A Study on the Structural Equation Modeling of Perception of College FIVB Players towards the Leadership Behavior of Coaches, Training Satisfaction and Team Cohesion

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ABSTRACT

The purpose of this study is first to investigate the current state of leadership behavior of coaches, training satisfaction, and team cohesion perceived by College FIVB players in Taiwan; second, to understand the variance of dimensional variables of leadership behavior of coaches, training satisfaction, and team cohesion perceived by College FIVB players in Taiwan; and third, to examine the path relationship of leadership behavior of coaches, training satisfaction, and team cohesion perceived by College FIVB players in Taiwan. This study adopts the questionnaire survey method to collect data and the questionnaire includes: 1. Personal information; 2. leadership behavior of coaches; 3. training satisfaction of players; and 4. Team cohesion. Research subjects are male and female players participating in 2011 College FIVB. A total of 360 copies were distributed with the valid 360 ones returned for a rate of 83.33%. The data processing of this study uses confirmatory factor analysis (CFA), descriptive statistics, one-way ANOVA, and structural equation modeling (SEM). Research results of this study are: 1. Variables in Scale of Leadership Behavior of Coach perceived by College FIVB players in Taiwan are found with significance and among five aspects, training and instruction are perceived with the highest level, Level 1, followed by caring and positive behavior, Level 2, autocratic behavior, Level 3, and democratic behavior, the lowest level, Level 4; 2. Variables in Scale of Training Satisfaction perceived by College FIVB players in Taiwan are found with significance and among five aspects, internal atmosphere of team is perceived with the highest level, Level 1, followed by venue facilities, leadership behavior of coach, and training contents, Level 2, and achievement performance, the lowest level, Level 3; 3. Variables in Scale of Team Cohesion perceived by College FIVB players in Taiwan are found with significance and among three aspects, team adjustment is perceived with the highest level, Level 1, followed by team cooperation and personal interaction, Level 2; 4. The leadership behavior of coaches has a significantly positive influence on training satisfaction and team cohesion; and 5. Training satisfaction has a significantly positive influence on team cohesion.

Keywords: volleyball players, leadership behavior of coaches, training satisfaction, team cohesion

INTRODUCTION

Research Background and Motivation

In a sports organization, coaches play the very important role of leader (Wang, 1997) and various studies on leadership theory indicated that coaches in modern times do not only give instruction in sports techniques but also play more diverse roles including sports team manager, player consultant, or even role model. The most important objective of coaches is to demonstrate the best sports performance. Thus, the required basic competencies of coaches include comprehensive training plans, the adoption of tactics,
adjustment and counseling of daily life issues and emotions of players, coaching style, and sports team management. The leadership behavior of a sports coach affects sports and the overall performance of teams in every aspect and during sports competition; meanwhile, the image and decision making of coaches directly or indirectly impact the performance of individual players and their teams. As a result, the above shed light on the importance of studies on the leadership of coaches.

Chelladurai and Carron (1983) pointed out that the maturity of players are developed from elementary, junior high, senior high, university to professional stages and along with the growth of maturity, the leadership behavior of coaches need to be more task-oriented. When players reach peak maturity, coaches will demonstrate caring and task oriented behaviors less often. Thus, when we discuss the perception of College FIVB players towards the leadership behavior of coaches, we need to also consider whether variances exist due to the different background variables of players. This is the motivation of this study.

Team cohesion refers to the drive that inspires team members to reach a common goal. In recent years, as indicated by studies on team cohesion, teams with a stronger team spirit, willingness, and cohesion are often the winner in a competition with equal peers (Cheng & Liu, 1991). That is to say stronger team cohesion makes team members contribute more to the team in order to achieve a common goal. When it is the critical moment of a competition, team cohesion is always the key variable to success (Cheng & Liu, 1991). Sports items, genders of players, the role of coaches all influence the type of team cohesion (Bass, 1985; Martens & Peterson, 1971). Hence, the researcher would like to understand the relationship between the perception of College FIVB players towards the leadership behavior of their coach and team cohesion in this study, another motivation of this research. The researcher has participated in team coaching work for more than a decade and during various trainings, the leadership behavior of the coach impacted players very much. In particular, volleyball is the single sport with the highest number of international sports federations. Under the promotion of the President of the FIVB, Mr. Ruben Acosta, and the support of its members, volleyball has become a popular sport (Chen, 2002). In recent years, the Male Volleyball Team of Chinese Taipei won the Bronze Plate at the 2002 East Asia Games in Osaka, Japan while the Female Volleyball Team won its first Silver Plate at the 2003 World University Games in Daegu, Korea. In 2005, the Female Volleyball Team of Chinese Taipei was the gold plate winner at the 2005 World University Games in Izmir, Turkey (Chinese Taipei University Sports Federation, 2012). Volleyball, however, is not a popular sport in Taiwan and schools at various levels aim to conduct training for team competition and not cultivate individual players for professional careers. This indicates the importance of the leadership behavior of the coach in the development of team cohesion. According to the experience of the researcher, several coaches have inspired the research for improvement of sports techniques and team cohesion. Hence, the performance of players ties closely with the leadership behavior of the coach and team cohesion. The leadership behavior of the coach does not only affect the development of individual techniques but also links closely to team success and development. Studies on leadership behavior, therefore, are keys to the development of team sports. It is hoped that the research results of this study can provide a reference for coaches to benefit the use of proper leadership in different backgrounds and to improve team cohesion and performance.

In the studies on training satisfaction and the leadership behavior of coaches, Schliesman (1987) investigated university athletes. The results indicated the positive relationship between the democratic and caring behavior of a coach and satisfaction of leadership behavior perceived by the athletes. Summer(1991) studied hockey players and found that training and coaching behavior and satisfaction of players have a significant correlation. From the studies of Weiss and Friedrich (1986), McMillin (1990),
Tseng (2003), Ou (2006), Chang & Wu (2007), and Chen (2009), the leadership behavior of coaches can be used to effectively forecast and positively impact satisfaction towards training. In studies on the influence of the leadership behavior of coaches, Wester and Weiss (1991), Tu (1999), Chiang, Chen, & Yeh (2001), Chen, Tsao & Wang (2007), Huang & Chao (2009) and Huang & Huang (2007) discovered that leadership behavior can effectively forecast and positively impact team cohesion. From the studies of Gruber and Gray (1981), William and Hacker (1982), and Chou (2005), training satisfaction is found to effectively forecast and positively impact team cohesion. The above studies showed the positive impact of the leadership behavior of coaches on training satisfaction and team cohesion. This study attempts to verify the relationship of the overall model path to provide reference for the organizational training of volleyball coaches.

Research Purpose
In lieu of the above research background and motivation, the research purposes include:
1. To discuss current state of leadership behavior, training satisfaction, and team cohesion perceived by College FIVB players in Taiwan;
2. To understand the differences in the dimensional variables of leadership behavior, training satisfaction, and team cohesion perceived by College FIVB players in Taiwan; and
3. To discuss the path relationship of leadership behavior, training satisfaction, and team cohesion perceived by College FIVB players in Taiwan.

Research Questions
Based on the above research background, the research questions include:
1. What is the current state of leadership behavior, training satisfaction, and team cohesion perceived by College FIVB players in Taiwan?
2. What is the difference in the dimensional variables of leadership behavior, training satisfaction, and team cohesion perceived by College FIVB players in Taiwan?
3. What is the path relationship of leadership behavior, training satisfaction, and team cohesion perceived by College FIVB players in Taiwan?

Research Hypotheses
According to the research purpose and relevant theories, this study proposes the hypotheses below:
1. The leadership behavior of coaches has a significantly positive impact on training satisfaction;
2. The leadership behavior of coaches has a significantly positive impact on team cohesion; and
3. Training satisfaction has a significantly positive impact on team cohesion.

Term Definition
1. College FIVB players
   The College FIVB players referred by this study are male and female volleyball players who were investigated and enrolled in colleges in Taiwan during School Year 2011.
2. Leadership behavior of coaches
   The leadership behavior of coaches is the behavioral process of coaches as they instruct and impact the achievement of objectives set by individuals and teams. These behaviors include training and instruction, the decision-making process for team objectives as well as care and praise given to players. This study uses the “Scale of Leadership Behavior of Coaches” compiled by Kuo (2004), Chang (2003),
and Chiou (2002) to develop the research tool. The scale consists of five dimensions: training and instruction behavior, democratic behavior, autocratic behavior, caring behavior, and positive behavior. The manipulative definition of the leadership behavior of coaches refers to the scoring results of players in the above scale. Higher scores indicate better performance of leadership behavior of coaches.

3. Training satisfaction

Training satisfaction is the positive perception or awareness towards organization, process, and result related to sports that originate from the needs of individual consciousness or sub-consciousness after a series of complicated evaluations (Chung, 1998; Riemer, 1995). This study defines training satisfaction as the positive perception of College FIVB players towards relevant experiences resulting from school training and the satisfaction based on the need for individual consciousness. Training satisfaction in this study refers to the satisfaction of the College FIVB players towards training. This study uses the “Scale of Training Satisfaction” compiled by Lu (2004) to develop the research tool. The scale consists of five dimensions: achievement performance, leadership behavior of the coach, internal atmosphere of team, training contents, and venue facilities. The manipulative definition of the training satisfaction of players refers to the scoring results of players in the above scale. Higher scores indicate higher satisfaction towards training.

4. Team cohesion

Cohesion is the most influential feature of team interaction, a dynamic process. Team cohesion demonstrates the attraction of the group for its members as well as attraction between and among group members; members with strong cohesion are more likely to accept and collaborate with each other in order to accomplish common goals (Wang, 1990). The manipulative definition of team cohesion refers to the scoring results of players in the above scale. Higher scores indicate stronger team cohesion.

5. Background variable

Background variables defined in this study include the basic background information of individuals and those of the school environment. There are a total of six: gender, grades, training days per week, majors related to sports, years of playing volleyball, and sports performance.

6. Structural Equation Modeling (SEM)

Structural Equation Modeling (SEM) is a method used to statistically analyze the causal model for processing research data with complicated and multiple variances; various contents include structural equation, hypothesized equation, and modeling (Chiou, 2001). In terms of statistical language, SEM is an inclusive statistic used to examine the hypothesized relationship between observed variables and latent variables (Hoyle, 1995). It mainly measures two types of models: a measurement model to describe the measurement of observed variables and latent variables as well as a structural model to identify the casual relationship between observed variables and latent variables (Yeh & Kao, 1998). This study adopts the structural model.
METHODOLOGY

Research Structure

Based on research purposes and hypotheses, the research structure of this study is proposed as in Fig. 1:

![Research framework](image)

**Figure 1: Research framework**

Research Scope and Subjects

1. Research scope

   This study investigates College FIVB players participating in 2011 competition excluding those from different levels (junior high school, senior high school, and social level) in regional competitions. Thus, the conclusions of the research results are limited.

2. Research subjects

   The questionnaire for this study was distributed to male and female players of 2011 College FIVB and is based on purposive sampling (the so-called judgmental sampling) that selects samples according to the judgment, based on personal experience, of the researcher. The questionnaire investigation was conducted between October 12 and 16, 2011. There were a total of 360 copies with 347 returned. The number of effective copies of the questionnaire reached 300 after removing 47 invalid ones for a return rate of 83.33%.

Research Tool

This study uses the “Questionnaire of Leadership Behavior, Training Satisfaction, and Team Cohesion Perceived by College FIVB Players” as the research tool; questionnaire contents include two parts: background information of the volleyball players as well as the Scale of Leadership Behavior of Coach, the Scale of Training Satisfaction, and the Scale of Team Cohesion described below:

1. Background Information of Volleyball Players

   (1) Gender: male and female for a total of two groups.
   (2) Grade: four groups of freshman, sophomore, junior and senior years (including graduate institutes).
   (3) Majors related to sports: Two groups of yes and no.
   (4) Sports performance: Four groups of national team, each level of youth or junior team, city and county team, and school team.
   (5) Training days per week: three groups of less than three days, between four to five days, and more than six days.
   (6) Years of playing volleyball: four groups of less than three years, between four to seven years, between eight and 12 years, and more than 13 years.
2. The Scale of Leadership Behavior of Coach, Scale of Training Satisfaction, and Scale of Team Cohesion

(1) Scale of Leadership Behavior of Coach

This study uses the Scale of Leadership Behavior of Coach compiled by Kuo (2004), Chang Chang-Bien (2003), and Chiou (2002) to develop the research tool. A total of 29 questions were scored with a five-point Likert scale; subjects filled in the questionnaire according to actual perception. There are five variable dimensions respectively: coaching and instruction behavior, democratic behavior, autocratic behavior, caring behavior, and positive behavior.

(2) Scale of Training Satisfaction

This study uses the Scale of Training Satisfaction compiled by Lu (2004) to develop the research tool. A total of 30 questions were scored with a five-point Likert scale; subjects filled in the questionnaire according to actual perception. There are five variable dimensions respectively: achievement performance, the leadership behavior of the coach, internal atmosphere of team, training content, and venue facilities.

(3) Scale of Team Cohesion

The Scale of Team Cohesion refers to that compiled by Wu (2002) with good construct validity and a reliability of internal consistency. But this study modifies the language used to describe the questions and uses a five-point Likert scale; subjects filled in the questionnaire according to actual perception. There are three variable dimensions respectively: team cooperation, interpersonal interaction, and team adjustment.

3. Confirmatory Factor Analysis (CFA)

(1) CFA Procedure

CFA procedure starts with parameter estimation, offending estimate test; overall model fit test, model modification, and an internal structural test.

(2) CFA of the Scale of Leadership Behavior of Coach

This study uses the statistical software AMOS20.0 to conduct the CFA. According to the research purposes and SEM methodology, the statistical analysis procedure includes the selection of a parameter estimation method, review of offending estimate, test of model fit, and evaluation of internal structure. The statistical analysis is shown below:

A. Parameter estimation

Before running the AMOS20.0 statistical analysis software, the researcher needs to understand the features of the data collected to make sure that the data matches the SEM assumption. In order to avoid the influence of the results of the model evaluation and test, SPSS for Windows 18.0 was first used to conduct a descriptive statistic of this study and CFA was then executed with AMOS 20.0. The skewness of leadership behavior of coach lies between -.55 and .47 and those with a skewness higher than 3 were removed while the peak value is between -.78 and .49 and the absolute value of peak coefficient higher than 10 is deleted. Both values in this study do not exceed the standard range and thus, this study is suitable for the normal distribution of variables and the maximum likelihood (ML) that has the least impact on estimation is used for the model parameter estimation.

B. offending estimate test

The offending estimate test refers to the test conducted for the following violations before examining the model fit. There are three possible situations (Huang, 2004):
a. The existence of a negative error variance or meaningless error variance.
b. Standard coefficient exceeding or too close to 1 (normally using .95 as the threshold value).

After statistical analysis, the standard parameter value of leadership behavior of coach is found to
be between .54 and .92 with an error variance between .02 and .08. There is no negative error variance and thus, this model has no offending estimates and can begin the model fit test.

C. Model fit test

The total number of model variables of the Scale of Training Satisfaction is 63 including 29 manifest ones (endogenous variable) and 34 latent ones (exogenous variable). The moment of unique sample is 493 (29*34/2=493) with 58 parameters for estimation (34 fixed parameters and 24 parameters to be estimated). When the moment of unique sample is larger than parameters to be estimated, the model is excessively identified and meets the modification requirement for the theoretical model (Chang, 2011); after CFA, the model does not meet the ideal standard and we need to modify the model. According to the analysis results, a modification index is selected to release or delete variable parameters. If the standard parameter value is too small, we need to delete relevant variables. If the Chi-square value of the CFA is too large, we need to use an AMOS modification index (MI) to identify the path and path modification model (Chen, 2007). Thus, this study deleted eight manifest variables including 1, 2, 6, 11, 18, 19, 20, and 24 with high MI values and reserved 20 manifest variables.

After modification, the total number of model variables for the Scale of Training Satisfaction is 45 including 20 manifest ones (endogenous variable) and 25 latent ones (exogenous variable) and the moment of unique sample is 250 (20*25/2=250). There are 40 estimation parameters including 25 fixed ones and 15 ones to be estimated; the model belongs to excessive identification that meets the modification requirement for the theoretical model (Chang, 2011). After the CFA, the model meets the standard of an ideal one with a reservation of 20 manifest variables; an offending estimates test is then conducted to identify standard parameter values with c3(.72), c4(.68), c5(.82), c7(.59), c8(.77), c9(.85), c10(.92), c12(.75), c13(.57), c14(.76), c15(.78), c16(.75), c17(.61), c21(.79), c22(.75), c23(.76), c25(.75), c26(.79), c27(.81), and c29(.78) between .57 and .92 with an error variance between .02 and .06. There is no negative error variance, indicating no offending estimate of this dimension. The composite reliability (CR) and the average variance extracted (AVE) of training and instruction are respectively .89 and .61, autocratic behavior with a CR of .79 and AVE of .55, democratic behavior with a CR of .82 and AVE of .50, caring behavior with a CR of .81 and AVE of .59, and caring behavior of CR of .86 and AVE of .61, showing good convergence validity. Table 1 is a model fit analysis of the Scale of Leadership Behavior of Coach with a Chi-square value of 254.16, freedom of 1.59, GFI of 0.93, AGFI of 0.90, RMSEA of 0.04, CFI of 0.97, and PCFI of 0.82, indicating a good overall model fit of Leadership Behavior of Coach as shown in Fig. 2:

<table>
<thead>
<tr>
<th>Fit Indices</th>
<th>Allowable Standard</th>
<th>Model (after modification)</th>
<th>Judgment of Model Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\chi^2)</td>
<td>Chi-square Value</td>
<td>The smaller the better</td>
<td>254.16</td>
</tr>
<tr>
<td>(\chi^2) freedom ratio</td>
<td>&lt;3.00</td>
<td>1.59</td>
<td>Good</td>
</tr>
<tr>
<td>GFI</td>
<td>&gt;0.90</td>
<td>0.93</td>
<td>Good</td>
</tr>
<tr>
<td>AGFI</td>
<td>&gt;0.80</td>
<td>0.90</td>
<td>Good</td>
</tr>
<tr>
<td>RMSEA</td>
<td>&lt;0.08</td>
<td>0.04</td>
<td>Good</td>
</tr>
<tr>
<td>CFI</td>
<td>&gt;0.90</td>
<td>0.97</td>
<td>Good</td>
</tr>
<tr>
<td>PCFI</td>
<td>&gt;0.50</td>
<td>0.82</td>
<td>Good</td>
</tr>
</tbody>
</table>
D. Discriminant validity

Discriminant validity tests the relevant degree of two different latent variables and according to the measurement results, the lower the relevance, the weaker the correlation between two variables, indicating the existence of an exterior heterogenic assumption. This method adopts a relevant pair confidence interval of latent variables proposed by Joreskog & Sorbom (1989) that suggests that under a condition of 95% of confidence interval, the relevant coefficient is set as a positive and negative 1.96 standard deviation of freedom estimation of two latent variables. If the confidence interval does not include the value of 1.00, it indicates two latent variables as discriminant with discriminant validity. After testing, the confidence interval of each variable dimension does not include 1.00, indicating discriminant validity.

(3) CFA of Scale of Training Satisfaction

This study uses statistical software AMOS20.0 to conduct a CFA. According to the research purposes and SEM methodology, the statistical analysis procedure includes the selection of the parameter estimation method, review of offending estimate, test of model fit, and evaluation of internal structure. The statistical analysis is shown below:

A. Parameter estimation

Before running the AMOS20.0 statistical analysis, the researcher needs to understand the features of data collected to ensure that the data matches with the SEM assumption. In order to avoid influencing the results of the model evaluation and test, SPSS for Windows18.0 was first used to conduct a descriptive statistic of this study and CFA was then executed with AMOS20.0. The skewness of training satisfaction lies between -.66 and .11 and those with a skewness higher than 3 are removed while the peak value is between -.71 and .71 and the absolute value of peak coefficient higher than 10 is deleted. Both
values in this study do not exceed the standard range and thus, this study is suitable for the normal
distribution of variables and the maximum likelihood (ML) that has the least impact on the estimation is
used for the model parameter estimation.

B. Offending estimate test

The offending estimate test refers to the test conducted for the following violations before
examining the model fit. There are three possible situations (Huang, 2004):

(a) The existence of negative error variance or meaningless error variance.
(b) A standard coefficient exceeding or too close to 1 (normally using .95 as the threshold value).

After statistical analysis, the standard parameter value of Training Satisfaction is found to be
between .63 and .87 with an error variance between .02 and .04. There is no negative error variance and
thus, this model has no offending estimates and can begin the model fit test.

C. Model fit test

The total number of model variables of the Scale of Training Satisfaction is 65 including 30
manifest ones (endogenous variable) and 35 latent ones (exogenous variable). The moment of unique
sample is 525(30*35/2=525) with 60 parameters for estimation (35 fixed parameters and 25 parameters to
be estimated). When the moment of unique sample is larger than the parameters to be estimated, the
model is excessively identified and meets the modification requirement of the theoretical model (Chang,
2011); after the CFA, the model does not meet the standard of an ideal one and we modify the model.

According to the analysis results, a modification index is selected to release or delete variable parameters.
If the standard parameter value is too small, we need to delete relevant variables. If the Chi-square value
of the CFA is too large, we need to use the AMOS modification index (MI) to identify the path and path
modification model (Chen, 2007). Thus, this study deleted ten manifest variables including 1, 2, 6, 8, 12,
13, 14, 18, 20, and 29 with high MI values and reserved 20 manifest variables.

<table>
<thead>
<tr>
<th>Fit Indices</th>
<th>Allowable Standard</th>
<th>Model (after modification)</th>
<th>Judgment of Model Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \chi^2 ) Chi-square Value</td>
<td>The smaller the better</td>
<td>251.72</td>
<td>Good</td>
</tr>
<tr>
<td>( \chi^2 ) Freedom Ratio</td>
<td>&lt;3.00</td>
<td>1.57</td>
<td>Good</td>
</tr>
<tr>
<td>GFI</td>
<td>&gt;0.90</td>
<td>0.92</td>
<td>Good</td>
</tr>
<tr>
<td>AGFI</td>
<td>&gt;0.80</td>
<td>0.90</td>
<td>Good</td>
</tr>
<tr>
<td>RMSEA</td>
<td>&lt;0.08</td>
<td>0.04</td>
<td>Good</td>
</tr>
<tr>
<td>CFI</td>
<td>&gt;0.90</td>
<td>0.97</td>
<td>Good</td>
</tr>
<tr>
<td>PCFI</td>
<td>&gt;0.50</td>
<td>0.82</td>
<td>Good</td>
</tr>
</tbody>
</table>
D. Discriminant validity

Discriminant validity tests the relevant degree of two different latent variables and according to the measurement results, the lower the relevance is, the weaker the correlation between two variables, indicating the existence of an exterior heterogenic assumption. This method adopts a relevant pair confidence interval of latent variables proposed by Joreskog & Sorbom (1989) that suggests that under a condition of 95% of confidence interval, the relevant coefficient is set as a positive and negative 1.96 standard deviation of freedom estimation of two latent variables. If the confidence interval does not include the value of 1.00, it indicates two latent variables as discriminant with discriminant validity. After testing, the confidence interval of each variable dimension does not include 1.00, indicating the discriminant validity.

(4) CFA of the Scale of Team Cohesion

This study uses the statistical software AMOS 20.0 to conduct a CFA. According to research purposes and SEM methodology, the statistical analysis procedure includes the selection of parameter estimation method, review of offending estimate, test of model fit, and evaluation of internal structure. The statistical analysis is shown below:

A. Parameter estimation

Before running the AMOS 20.0 statistical analysis, the researcher needs to understand the features of data collected to make sure if the data matches with the SEM assumption. In order to avoid influencing the results of the model evaluation and test, SPSS for Windows18.0 was first used to conduct a
The descriptive statistic of this study and a CFA was then executed with AMOS 20.0. The skewness of team cohesion lies between -.82 and -.17 and those with skewness higher than 3 are removed while the peak value is between -.97 and 1.16 and the absolute value of peak coefficient higher than 10 is deleted. Both values in this study do not exceed the standard range and thus, this study is suitable for the normal distribution of variables and the maximum likelihood (ML) that has the least impact on the estimation is used for the model parameter estimation.

**B. Offending estimate test**

The offending estimate test refers to the test conducted for the following violations before examining the model fit. There are three possible situations (Huang, 2004):

(a) The existence of a negative error variance or meaningless error variance.

(b) A standard coefficient exceeding or too close to 1 (normally using .95 as the threshold value).

After statistical analysis, the standard parameter value of the Scale of Team Cohesion is found to be between .59 and .77 with an error variance between .02 and .03. There is no negative error variance and thus, this model has no offending estimate and can begin the model fit test.

**C. Model fit test**

The total number of model variables of the Scale of Team Cohesion is 51 including 24 manifest ones (endogenous variable) and 27 latent ones (exogenous variable). The moment of unique sample is 324 (24*2=525) with 48 parameters for estimation (27 fixed parameters and 21 parameters to be estimated). When the moment of unique sample is larger than the parameters to be estimated, the model is excessively identified and meets the modification requirement of the theoretical model (Chang, 2011); after the CFA, the model does not meet the standard of an ideal one and we modify the model. According to the analysis results, a modification index is selected to release or delete variable parameters. If the standard parameter value is too small, we need to delete relevant variables. If the Chi-square value of CFA is too large, we need to use AMOS modification index (MI) to identify the path and path modification model (Chen, 2007). Thus, this study deleted 11 manifest variables including 1, 2, 3, 5, 6, 7, 9, 13, 16, 18, and 20 with high MI values and reserved 13 manifest variables.

After modification, the total number of model variables of the Scale of Team Cohesion is 29 including 13 manifest ones (endogenous variable) and 16 latent ones (exogenous variable) and the moment of unique sample is 104 (13*16/2=104). There are 26 estimation parameters including 16 fixed ones and ten to be estimated; the model belongs to an excessive identification that meets the modification requirement of the theoretical model (Chang, 2011). After the CFA, the model meets the standard of an ideal one with a reservation of 20 manifest variables; an offending estimate test is then conducted to identify standard parameter values with a4(.64), a8(.67), a10(.72), a11(.75), a12(.76), a14(.69), a15(.71), a17(.70), a19(.68), a21(.72), a22(.75), a23(.77), and a24(.72) between .64 and .77 with error variance between .02 and .05. There is no negative error variance, indicating no offending estimate of this dimension. The composite reliability (CR) and the average variance extracted (AVE) of the Scale of Team Cohesion are respectively .83 and .50, interpersonal interaction with a CR of .74 and AVE of .50, and team adjustment with a CR of .85 and AVE of .53, showing good convergence validity. Table 3 is a model fit analysis of the Scale of Team Cohesion with a Chi-square value of 108.95, freedom of 1.76, GFI of 0.95, AGFI of 0.92, RMSEA of 0.05, CFI of 0.97, and PCFI of 0.77, indicating a good overall model fit of Scale of Team Cohesion as shown in Fig. 4:
Table 3: Model Fit Analysis of Scale of Team Cohesion

<table>
<thead>
<tr>
<th>Fit Indices</th>
<th>Allowable Standard</th>
<th>Model (after modification)</th>
<th>Judgment of Model Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>χ² Chi-square Value</td>
<td>The smaller the better</td>
<td>108.75</td>
<td></td>
</tr>
<tr>
<td>χ² Freedom Ratio</td>
<td>&lt;3.00</td>
<td>1.76</td>
<td>Good</td>
</tr>
<tr>
<td>GFI</td>
<td>&gt;.90</td>
<td>0.95</td>
<td>Good</td>
</tr>
<tr>
<td>AGFI</td>
<td>&gt;.80</td>
<td>0.92</td>
<td>Good</td>
</tr>
<tr>
<td>RMSEA</td>
<td>&lt;.08</td>
<td>0.05</td>
<td>Good</td>
</tr>
<tr>
<td>CFI</td>
<td>&gt;.90</td>
<td>0.97</td>
<td>Good</td>
</tr>
<tr>
<td>PCFI</td>
<td>&gt;.50</td>
<td>0.77</td>
<td>Good</td>
</tr>
</tbody>
</table>

Figure 4: Model of scale of team cohesion

D. Discriminant validity

Discriminant validity tests the relevant degree of two different latent variables and according to the measurement results, the lower the relevance, the weaker the correlation between two variables, indicating the existence of an exterior heterogenic assumption. This method adopts a relevant pair confidence interval of latent variables proposed by Joreskog & Sorbom (1989) that suggests that under the condition of 95% of confidence interval, the relevant coefficient is set as a positive and negative 1.96 standard deviation of freedom estimation of two latent variables. If the confidence interval does not include the value of 1.00, it indicates two latent variables as discriminant with discriminant validity. After testing, the confidence interval of each variable dimension does not include 1.00, indicating the discriminant validity.
Data Processing

This study uses purposive sampling to collect data and SPSS for Window 18.0 and AMOS 20.0 statistical software for analysis. According to the research purposes, the analysis and test methods of this study are shown below:

1. **Descriptive statistics**

   With frequency distribution, the mean and standard deviation, the current Scale of Leadership Behavior of Coach, Training Satisfaction, and Team Cohesion of the 2011 College FIVB players are examined.

2. **Confirmatory Variable Analysis (CFA)**

   With AMOS20.0, this study conducts a CFA to examine the reliability and validity of variables and questions on the leadership behavior of coaches, training satisfaction, and team cohesion; overall model fit is also tested.

3. **One-way ANOVA**

   Variance of each variable is analyzed from the leadership behavior of coach, training satisfaction, and team cohesion perceived by the 2011 College FIVB players.

4. **LSD method**

   After one-way ANOVA, if the F value of each variable reaches a significant level, LSD is then utilized to understand the variance of each variable.

5. **Structural Equation Modeling (SEM)**

   SEM is used to test the overall model of the leadership behavior of coach, training satisfaction, and team cohesion perceived by the 2011 College FIVB players. Maximum likelihood is adopted for model parameter estimation and three indices, absolute fit, incremental fit and parsimonious fit, are introduced as the judgment basis.

6. **This study uses p <.05 as the significant level.**

RESULTS AND DISCUSSION

Descriptive Statistics of Sample Characteristics

1. **Gender**

   There are more male players in 2011 College FIVB with the number of 155 and the percentage of 51.7 compared to 145 female players and 48.3%.

2. **Grade**

   Most players are freshmen with the number of 102 and the percentage of 34.0% followed by 74 sophomores, 24.7%; 65 juniors, 21.7%, and 59 seniors and up (including postgraduates), 19.7%.

3. **Majors**

   There are 229 sports majors, 76.3% and 71 non-sports majors, 23.7%.

4. **Sports achievement**

   In terms of sports achievement, there are 178 players in school teams accounting for 59.3% followed by 71 players in city and county teams, 23%; 26 in national youth and junior teams, 8.7%; and 25 in national teams, 8.3%.

5. **Years of playing volleyball**

   There are 158 players who have played volleyball for eight to 12 years, 52.7% followed by 107 players who have played between four and seven years, 35.7%, 19 have played more than 13 years, 6.3%, and 16 have played less than three years, 5.3%.
6. Training days per week

Each week, about 185 players train about four to five days followed by 36 players that train less than three days, 26.3%. The least, 12% of players, train more than six days.

Current State and Analysis of Variables of the Leadership Behavior of Coach, Training Satisfaction, and Team Cohesion Perceived by College FIVB Players in Taiwan

1. Current State and analysis of variables of leadership behavior of coach perceived by College FIVB players in Taiwan

For the current state of leadership behavior of coach perceived by College FIVB players in Taiwan, training and instruction receive an average score of 3.83 points, autocratic behavior of 2.69, democratic behavior of 3.59, caring behavior of 3.78, and positive behavior of 3.74. Table 4 shows the summary of one-way ANOVA for the Scale of Leadership Behavior of Coach perceived by College FIVB players in Taiwan. The F value is 167.81*, indicating a significant difference of perception towards variables in the Scale of Leadership Behavior of Coach. Thus, LSD shall be conducted. Table 5 is a LSD summary of variables in the Scale of Leadership Behavior of Coach perceived by College FIVB players in Taiwan. As shown in Table 5, among the five aspects, training and instruction are perceived with the highest level, Level 1 followed by caring and positive behavior, Level 2, autocratic behavior, Level 3, and democratic behavior, the lowest level, Level 4.

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjects SSx</td>
<td>324.68</td>
<td>299</td>
<td>1.09</td>
<td></td>
</tr>
<tr>
<td>Independent Variable SSa</td>
<td>271.46</td>
<td>4</td>
<td>67.87</td>
<td>167.81*</td>
</tr>
<tr>
<td>Error Term SSsa</td>
<td>483.69</td>
<td>1196</td>
<td>0.40</td>
<td></td>
</tr>
</tbody>
</table>

*p < .05

Table 5: LSD Result and Ranking Summary of Variables in the Scale of Leadership Behavior of Coach

<table>
<thead>
<tr>
<th>Name of Variable</th>
<th>M</th>
<th>V1</th>
<th>V4</th>
<th>V5</th>
<th>V2</th>
<th>V3</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1 Training and instruction</td>
<td>3.83</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>1</td>
</tr>
<tr>
<td>V4 Caring behavior</td>
<td>3.78</td>
<td></td>
<td>-</td>
<td>-</td>
<td>*</td>
<td>*</td>
<td>2</td>
</tr>
<tr>
<td>V5 Positive behavior</td>
<td>3.74</td>
<td>-</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>V2 Autocratic behavior</td>
<td>3.69</td>
<td>-</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>V3 Democratic behavior</td>
<td>3.59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

*With significant variance

2. Current State and analysis of variables of training satisfaction perceived by College FIVB players in Taiwan

For the current state of training satisfaction perceived by College FIVB players in Taiwan, achievement performance receives an average score of 3.20 points, leadership behavior of coach of 3.64, internal atmosphere of team of 3.79, training contents of 3.78, and venue facilities of 3.68. Table 6 shows the summary of one-way ANOVA for the Scale of Training Satisfaction perceived by College FIVB players in Taiwan.
players in Taiwan. The F value is 52.57*, indicating a significant difference of perception towards variables in the Scale of Training Satisfaction. Thus, LSD shall be conducted. Table 7 is a LSD summary of variables in the Scale of Training Satisfaction perceived by College FIVB players in Taiwan. As shown in Table 7, among the five aspects, internal atmosphere of team is perceived with the highest level, Level 1 followed by venue facilities, leadership behavior of coach, and training contents, Level 2, and achievement performance, the lowest level, Level 3.

### Table 6: Summary of One-way ANOVA of Scale of Training Satisfaction Perceived by College FIVB Players in Taiwan

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjects SSs</td>
<td>426.61</td>
<td>299</td>
<td>1.43</td>
<td></td>
</tr>
<tr>
<td>Independent variable SSa</td>
<td>60.90</td>
<td>4</td>
<td>15.22</td>
<td>52.57*</td>
</tr>
<tr>
<td>Error term SSsa</td>
<td>346.34</td>
<td>1196</td>
<td>.29</td>
<td></td>
</tr>
</tbody>
</table>

* p < .05

### Table 7: LSD Result and Ranking Summary of Variables in the Scale of Training Satisfaction

<table>
<thead>
<tr>
<th>Name of Variable</th>
<th>M</th>
<th>LSD</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal atmosphere of team</td>
<td>3.79</td>
<td>*</td>
<td>1</td>
</tr>
<tr>
<td>Venue facilities</td>
<td>3.68</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Leadership of coach</td>
<td>3.64</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Training contents</td>
<td>3.60</td>
<td>*</td>
<td>2</td>
</tr>
<tr>
<td>Achievement performance</td>
<td>3.20</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

*With significant variance

3. Current State and analysis of variables of team cohesion perceived by College FIVB players in Taiwan

For the current state of team cohesion perceived by College FIVB players in Taiwan, team cooperation receives an average score of 3.83 points, personal interaction of coach of 3.82, and team adjustment of 3.98. Table 8 shows the summary of one-way ANOVA for the Scale of Team Cohesion perceived by College FIVB players in Taiwan. The F value is 15.86*, indicating a significant difference of perception towards variables in the Scale of Team Cohesion. Thus, LSD shall be conducted. Table 9 is a LSD summary of variables in the Scale of Team Cohesion perceived by College FIVB players in Taiwan. As shown in Table 9, among the three aspects, team adjustment is perceived with the highest level, Level 1 followed by team cooperation and personal interaction, Level 2.

### Table 8: Summary of One-way ANOVA of Scale of Team Cohesion Perceived by College FIVB Players in Taiwan

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjects SSs</td>
<td>263.96</td>
<td>299</td>
<td>.88</td>
<td></td>
</tr>
<tr>
<td>Independent variable SSa</td>
<td>4.42</td>
<td>2</td>
<td>2.21</td>
<td>15.86*</td>
</tr>
<tr>
<td>Error term SSsa</td>
<td>83.24</td>
<td>598</td>
<td>.14</td>
<td></td>
</tr>
</tbody>
</table>

* p < .05
Table 9: LSD Result and Ranking Summary of Variables in Scale of Team Cohesion

<table>
<thead>
<tr>
<th>Variable analysis</th>
<th>M</th>
<th>LSD</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V3</td>
<td>V1</td>
<td>V2</td>
</tr>
<tr>
<td>V3 team adjustment</td>
<td>3.98</td>
<td>-</td>
<td>*</td>
</tr>
<tr>
<td>V1 team cooperation</td>
<td>3.83</td>
<td>-</td>
<td>*</td>
</tr>
<tr>
<td>V2 personal interaction</td>
<td>3.82</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

*With significant variance

Construction of the Path Model of Leadership Behavior of Coach, Training Satisfaction, and Team Cohesion Perceived by College FIVB Players

1. Check of parameter estimation of manifest variables

   After statistical analysis, when the absolute value of the skewness coefficient is higher than 3, the manifest variables are removed while the absolute value of peak coefficient higher than 10, which is not normal, is deleted. Both values in this study do not exceed the standard range and thus, this study is suitable for the normal distribution of variables and the maximum likelihood (ML) that has the least impact on estimation is used for the model parameter estimation.

2. Inspection of offending estimate

   The offending estimate test refers to the test conducted for the following violations before examining model fit. There are three possible situations (Huang, 2004):

   1) The existence of a negative error variance or meaningless error variance.

   2) Standard coefficient exceeding or too close to 1 (normally using .95 as the threshold value).

   After statistical analysis, the standard parameter value of overall manifest variables is found to be between .03 and .73 with an error variance between .02 and .04. There is no negative error variance and thus, this model has no offending estimate and can begin model fit test.

3. Test of model fit

   This study examines a total of 13 dimensional variables of overall manifest variables of leadership behavior of coach, training satisfaction, and team cohesion perceived by College FIVB players including five variables of training and instruction, autocratic behavior, democratic behavior, caring behavior, positive behavior for leadership behavior of coach; five variables of achievement performance, leadership of coach, team atmosphere, training contents, and venue facilities for training satisfaction; and three variables of team adjustment, team cooperation, and personal interaction for team cohesion. The overall dimensional fit test is conducted and modified via parameter estimation and offending estimate check to conduct the model fit test of the overall manifest variables.

   The standard parameter values are, respectively, training and instruction (.73), autocratic behavior (-.17), democratic behavior (.67), caring behavior (.86), positive behavior (.85), achievement performance (.52), leadership behavior of coach (.71), team atmosphere (.75), training contents (.82), venue facilities (.57), team adjustment (.62), team cooperation (.73), and personal interaction (.57) while composite validity of leadership behavior of coach is .77 and AVE is .50, training satisfaction .81 and .47, and team cohesion .84 and .64, indicating good convergence validity. Table 10 shows the model fit analysis of the overall manifest variables with a Chi-square value of 171.11, freedom of 2.76, GFI of 0.92, AGFI of 0.88, RMSEA of 0.08, CFI of 0.94 and PCFI of 0.78, indicating good model fit. The overall model is shown in Fig. 6:
<table>
<thead>
<tr>
<th>Fit Indices</th>
<th>Allowable Standard Model</th>
<th>Model (after modification)</th>
<th>Judgment of Model Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$ Chi-square Value</td>
<td>the smaller the better</td>
<td>171.11</td>
<td></td>
</tr>
<tr>
<td>$\chi^2$ freedom Ratio</td>
<td>&lt;3.00</td>
<td>2.76</td>
<td>Good</td>
</tr>
<tr>
<td>GFI</td>
<td>&gt;0.90</td>
<td>0.92</td>
<td>Good</td>
</tr>
<tr>
<td>AGFI</td>
<td>&gt;0.80</td>
<td>0.88</td>
<td>Good</td>
</tr>
<tr>
<td>RMSEA</td>
<td>&lt;0.08</td>
<td>0.08</td>
<td>Good</td>
</tr>
<tr>
<td>CFI</td>
<td>&gt;0.90</td>
<td>0.94</td>
<td>Good</td>
</tr>
<tr>
<td>PCFI</td>
<td>&gt;0.50</td>
<td>0.78</td>
<td>Good</td>
</tr>
</tbody>
</table>

4. Results of the hypotheses test

The results of the research hypotheses are described below:

**H1**: Leadership behavior of coach has a significantly positive influence on training satisfaction.

The parameter estimation of leadership behavior for training satisfaction of the coach is .72, t (*p < 0.05), reaching a significant level and indicating that the leadership behavior of the coach has a significantly positive influence on training satisfaction. Therefore, H1 stands.

**H2**: Leadership behavior of coach has a significantly positive influence on team cohesion.

The parameter estimation of leadership behavior for team cohesion is .57, t (*p < 0.05), reaching a significant level and indicating that the leadership behavior of the coach has a significantly positive influence on team cohesion. Therefore, H2 stands.

**H3**: Training satisfaction has a significantly positive influence on team cohesion.

The parameter estimation of training satisfaction for team cohesion is .66, t (*p < 0.05), reaching a significant level and indicating that training satisfaction has a significantly positive influence on team cohesion. Therefore, H3 stands.

5. Summary

As shown in the above research results, the variables of leadership behavior of coach, training satisfaction, and team cohesion perceived by College FIVB players all make a positive impact and the parameter estimation of leadership behavior of coach for training satisfaction is as high as .72, matching
that of Wu (2002), Lu (2004), Chang (2006), Tsai (2006), Chiou (2009), Chang-Chian (2009), Shi (2009), Pan (2010), Lien (2012), Yeh (2010) and Hung (2011) because good training contents are key factors in facilitating cooperation and coordination among players. Volleyball is a group sport that requires the coordination of players to make progress and grow and coaches shall utilize caring and positive behavior as leaders to positively influence the satisfaction of players and team cohesion and to enable the team to work for common goals.

According to the results in the above overall model, team cohesion is perceived by players from multiple variables including key factors either the impact of leadership style or venue facilities on training satisfaction. Good leadership behavior of coaches improves training satisfaction as well as team cohesion. As a result, better team interaction and performance are expected. Coaches can also improve players’ perception towards team cohesion by enhancing training satisfaction.

CONCLUSIONS & SUGGESTIONS

Conclusions

According to the research questions, the conclusions are acquired below after statistical analysis and discussion:

1. Variables in Scale of Leadership Behavior of Coach perceived by College FIVB players in Taiwan are found with significance and among five aspects, training and instruction are perceived with the highest level, Level 1 followed by caring and positive behavior, Level 2, autocratic behavior, Level 3, and democratic behavior, the lowest level, Level 4.

2. Variables in Scale of Training Satisfaction perceived by College FIVB players in Taiwan are found with significance and among five aspects, internal atmosphere of team is perceived with the highest level, Level 1 followed by venue facilities, leadership behavior of coach, and training contents, Level 2, and achievement performance, the lowest level, Level 3.

3. Variables in Scale of Team Cohesion perceived by College FIVB players in Taiwan are found with significance and among three aspects, team adjustment is perceived with the highest level, Level 1, followed by team cooperation and personal interaction, Level 2.

4. Results of hypotheses test

H1 : Leadership behavior of coach has a significantly positive influence on training satisfaction.

H2 : Leadership behavior of coach has a significantly positive influence on team cohesion.

H3 : Training satisfaction has a significantly positive influence on team cohesion.

Suggestions

According to the research conclusions, the following relevant suggestions are proposed:

1. This study finds the lowest average score of democratic behavior perceived by College FIVB players in Taiwan. We suggest that coaches shall use a democratic method to improve the recognition of students in the leadership of coaches.

2. This study finds the lowest average score of achievement performance perceived by College FIVB players in Taiwan. We suggest that coaches shall help and train players to build their confidence in order to improve their perception towards achievement performance.

3. This study finds the lowest average scores of team cooperation and personal interaction perceived by College FIVB players in Taiwan and we suggest that coaches shall facilitate mutual communication among players and design more training courses on team interaction and cooperation in order to enhance interaction and trust.
4. This study establishes an overall model and we suggest that coaches shall improve their perception towards training satisfaction and team cohesion to allow more acceptances for the leadership style and to improve overall performance.

5. This study only investigates College FIVB players in Taiwan. Future studies shall be conducted on different groups or players at different levels.

REFERENCES


Chung, C. C. (1998). A study on the leisure behavior of college athletes- A case study of students majoring in sports at the National Taiwan College of Sport. *Selected papers of sport and leisure management (2).* ed. by the National Taiwan College of Sport, 329-358, Taipei City, Taiwan Normal University.


Huang, H. C., & Chao, R. R. (2009). A study on coach leadership and team cohesion as perceived by members of outstanding college cheer leading teams. Journal of Taiwan Society for Sport Management, 6, 33-44.


