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## Variance analysis-based cheerleading to female university students confidence activation effects research

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### ABSTRACT

The paper makes analysis of cheerleading features, confidence functions and confidence measurement three aspects, it detailed states single factor variance and covariance analysis mathematical principle, application conditions and SPSS implementation steps, uses SPSS software to make before and after experiments single factor variance analysis and covariance analysis of aerobics option course, sports dance option course and cheerleading option course students' four dimensional confidence levels, in single factor variance analysis, it gets cheerleading overall efficiency on female university students confidence level improving advantages, in covariance analysis, it gets each dimensional cheerleading to female university students' confidence level promotion and other two learners' comparison, and gets that cheerleading has very remarkable effects on female university students confidence level promotion.

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### KEYWORDS

Cheerleading;  
Teaching experiment;  
Variance analysis;  
SPSS software;  
Four dimensional confidences.

### INTRODUCTION

Teng Feng-Xian(2011) pointed out confidence was a multiple dimensions and multiple layers psychological system, it played important roles in personal growth and development, it could be improved by some specific activities as sports activities, behaviors, social activities and reading<sup>[1]</sup>. And cheerleading was a kind of event that gathered enthusiasm and fitness practice, the paper carried out confidence level investigation research on one university sophomore cheerleading option course, aerobics option course and sports dance option course each thirty-five students, in the hope of using SPSS statistical software and single factor variance analysis methods to explore cheerleading promotion

effects on female university students confidence level.

For cheerleading sports features and university students confidence level measurement researches, lots of people have made efforts, which made contributions to contemporary university students confidence level promotion and cheerleading popularity degree improvement, from which Xie Xiao-Hu(2013) adopted "Confidence level test", "Personal report of disposition" and "Subjective well-being scale" to test on 465 university students, with an aim to explore university students confidence levels, disposition type and subjective well-being relations problems, he got that confidence level had significant main effect on subjective well-being while interaction effects on gender were insignificant, disposition type had significant main effect on subjective well-

being while interaction effects on gender were insignificant<sup>[2]</sup>; Li Ruo-Guo and others (2013) discussed cheerleading to university students one of personality core peculiarities as confidence impacts, and got that compared with other items cheerleading event had significant advantages in cultivating students' overall affirmation, action figure and appearance expression as well as other confidence dimensions aspects<sup>[3]</sup>.

The paper on the basis of previous research, starts from cheerleading sports features, confidence functions and confidence measurement analysis, it explores cheerleading superiority in female university students confidence level promotion by comparing with aerobics and sports dances, which provides a more effective way for contemporary students confidence level, meanwhile it impels cheerleading popularization process.

### RESEARCH OBJECTS AND RESEARCH METHODS

#### Research objects

The paper makes confidence test on one university sophomore undergraduate 105 students in school, the students majors are from female students in whole university except for physical culture institute, makes comparative analysis of aerobics option course, sports dance option course and cheerleading option course each thirty-five students, in the hope of exploring cheerleading option course superiorities in female university students' confidence impacts. Research objects basic information is as TABLE 1 show.

#### Research method

##### Document literature

In CNKI, searching 12 pieces of research documents about sports to students' confidence promotion effects, 15 pieces of research documents about university students confidence promotion and monitoring methods, 6 pieces of documents about university students confidence investigation data analysis and researches, 10 pieces of research documents about university students sports option course cheerleading similar events, which provides basis for university students confidence evaluation indicator extracting, teaching experiments designing and investigation data analysis method.

##### Questionnaire survey

The paper adopted questionnaire designing is Che Li-Ping(2010) compiled university confidence questionnaire content<sup>[4]</sup>, questionnaire content divides into overall confidence, social confidence, academic confidence and body confidence four dimensions, it totally has 70 questions, questionnaire release amount is 221 pieces, effective recycle is 200 pieces and effective recycle rate arrives at 90.5%.

##### Expert interview

In order to provide scientific questions for questionnaire survey, it sets expert group that is composed of university psychological department research's twelve experts, which provides basis for university students confidence evaluation indicators optimization and investigation data authority.

##### Teaching experiment method

For cases as TABLE 1 showed research objects,

TABLE 1 : Aerobics, sports dance and cheerleading option courses' students' samples status

Type	Category options	Aerobics option course students		Sports dance option course students		Cheerleading option course students	
		Option population	Population rate	Option population	Population rate	Option population	Population rate
		Origin of student	Village	16	45.7 %	19	54.3 %
	City	19	54.3 %	16	45.7 %	14	40.0 %
Only daughter or not	Yes	11	31.4 %	13	37.1 %	9	25.7 %
	No	24	68.6 %	22	62.9 %	26	74.3 %
Major	Liberal arts	25	71.4 %	20	57.1 %	25	71.4 %
	Science	10	28.6 %	15	42.9 %	10	28.6 %

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it uses experimental group, control group, pretesting and post testing experimental ways, in order to ensure equivalent group features, it carries out basic body quality, special sports technology and confidence level pretesting on participated aerobics, sports dances and cheerleading option courses all sophomore female students, then extract similar levels research samples from every class. Experimental group students are cheerleading option course students, control group students are aerobics and sports dances option courses students, carries on continuous 12 weeks and every week two courses, every courses 45 minutes teaching. Teaching contents are three levels' aerobics teaching, sports dance teaching and cheerleading teaching that are regarded as independent variable, students confidence is regarded as dependent variable. Three kinds of option courses students' teaching contents status is as TABLE 2 show.

**Mathematical statistics**

In the paper, it selects SPSS statistical software and EXCEL statistical software to make analysis, applies covariance statistical analysis method to research on pretesting data, and applies single factor variance statistical analysis method to make research on confidence level change status.

**VARIANCE ANALYSIS PRINCIPLE AND**

**TABLE 2 : Aerobics, sports dance and cheerleading option course teaching content**

Aerobics option course teaching content	Sports dance option course teaching content	Cheerleading option course teaching contents
<b>Basic stance and arms exercise</b>		
Basic pace exercise		Basic pace and slogan exercise
New mass first grade routine	Cha Cha bronze routine	Crystal grade cheerleading routine
Body control and motion elastic exercise	Dance basic skills exercise	Music performance

**Basic quality exercise**

**TABLE 3 : Before teaching experiment three groups of students confidence level single factor variance analysis result**

Type	Aerobics	Sports dance	Cheerleading	F value	P value
Overall confidence	3.59 ± 0.49	3.59 ± 0.42	3.54 ± 0.45	2.37	0.099
Academic confidence	3.33 ± 0.56	3.31 ± 0.53	3.30 ± 0.55	2.35	0.101
Body confidence	3.30 ± 0.43	3.32 ± 0.40	3.21 ± 0.48	0.84	0.437
Social confidence	3.59 ± 0.48	3.58 ± 0.61	3.39 ± 0.47	0.86	0.429
Confidence total score	3.44 ± 0.38	3.44 ± 0.43	3.35 ± 0.42	1.34	0.268

**SPSS IMPLEMENTATION**

The paper makes theoretical statement by two sections on variance analysis single factor variance analysis and covariance analysis, and introduces analysis SPSS implementation, in the hope of building theoretical basis for cheerleading confidence promotion effects researching.

**Single factor variance analysis and SPSS implementation**

Single factor variance research is a classified independent variable impacts on a numeric type dependent variable impact. In practical problems single factor variance analysis, firstly it needs to put forward hypothesis, if investigation result after processing data is from *s* pieces of different total sample value, it needs to successive record each totality average value as  $\mu_1, \mu_2, \dots, \mu_s$ , according to problems analysis purpose, it can make as formula(1) showed test hypothesis:

$$\begin{aligned}
 H_0 : & \mu_1 = \mu_2 = \dots = \mu_s \\
 H_1 : & \forall \mu_i \neq \bar{\mu}, (i = 1, 2, \dots, s) ; \bar{\mu} = \frac{1}{s} \sum_{i=1}^s \mu_i
 \end{aligned}
 \tag{2}$$

And then calculate each sample average value ( $\bar{x}_i$ ), whole observed value total average value ( $\bar{\bar{x}}$ ) and each error squares sum (total squares sum *SST*, intergroup squares sum *SSA* as well as intra-group squares sum

SSE), its computational method is as formula (3) show:

$$\left\{ \begin{aligned} \bar{x}_i &= \frac{1}{n_i} \sum_{j=1}^{n_i} x_{ij}; \bar{\bar{x}} = \frac{1}{n} \sum_{i=1}^k n_i \bar{x}_i \\ SST &= \sum_{i=1}^k \sum_{j=1}^{n_i} (x_{ij} - \bar{\bar{x}})^2; SSA = \\ &= \sum_{i=1}^k n_i (\bar{x}_i - \bar{\bar{x}})^2; SSE = \sum_{i=1}^k \sum_{j=1}^{n_i} (x_{ij} - \bar{x}_i)^2 \end{aligned} \right. \quad (3)$$

In formula (3),  $n$  represents number of observed value,  $k$  represents factor level number,  $n_i$  represents the  $i$  sample observed value number, three squares sum freedom degree are respectively  $(n-1), (k-1), (n-k)$ , variance analysis compared is difference between intragroup average square and intergroup average square, therefore total squares sum  $SST$ , intergroup squares sum  $SSA$  and intragroup squares sum  $SSE$  average squares respectively record as  $MST, MSA, MSE$ , their value computing method is squares sum and freedom degree ratio, when test hypothesis  $H_0$ ,  $MSA$  and  $MSE$  ratio conforms to numerator freedom degree as  $k-1$ , and denominator freedom degree as  $n-k$  Chi-squared distribution, expression is as formula (4) show:

$$F = \frac{MSA}{MSE} \sim F(k-1, n-k) \quad (4)$$

Finally, according to given significance level  $\alpha$  in Chi-squared distribution table, find out numerator freedom degree  $df_1 = k-1$  and denominator freedom degree  $df_2 = n-k$  corresponding critical value  $F_\alpha(k-1, n-k)$ , if obtained  $F > F_\alpha$  then refuse original hypothesis  $H_0$ , which shows tested factor has significant impacts on observed value, if  $F < F_\alpha$  and then don't refuse original hypothesis, which shows tested factor has no significant impacts on observed value.

For fully random designed single factor variance analysis, path in SPSS single factor analysis is [Analyze] → [Compare means] → [One-Way ANOVA] → [Post Hoc Multiple Comparisons] → [Equal Variances Assumed] → [LSD/S-N-K], for random unit group designed single factor variance analysis, path in SPSS single factor analysis is [Analyze] → [General Linear Models] → [Univariate] → [Post

Hoc Multiple Comparisons for Observed Means] → [Equal Variances Assumed] → [LSD].

### Covariance analysis and SPSS implementation steps

In practical data research, experiment result often suffers some mixed factors impacts, these mixed factors in statistics is called covariant, if ignore covariant effects, and then it may get relatively partial conclusions, covariance analysis refers to a kind of statistical method that combines application of linear regression with variance analysis, which is used to eliminate mixed factors to analysis indicators impacts, its basic thought is before two groups or multiple groups  $Y$  average value hypothesis testing, use linear regression method to find out each group  $Y$  and covariant  $X$  quantity relations, solve adjusted mean when assume  $X$  is equal, and then use variance analysis to compare adjusted mean differences. As following showed covariance analysis four applied conditions:

- 1) Each group covariant  $X$  and independent variable  $Y$  is in linear relations.
  - 2) Each sample regression coefficient  $b$  differences have no statistical significance.
  - 3) Each group residual is in normal distribution.
  - 4) Each covariant mean difference cannot be too big.
- At first, make test hypothesis as following show:

$H_0$ : Each totality adjusted mean is equal;  $H_1$ : each totality adjusted mean is not fully equal;  $\alpha = 0.05$

Then, calculate total covariance, intergroup covariance and intragroup covariance ( $I_{XX}, I_{YY}, I_{XY}$ ) respectively as formula (5), formula(6) and formula (7) show:

$$\left\{ \begin{aligned} I_{XX} &= \sum X - \frac{1}{N} (\sum X)^2; I_{YY} = \sum Y - \frac{1}{N} (\sum Y)^2 \\ I_{XY} &= \sum XY - \frac{1}{N} (\sum X)(\sum Y), v = N-1 \end{aligned} \right. \quad (5)$$

$$\left\{ \begin{aligned} I_{XX} &= \sum \frac{(\sum X_j)^2}{n_j} - \frac{1}{N} (\sum X)^2; I_{YY} = \sum \frac{(\sum Y_j)^2}{n_j} - \frac{1}{N} (\sum Y)^2 \\ I_{XY} &= \sum \frac{(\sum X_j)(\sum Y_j)}{n_j} - \frac{1}{N} (\sum X)(\sum Y), v = G-1 \end{aligned} \right. \quad (6)$$

$$(5) - (6) = \begin{cases} I_{XX}; I_{YY} \\ I_{XY}; v \end{cases} \quad (7)$$

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Finally, according to given significance level  $\alpha$  in Chi-squared distribution table, find out numerator freedom degree  $df_1 = G - 1$  and denominator freedom degree  $df_2 = N - G$  corresponding critical value  $F_{\alpha}(G-1, N-G)$ , if obtained  $F > F_{\alpha}$  then refuse original hypothesis  $H_0$ , which shows tested factor has significant impacts on observed value, if  $F < F_{\alpha}$  and then don't refuse original hypothesis, which shows tested factor has no significant impacts on observed value.

Covariance analysis implementation path in SPSS statistical software is [Analyze] -> [General Linear Models] -> [Univariate] -> [Model] -> [Specify Model] -> [Full factorial] -> [Sum of square] -> [Type 111].

EMPIRICAL ANALYSIS

Before and after experiment each confidence level single factor variance analysis result

Before experiment, carry out confidence level single factor variance analysis of aerobics, sports dances and cheerleading option course students, its result is as TABLE 3 show.

From TABLE 3 data, it is clear that before experiment each group of student confidence level in four dimensions have no significant differences, and can distinguish students' confidence level promotion reasons from teaching content after experiment.

Due to experiment investigation result involved data is various, in order to stress key points, the paper shows key data and analyzes it, makes literal statement on general surface data, the three groups of students after teaching experiments, four dimensions confidence level has been improved, only each group increment status is different, as TABLE 4 showed aerobics, sports dances and cheerleading students confidence level differences in four dimensions.

By TABLE 4 data, it is clear that sports dance students and cheerleading students four dimensional confidence level has been significant improved, and aerobics students improvement in academic confidence level dimension is not significant, while confidence level in other three dimensions has been significant improved, from three groups of students confidence level four dimensional  $T$  test  $P$  value comparison, it is clear that cheerleading student difference significance in overall confidence and academic confidence two dimensions are higher than other two groups of students, for body confidence and social confidence two dimensional con-

TABLE 4 : Each group of students before and after experiment confidence level four dimensional increment  $T$  test result

Type	Aerobics		Sports dance		Cheerleading	
	$T$ value	$P$ value	$T$ value	$P$ value	$T$ value	$P$ value
Overall confidence	[-2.556]	0.016	[-3.274]	0.002	[-10.180]	0.000
Academic confidence	(-1.453)	0.157	[-2.767]	0.007	[-3.660]	0.001
Body confidence	[-2.166]	0.039	[-4.722]	0.000	[-6.726]	0.000
Social confidence	[-0.637]	0.013	[-3.957]	0.000	[-6.110]	0.000
Confidence total score	[-3.081]	0.004	[-4.262]	0.000	[-7.592]	0.000

Note: In  $T$  value [ ] represents  $P < 0.01$ , [ ] represents  $< 0.05$ , () represents  $> 0.05$

TABLE 5 : Before and after experiment aerobics student other three dimensions sub dimension confidence level difference test result beyond academic confidence

Dimension	Overall confidence				Body confidence				Social confidence		
	A	B	C	D	E	F	G	H	I	J	
$T$ value	-1.218	-2.882	-0.087	-3.199	-1.013	0.317	-1.249	-0.518	-5.283	6.265	
$P$ value	0.233	0.007	0.932	0.003	0.319	0.753	0.222	0.609	0.000	0.000	

Note: A represents comprehensive confirmation, B represents overall affirmation, C represents self -negation, D represents sports event, E represents health quality, F represents action and figure, G represents appearance and expression, H represents looks and height, I represents classmates and others, J represents family and teacher



confidence level, aerobics students before and after experiment difference significance is lower than other two groups of students. In order to analyze aerobics students before and after experiment other three dimensions confidence level difference beyond academic confidence dimension, it gets as TABLE 5 showed each dimensional sub dimension confidence level difference *T* test result.

By TABLE 5 data, it is clear that aerobics students before and after teaching experiments, except for academic confidence has no significant differences, other three dimensions confidence level has significant differences on a whole, but in comprehensive confirmation, self-negation, health quality, action and figure, appearance and expression as well as looks and height seven sub dimensions have no significant differences.

**Before and after experiment each group of confidence level covariance analysis result and each group after experiment multiple comparative analyses**

Covariance analysis researched is problem whether pretesting impacts among groups are the same or not, the paper set covariance analysis significance level is  $\alpha = 0.05$ , if in each group students before and after experiment four dimensions confidence level difference covariance test result  $P > 0.05$ , then it is thought the dimension has no statistical significance, and it should eliminate the dimension confidence level variable in multiple analysis, as TABLE 6 show the three groups of students before and after experiment confidence level linear regression analysis result.

By TABLE 6 linear regression analysis result, it is

**TABLE 6 : Pretesting as independent variable and post testing as dependent variable each group students confidence level linear regression analysis result**

Test statistical quantity	Overall confidence	Academic confidence	Body confidence	Social confidence	Confidence total score
<i>F</i> value	75.757	132.248	44.926	41.380	71.954
<i>P</i> value	0.000	0.000	0.000	0.000	0.000

**TABLE 7 : Three groups of students after experiment each dimension confidence level difference covariance analysis result**

Test statistical quantity	Overall confidence	Academic confidence	Body confidence	Social confidence	Confidence total score
<i>F</i> value	15.711	2.821	8.625	10.555	11.489
<i>P</i> value	0.000	0.065	0.000	0.000	0.000

clear that three groups of students before experiment confidence level has larger impact on after experiment confidence level, it needs to make covariance analysis of post testing data as TABLE 7 show three groups of students after experiment each dimension confidence level differences covariance analysis result.

By TABLE 7 data, it is clear that difference in academic confidence dimension has no significance change after experiment, therefore eliminate academic confidence dimension, confidence level differences sub dimensional covariance analysis in other three dimensions is as TABLE 8 show.

By TABLE 8 data, it is clear that sports, health quality and looks height three sub dimensional confidence level has no significant differences before and after experiment, therefore eliminate E and H two sub dimensional levels, in the following it carries out each group multiple comparison for other eight sub dimensions confidence level differences before and after experiment, in the hope of exploring three movements to female university student confidence promotion effects, as TABLE 9 show after experiment three groups of students seven sub dimensions confidence level differences covariance test result.

By TABLE 9 data, it is clear that sub dimension A, B, F and G in after experiment sports dance group and aerobics group students confidence level difference covariance test, it shows insignificant level, sub dimension C and D in after experiment cheerleading group and aerobics group students' confidence level difference covariance test, it shows insignificant level, sub dimension D in before and after experiment cheerleading and sports dance group students' confidence level dif-

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**TABLE 8 : Three groups of student after experiment other three dimensions sub dimensional covariance analysis result beyond academic confidence dimension**

Dimension	Overall confidence			Body confidence				Social confidence		
	A	B	C	D	E	F	G	H	I	J
T value	9.679	9.004	5.531	3.330	1.267	8.680	5.952	0.529	14.262	25.698
P value	0.000	0.000	0.005	0.040	0.287	0.000	0.004	0.591	0.000	0.000

Note: The same as Table 5

**TABLE 9 : After experiment three groups of students seven sub dimensional confidence level differences covariance test result**

Experimental group	Control group	Dimension	Average difference	Standard deviation	P value	Dimension	Average difference	Standard deviation	P value
1	2	A	-0.441	0.102	0.000	F	-0.455	0.138	0.001
	3		-0.138	0.102	0.179		0.081	0.139	0.564
2	1		0.441	0.102	0.000		0.455	0.138	0.001
	3		0.303	0.102	0.004		0.536	0.139	0.000
3	1		0.138	0.102	0.179		-0.081	0.139	0.564
	2		-0.303	0.102	0.004		-0.536	0.139	0.000
1	2	B	-0.542	0.129	0.000	G	-0.489	0.148	0.001
	3		-0.199	0.129	0.128		-0.119	0.148	0.423
2	1		0.542	0.129	0.000		0.489	0.148	0.001
	3		0.343	0.129	0.009		0.369	0.147	0.014
3	1		0.199	0.129	0.128		0.119	0.148	0.423
	2		-0.343	0.129	0.009		-0.369	0.147	0.014
1	2	C	-0.459	0.139	0.001	I	-0.441	0.145	0.003
	3		-0.275	0.139	0.052		-0.761	0.143	0.000
2	1		0.459	0.139	0.001		0.441	0.145	0.003
	3		0.184	0.139	0.189		-0.320	0.144	0.029
3	1		0.275	0.139	0.052		0.761	0.143	0.000
	2		-0.184	0.139	0.189		0.320	0.144	0.029
1	2	D	-0.310	0.180	0.088	G	-0.409	0.162	0.013
	3		-0.447	0.177	0.013		0.739	0.162	0.000
2	1		0.310	0.180	0.088		0.409	0.162	0.013
	3		-0.136	0.178	0.445		1.148	0.162	0.000
3	1		0.447	0.177	0.013		-0.739	0.162	0.000
	2		0.136	0.178	0.445		-1.148	0.162	0.000

Note: 1 represents sports dance student, 2 represents cheerleading student, 3 represents aerobics student, letter definition is as Table 5

ference covariance test, it shows insignificant level, all data features are  $P > 0.05$ .

By TABLE 9 data, it can also get that in comprehensive confirmation and overall affirmation two sub dimensions, cheerleading option course students have

very remarkable promotion by comparing to other two option courses students; in action figure and appearance as well as expression these two sub dimensions, cheerleading option course students have remarkable promotion by comparing to other two kinds of option

courses students, on a whole, cheerleading students have great advantages in female university students confidence level promotion aspect.

### CONCLUSION

The paper firstly makes analysis of cheerleading features, confidence functions and confidence measurement three aspects, which builds basis for cheerleading to female university students' confidence level promotion teaching experiment design and confidence level evaluation indicator extracting. It detailed states single factor variance and covariance analysis mathematical principle, application conditions and SPSS implementation steps, which provides methods and evidence for the paper experiment result data processing and targeted analysis. Use SPSS software to make before and after experiments single factor variance analysis and covariance analysis of aerobics option course, sports dance option course and cheerleading option course students' four dimensional confidence levels, in single factor variance analysis, it gets cheerleading overall efficiency on female university students confidence level improving advantages, in covariance analysis, it gets each dimensional cheerleading to female university students' confidence level promotion and other two learners' comparison, and gets that cheerleading has very remarkable effects on female university students confidence level promotion.

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