect data a questionnaire was used to survey the coaches and players views on using video analysis as a tool for coaching. The study was done in Montreal Quebec, Canada with coaches that ranged from midget grade, through junior to college and men’s pro. The survey covered what video analysis is currently being used for, what both the coaches and players expected to gain from its use, its benefits and draw backs with regards to athletes playing ability and its usefulness as a coaching tool. The findings were compared with existing research which has made use of notational analysis and latterly
video analysis. The study shows that the views towards video analysis of both coaches and players are positive, with its overall being found as useful. Coaches’ results showed that at the younger levels it is presented more as a player development tool to help the young athlete reach the next level. Coaches in the higher levels use video mainly as an opposition scouting tool and a systems presentation to the team. Players at a younger age liked to use video to help with their “game sense” whereas older players in higher levels do not rely on video to help “fix” their game but more to just study the other team’s systems as well as their own (Martin Lee, 2011).

Corrado’s study on notational analysis of elite men’s water polo related to specific margins of victory. The present study aimed to analyze the water polo matches of the men’s World Championships, comparing technical and tactical aspects of winning and losing teams, during closed (≤3 goals of margin of victory at the end of the 4th quarter; winning, W; losing, L) and unbalanced (>3 goals; winning, MW; losing, ML) games. Therefore, 42 of the 48 (6 were draw at end of the 4th quarter) matches were considered. According to each game situation (i.e., even, counterattack, power-play, transition), a notational analysis was performed in relation to the following aspects: occurrence of actions, action outcome, execution and origin of shots, and mean duration. In addition, the occurrence of the offensive (and role) and defensive arrangements of even and power-play were analyzed. To show differences (p < 0.05) in terms of margin of victory, an analysis of variance was applied. Although ML (74 ± 11%) performed more even actions than W (68 ± 7%) and MW (69 ± 6%), the latter teams (W = 9 ± 6%; MW = 13 ± 6%) performed more counterattacks than L (3 ± 2%) and ML (5 ± 5%). Power-play is more played during closed (W = 20 ± 3%; L = 22 ± 3%) than unbalanced games (MW = 17 ± 4%; ML = 16±7%). Moreover, differences in terms of margin of victory emerged for mean duration (even, power-play, transition), action outcome (even, power-play), zone origin (even, counterattack, power-play) and technical execution (even, power-play) of shots, and even and power-play offensive (and role) and defensive arrangements. Divergences mainly emerged between closed and unbalanced games, highlighting that the water polo matches of the men’s World Championships need to be analyzed either considering the winning and losing outcome of match and specific margins of victory. Thus, coaches can advance their knowledge, considering that closed and unbalanced games are largely characterized by the
opponent’s exclusion fouls to perform power-play actions, and by a divergent grade of
defensive skills regardless of game situation, respectively (Corrado et.al. 2012).

Falco worked on Match Analysis in a University Taekwondo Championship. The aim
of this study was to analyze the performance of medalists’ taekwondo athletes in
University level Championship. Kicking actions were grouped into three categories;
circular, linear and with a previous spin kicks. Performance was evaluated based on 1)
the type and height of the kicks employed, 2) the attacking and counterattacking nature
of the kicking actions and 3) the scoring profiles of these. Forty-five matches from the
four Olympic weight categories were notationally analyzed in male and female
populations. Kruskal-Wallis tests revealed that the reading scores in the four weight
categories differed significantly in males for linear kicks, and in circular kicks to the
chest, attacking kicks and total actions ($p < 0.05$) for females. A greater number of
circular kicks was recorded in male and female taekwondo athletes; this was followed
by linear kicks and those with a previous spin. Kicks to the chest were also more
common than kicks to the head as well as attacking kicks were used more frequently
than counterattacking kicks. Given the new competition rules, coaches are encouraged
to induce athletes to increase the frequency of kicks to the head and with a previous
spin to maximize the point scoring rate per kicks delivered (Falco, et.al. 2012).

Kumar study on construction and development skill test in service among ball
badminton players. The purpose of this study was to assess the service in Ball
Badminton. In order to achieve this purpose four test items were designed by the
investigators, after analysing the various factors. These test items were Low service,
High service, High spin (twist) service and Fast drive (wrist) service. The above said
test items were administered to sixty seven male Inter - collegiate level Ball Badminton
players and their age ranges from 16 to 20 years (Mean = 17.72, SD = ±1.64). In order
to find out the reliability, objectivity and validity correlation analysis was used. Based
on the test-retest method, the reliability coefficient score on tests item reveals that it
was acceptable according to arbitrary standards for the evaluation of physical
performance tests. But, the acceptable coefficient for validity was observed only in Low
service. Among the four test items, low service was most appropriate to measure the
service in Ball Badminton (Kumar.2013).
2.4 Reviews related to Content Validity

Wangwad had developed norms for selection of junior volleyball players in Maharashtra. The purpose of the study to develop some standard criteria or norms for selecting the players to form an efficient volleyball team which will exhibit more consistent and reliable performance. The study was conducted on 272 under 18 age group volleyball players who was participated in Maharashtra state volleyball championship in 19998. Study considered 100% population as a study. The study proceeds through seven different stages, 1. Identification of dimensions representing selection criteria, 2. Preparation of selection criteria (test-retest) for each dimensions, 3. Administration of selection criteria non try out basis, 4. Administration of selection criteria on large sample, 5. Item analysis and arrangements of item, 6. Determination of reliability and validity. The study considered three dimensions as physical structure, fitness components and volleyball skills. To finalize format of selection criteria or establishing content validity experts judgment from the field of physical education and sports was taken into the consideration. And reliability was established by test-retest method. The content validity was established 95% and the overall reliability was established .87 which was statistically significant at the 0.01 level. The developed selection criteria were compared with the test of Singh (1990) on 20% of the population. The result indicates that the validity coefficient was statistically significant .78 at 0.01 levels. And the study concluded that the selection criteria developed and standardized is reliable and valid which can objectively assess the efficiency of volleyball player to get entry in junior volleyball team of Maharashtra state (Wangwad, 2001).

Mortensen developed a notational analysis system for volleyball to evaluate only setting performance during match through three variables, the distance the ball is to the net, the height of the set, and the position of the set in relation to the setter. To establish the setting evaluation criteria, volleyball experts’ opinion was taken. The two cameras were placed in two different places of volleyball court to record the matches of Division I intercollegiate women’s volleyball team. The data was collected from 1353 video recorded set. As per the evaluation criteria, collected data indicated that 26 different setting scenario occurred. Overall, sets within 3-5 feet from the net resulted in the highest probability of winning a point and lowest probability of lossing a point. Low sets, whether inside or outside in relation to the hitter also resulted in a high probability
of a winning a point. High sets, whether inside or outside in relation to the hitter, resulted in the lowest probability of success and the highest probability of success of a point for the opponents. Such notational analysis system help coaches to get effective feedback of setting performance for ongoing event to understand the players strength and overcome the weaknesses, as well as to develop team strategy and style of play (Mortensen, 2007).

Carine developed and validated a technical-tactical performance evaluation instrument in volleyball (PEI-VB). Content validation was performed by 10 experts in the field for the dimensions of clarity of language, practical relevance and theoretical relevance. Intra-examiner (test-retest method) and inter-examiner (6 examiners) reliability was tested. Data collection consisted of the analysis of a video of games from the finalist team of the 2009 Catarinense Children’s Volleyball Championship. Data were analyzed using the SPSS for Windows 11.5 and SAS programs, with the level of significance set at 5%. Spearman’s correlation coefficient, weighted kappa index of agreement, and intraclass correlation coefficient were used for the analysis of each specific action of the game and each performance component. The PEI-VB comprises an instrument that evaluates the components of technical-tactical performance of the actions of a 6x6 volleyball game, permitting the identification of the general performance level of each player, as well as the specific performance according to action and component. In addition, the validity of the instrument was 92.9% and the intra- and inter-examiner reliability was 0.84 and 0.78, respectively. All indices were high, indicating that the PEI-VB is a valid and consistent instrument that permits the evaluation of the level of sports performance of volleyball players of different categories (Carine et.al.2011).

2.5 Reviews related to Reliability

Marx study on development and evaluation of an activity rating scale for disorders of the knee. The goal of this study was to develop and evaluate a new rating scale to measure activity level of patients. Study assessed reliability by administering the scale to 40 subjects on 2 separate occasion, 1 week apart. Validity was evaluated by comparing the activity rating on the new scale with that from other instruments that use activity level scales (concurrent construct validity) and also by correlating the score on the new scale with age (divergent validity). Patient easily understood the scale and were able to complete it in 1 minute. The reliability was high (intraclass correlation
The scale also correlated well with existing activity rating scale: spearman correlation coefficient for Cincinnati scores, 0.67; for Tegner scale, 0.66; for Daniel scale, 0.52. The activity score was significantly inversely correlated with age (p=0.002), indicating divergent validity. This instrument will facilitate generalizability of results and allow more accurate comparisons among patient groups in outcomes research in sports medicine (Marx, 2001).

Dawes study on Five Points vs. Eleven Point Scales: Does It Make A Difference To Data Characteristics. Study examines whether the number of scale points used in a market research survey affects the resultant data. It uses two 'split sample' surveys, one using face to face interviews and one gathered using telephone interviews. In each case, a subset of the sample was administered questions using a five point scale and another subset was administered an eleven point 'zero to ten' scale. The results show that the eleven point scale produces data that is essentially the same as that produced by the five point scale in terms of mean, after allowing for the five point scale to be re-scaled for comparability. However, the eleven point scale produced data with more variance (coefficient of variation) than the five point scale. There were some differences between the scale types in terms of kurtosis and skewness, but these were not systematic (Dawes, 2002).

Manuel study notational analysis of European, World, and Olympic BMX cycling races. The objectives of this study were 1) to describe the technical requirements of different tracks where classifying points are disputed for the Olympics as the European continent tracks (E), world championship competitions tracks (W), and Olympic Games track -Beijing, 2008- (O); and 2) to compare and establish differences or similarities between the three previous contexts. The sample used for this study was made of the 8 best qualifying male athletes from each competition (n = 48) during the 2007 and 2008 seasons (pre-Olympic and Olympic years). A descriptive design was used, based on systematic structured observation of the competitions filmed on video, paying attention to the different techniques used (overtaking skills, complete pedalling cycles and registered effort times). The results show that aerial techniques predominate over non-aerial techniques on O and W type tracks more than on E tracks by ~20% (p < 0.001),
pedaling cycles predominate in E vs. W and O by 11.85 and 24.23% respectively (p ≤ 0.05), and effort times predominate in O vs. W and E by 6.50 and 12.94% respectively (p ≤ 0.01). In conclusion, O and W tracks stand out because of the aerial component and greater technical complexity in comparison to E tracks, which has a decisive effect on the way the riders train in relation to the type of championship they aim to compete in. (Manuel, et.al. 2012).

Rabaz’s studied the relationship between Performance in game actions and the match result. The main aim of this research was to clarify the importance of performance in game actions as determinant of match result in a sample of young volleyball male players. The study sample was composed of 74 male participants belonging to the Under-16 teams (M: 14.61; SD: .88) from the Extremadura Volleyball League in the 2010/2011 season. The studied variables were: performance in game actions (serve, defense, setting and spike) and match result (win/lost). FIVB Observational System (Coleman, 1975) has been the instrument for data recollection, it has been applied previously in numerous studies and is accepted as a valid tool for research community. The T-test for independent samples results showed statistically significant differences in performance of game actions: serve (F1,72= 3.86; p=.048; np2=.492), defense (F1,72=14.07; p<.001.; np2=.959), setting (F1,72=34.83; <.001.; np2=1.00) and spike (F1,72=9.05 ; p=.004; np2=.84) between players from winner and loser teams. Our results coincide with previous studies that emphasize the importance of game actions in volleyball (Asterios et al., 2009). This analysis is important as it assists in the collection of performance information that can feedback athletes in an attempt to enhance their understanding and competitive performance (Maslovat & Franks, 2008) and also for talent identification and recruitment (Carling et al., 2005).

2.6 Summary of Review

While critically evaluating the preceding review of the relevant literature including studies conducted by the various researchers, it has been noticed by the researcher that very few studies so far have been conducted for developing performance evaluation system in the game of volleyball.
However, some of the studies mentioned in the reviewed literature tried to evaluate the performance of individual Volleyball skills and its related parameters. On the other hand, the studies conducted in other games and sports, reveal that they have adopted various methods by taking the cognizance of the nature of the games selected for this investigation.

The reviews with reference to methodologies have assisted the researcher in designing and implementing the tool of her data collection, viz. the rating scale as well as in adopting the process of establishing content validity in terms of experts’ opinion of the tool.

Moreover, the preceding review pertaining to content validity, observational method, objectivity and reliability assisted the researcher in the present study for developing the performance evaluation system in volleyball.

It is pertinent to note that the above views have also brought to the notice of the researcher about the importance of the skills which have been selected by her in the present study. hence the reviews t which the researcher has come across are not only justifying the appropriateness of the researcher problem under taken but also provided necessary further directions in completing study.
Reference


Kumar, P. R., & Kalidasan, R. (2013). Construction and development skill test in service among ball badminton players. *Published doctoral dissertation, Department of Physical Education, Bharathidasan University, 1*(2).


