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典型相關應用於學生滿意度調查之研究

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《中文摘要》

本研究旨在應用典型相關分析「學生滿意度問卷」（Student Satisfaction Inventory）中學生期望及滿意度之相關性。發現「學生滿意度問卷」調查結果，學生期望及滿意度呈現正相關，然而，學生期望量表之十一個向度透過典型相關變項對於學生滿意度十一向度的解釋變異量很小。本研究發現學生期望及學生滿意度間無法互相預測，因此實証研究發現支持「學生滿意度問卷」同時用於調查學生期望及學生滿意度的適切性。

關鍵詞：全面品質管理、典型相關、學生滿意度問卷、顧客滿意

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Introduction

In the past decade, many higher education institutions in the western, more developed countries have sought improved performance by adapting Total Quality Management (TQM) and are turning to its principles—customer satisfaction, continuous improvement, and teamwork (Hartman & Schmidt, 1995; Seymour, 1992). Thus, satisfaction of their students as the consumers of the services they produce has become an important issue in higher education institutions. Rowley, Lujan, and Dolence (1997) stated, "If a central purpose of higher education is to advance knowledge while helping to create a better society, then colleges and universities must respond to consumer demands in ways not yet perfected by present practice" (p. 54). Educational administrators need to know what services will help students achieve their educational goals, and what factors determine overall student satisfaction or dissatisfaction.

While the 1970s marked the beginning of institutional research into college student retention, the 1980s marked the merging of student retention and satisfaction in the United States (Anthrop, 1996; Noel, 1994). Deriving from the meaning of job satisfaction, student satisfaction can be defined as the students' emotional reactions or affective responses to college experiences (Bean & Bradley, 1986; Reed, Lahey & Downey, 1984). Student satisfaction can also be seen as students' having high-quality experiences on campus, and satisfaction assessment is concerned with the extent to which students evaluate their experiences as of high quality (Bogue & Saunders, 1992; Upcraft & Schuh, 1996). Hartman & Schmidt (1995) reviewed the literature of satisfaction and stated that satisfaction may be a positive response to the question of whether the student would attend the college again (Abrahamowicz, 1988), or the student's willingness to recommend the school to others (Chadwick & Ward, 1987). In a general overall measure of satisfaction, Hearn (1985) indicated that the professor's availability outside of class and the student's interaction with peers had the strongest effect on satisfaction.

Schreiner and Juillerat (1994) formulated the Student Satisfaction Inventory (SSI) as the trends in higher education towards a more consumer-oriented environment than the existing satisfaction assessments, such as College Student Satisfaction Questionnaire (CSSQ) developed by Betz, Menne, Starr, and Klingensmith (1971) or College Student Experience Questionnaire (CSEQ) developed by Pace (1979). Both CSSQ and CSEQ measure only student satisfaction. SSI is a unique questionnaire that measures both expectations and satisfaction of students and provides the performance gap between expectations and satisfaction.

Chang (2000) empirically examined student satisfaction with their educational experience in universities in Taiwan. Students in six out of a total of 38 public and private universities were selected

to receive the SSI survey questionnaire through two-stage stratified random sampling. The 70-plus items of the SSI are to measure how important various areas are to students, while assessing their satisfaction. SSI examines 12 scales which consist of Academic Advising, Campus Climate, Campus Life, Campus Support Services, Concern for the Individual, Instructional Effectiveness, Recruitment and Financial Aid, Registration Effectiveness, Responsiveness to Diverse Populations, Safety and Security, Service Excellence and Student Centeredness. Students are asked to indicate the level of importance they assign to the expectation as well as their level of satisfaction that the expectation is being met, using a seven-point Likert rating scale 1 to 7. A total of 1,200 questionnaires were sent to the selected departments in April 1999. With a total of 972 questionnaires returned in June 1999, the response rate was 81 percent. This is the first study by adapting SSI to empirically examine the levels of importance, levels of satisfaction, and the performance gap of college students in Taiwan. The study seeks to assess if the programs and services provided are of high quality and meet the overall student satisfaction in selected Taiwanese universities.

The purpose of this research is to apply the results of Chang (2000) study. Most researchers applied SSI and focused their analysis on performance gap scores throughout the study. This study is the first attempt to use canonical correlation analysis (CCA) to examine the relationships between the sets of importance variables and the sets of satisfaction variables. More specifically, to investigate whether two sets of variables are independent of one another or, conversely, determine the magnitude of the relationships that may exist between the two sets by applying canonical correlation analysis.

By applying CCA, this study attempted to investigate three questions (Thompson, 1984):

1. To what extent can the importance set of variables be predicted or explained by the satisfaction set of variables?
2. What contributions do variables make to the explanatory power of the set of variables to which the variables belong?
3. To what extent do variables contribute to predicting or explaining the composite of the variables in the variable set to which the variables do not belong?

Method

Data for this study were applying the results of Chang (2000) for the 11 re-grouped scales of SSI, such as Faculty Advising, Administrative Support, Campus Life and Information Service, Prestige, Belonging, Living Environment, Add-Drop Policy, Curriculum and Teaching Quality, Campus

Environment, Library, and Tuition. The SAS computer program was used for all statistical analysis in this study. Canonical correlation analysis was used to determine the magnitude, and to explain the nature of whatever relationships may exist between the two sets of importance and satisfaction variables. CCA is a measure of the strength of the overall relationships between the canonical variates of multiple criterion variables and multiple predictor variables. In this paper, the levels of importance are designated as the set of multiple criterion variables and the levels of satisfaction are specified as the set of multiple predictor variables. The problem involves identifying relationships between students' perceptions about university environment and students' level of satisfaction.

A canonical correlation analysis is performed on the set of 11 criterion variables and 11 predictor variables by first deriving the linear combinations of the 11 sets of variables and creating 11 canonical variates, so that the correlation between these variates is maximized. The first pair of canonical variates exhibits the largest canonical correlation coefficient between predictor and criterion variables. The second pair of canonical variates is then located so that it exhibits the maximum relationship between the two sets of variates that was not accounted for by the first pair (Hair, Anderson, Tatham & Black, 1992, p. 197). The procedure continues with each pair having a smaller canonical correlation than the preceding pair but having the highest possible correlation at the stage whose pair of linear combinations is uncorrelated with all the preceding pairs (Cook, Razzano & Cappelleri, 1996).

Results

Canonical Correlation Analysis

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Canonical Correlation Coefficient

By applying CCA, this study attempted to investigate three questions. The first question is "To what extent can the importance set of variables be predicted or explained by the satisfaction set of variables" (Thompson, 1984, pp. 60-61)? The first question can be approached by canonical correlation coefficient and redundancy coefficient. Table 1 contains summary multivariate test statistics for the 11 cannonical functions. The lower part of the Table presents the multivariate statistics and F approximations for this model. Wilk's lambda, Pillai's criterion, Hotelling's trace, and Roy's greatest root all showed statistical significance at the .05 level. The value of Wilk's lambda 0.5626 indicating 56.26% of the variance not accounted for in the canonical correlation (McKenzie, 2000).

The first type of variance was obtained by squaring the canonical correlation coefficient. The upper part presents the canonical correlation analysis results for 11 canonical functions. Canonical correlation functions 1 through 6 were statistically significant beyond .05 level. This showed that there was an observed relationship between the importance variables and the satisfaction variables. The canonical correlations were .4520, .3135, .2854, .2256, .2060, and .1613 while the squared canonical correlations were .2043, .0983, .0815, .0509, .0424, and .0260 respectively.

According to Cohen (1988), squared canonical correlations greater than .09 is considered medium effect size. The most important was the first function with the squared canonical correlations .2043, which indicating the first function explained 20.43% of the variance in the importance variable that was accounted for by the satisfaction variable. The effect size for the other five were considered small effect size with squared canonical correlations greater than .01. Therefore, only the first function needs interpretation in this research.

Table 1. Canonical correlation analysis relating importance to satisfaction

Canonical Correlation Analysis

Function	Canonical Correlation	Approx Standard Error	Squared Canonical Correlation	Approx F	Pr > F
1	0.4520	0.0258	0.2043	4.6061	0.0001
2	0.3135	0.0292	0.0983	3.3194	0.0001
3	0.2854	0.0298	0.0815	2.8615	0.0001
4	0.2256	0.0307	0.0509	2.3459	0.0001
5	0.2060	0.0310	0.0424	2.0468	0.0001
6	0.1613	0.0316	0.0260	1.6417	0.0093
7	0.1263	0.0319	0.0159	1.3661	0.1058
8	0.1022	0.0320	0.0105	1.1863	0.2705
9	0.0905	0.0321	0.0082	1.0084	0.4307
10	0.0375	0.0323	0.0014	0.3337	0.8554
11	0.0037	0.0324	0.0000	0.0127	0.9103

Multivariate Statistics and F Approximations

Statistic	Value	F	Pr > F
Wilks' Lambda	0.5626	4.6061	0.0001
Pillai's Trace	0.5394	4.4162	0.0001
Hotelling-Lawley Trace	0.6156	4.7324	0.0001
Roy's Greatest Root	0.2568	21.9927	0.0001

Note: F Statistic for Roy's Greatest Root is an upper bound.

Redundancy Analysis

Besides the multivariate statistics, redundancy index is also needed to interpret. The

second type of variance was that shared by the original sets of importance and satisfaction variables by redundancy coefficient. A squared canonical correlation does not give the proportion of variance shared by the original variables. The redundancy coefficient represents the proportion of variance in the importance set that is "redundant" to by the variance in the satisfaction set. It is the equivalent of computing the squared multiple correlation coefficient between the total predictor set and each variable in the criterion set, and then averaging these squared coefficients to arrive at an average R square (Stewart & Love, 1968; Thomson, 1984). The first step involves calculating the amount of variance from the importance set of variables that is included in the importance canonical variate. The second step involves calculating the amount of variance in the importance canonical variate that can be explained by the satisfaction set canonical variate. The redundancy is then found by multiplying these two components (Hair, Anderson, Tatham & Black, 1992, p. 201). Therefore, in order to have a high redundancy index, one must have a high canonical correlation and a high degree of shared variance explained by the criterion variate.

The canonical redundancy analysis results are presented in Table 2. For the first function, the redundancy index of .0801 indicated that 8 percent of the variance in the importance variables had been explained by the canonical variate for the satisfaction variable set. The redundancy index of .0259 indicated that 2 percent of the variance in the satisfaction variables had been explained by the canonical variate for the importance variable set. Stewart and Love (1968) argued that this non-symmetry was desirable.

A significant CCA does not imply that a strong correlation exists among the original variables themselves. If the canonical relationship is statistically significant and the magnitude of the canonical root and the redundancy index is acceptable, the analysis needs to make interpretations of the results. In this study, the first function, with the squared canonical correlation of .2043, had most of the variance associated with it while the second function with the squared canonical correlation of .0982 had far less variance associated with it. A weak canonical correlation may be of little practical value and is not worth interpreting. Therefore, as mentioned earlier, only the first function needs interpretation in this research.

The second question is "What contributions do variables make to the explanatory power of the set of variables to which the variables belong" (Thompson, 1984)? More

specifically, it is to interpret the extent to which the pair of canonical variates and their associated variables contribute to the multivariate relationships (Thompson, 1984; Cook, Razzano & Cappelleri, 1996)**.** This question can be addressed by canonical loadings. Canonical loadings measure the simple linear correlation between the independent variables and their respective canonical variates. The larger the coefficient, the more important it is in deriving the canonical variate. For each set of variables, the correlation is computed between each original observed variable and its respective canonical variate. Thus, the canonical loading reflects the variance that the observed variable shares with the canonical variate.

Table 2. Canonical redundancy analysis for importance and satisfaction variates

Standardized Variance of the Predictor 'WITH' Variables Explained by:					
	Their Own Canonical Variables			The Opposite Canonical Variables	
Function	Proportion	Cumulative Proportion	Canonical R-Squared	Proportion	Cumulative Proportion
1	0.3919	0.3919	0.2043	0.0801	0.0801
2	0.0568	0.4487	0.0983	0.0056	0.0857
3	0.1206	0.5693	0.0815	0.0098	0.0955
4	0.0626	0.6319	0.0509	0.0032	0.0987
5	0.0344	0.6663	0.0424	0.0015	0.1001
6	0.0346	0.7009	0.0260	0.0009	0.1010
7	0.0221	0.7230	0.0159	0.0004	0.1014
8	0.0306	0.7537	0.0105	0.0003	0.1017
9	0.1085	0.8622	0.0082	0.0009	0.1026
10	0.0741	0.9363	0.0014	0.0001	0.1027
11	0.0637	1.0000	0.0000	0.0000	0.1027
Standardized Variance of the Predictor 'WITH' Variables Explained by:					
	Their Own Canonical Variables			The Opposite Canonical Variables	
Function	Proportion	Cumulative Proportion	Canonical R-Squared	Proportion	Cumulative Proportion
1	0.1266	0.1266	0.2043	0.0259	0.0259
2	0.1375	0.2641	0.0983	0.0135	0.0394
3	0.3069	0.5710	0.0815	0.0250	0.0644
4	0.1082	0.6793	0.0509	0.0055	0.0699
5	0.0608	0.7400	0.0424	0.0026	0.0725
6	0.0388	0.7788	0.0260	0.0010	0.0735
7	0.0493	0.8281	0.0159	0.0008	0.0743
8	0.0304	0.8584	0.0105	0.0003	0.0746
9	0.0409	0.8993	0.0082	0.0003	0.0749
10	0.0422	0.9415	0.0014	0.0001	0.0750
11	0.0585	1.0000	0.0000	0.0000	0.0750

In interpreting the first canonical function as shown in the upper part of Table 3, it indicated that all 11 variables have high correlation between the original variable and its canonical variate with canonical loading over 0.40. Add-Drop Policy, Curriculum and Teaching Quality, Campus Environment, Campus Life and Information Service, and Administrative Support accounted for most of the variance in the importance set with its canonical variate. The structure coefficients were larger than 0.65. Add-Drop Policy showed highest canonical loading .7876, Curriculum and Teaching Quality showed the second, and then Campus Environment, Campus Life and Information Service, and Administrative Support. This indicated that the importance of Add-Drop Policy, Curriculum and Teaching Quality, Campus Environment, Campus Life and Information Service, and Administrative Support all had high correlation with their canonical variates.

By squaring these terms, we may find the percentage of the variance for each of the variables explained by the importance variate of the first canonical function (V1). The results showed that 62 percent of the variance in the importance of Add-Drop Policy was explained by its variate. About 58 percent of the variance in Curriculum and Teaching Quality, 50 percent in Campus Environment, 49 percent in Campus Life and Information Service, and 45 percent of the variance in the importance of Administrative Support was explained by its importance variate.

The lower part of Table 3 indicated that all variables from BF1-BF11 had an inverse relationship with its canonical variate. Campus Life and Information Service showed highest loading (-.6411), Living Environment (-.5598) shows the second, and then Tuition (-.4512). Faculty Advising, Prestige, and Library were with canonical loadings smaller than .10, it indicated that these variables had low correlation between the original variable and its canonical variate. Campus Life and Information Service, Living Environment, and Tuition accounted for most of the variance in the satisfaction set with its canonical variate.

By squaring these terms, we found the percentage of the variance for each of the variables explained by the satisfaction variate of the first canonical function (W1). The results showed that 41 percent of the variance in the satisfaction of Campus Life and Information Service was explained by its variate. About 30 percent of the variance in Living Environment, and 20 percent of the variance in the satisfaction of Tuition was explained by its satisfaction variate.

Table 3. Canonical loadings

Correlations Between the 'VAR' Variables and Their Canonical Variables		
Variables	V1	V2
AF1 Faculty Advising	0.5728	0.2016
AF2 Administrative Support	0.6693	0.1632
AF3 Campus Life and Information Service	0.6968	0.0131
AF4 Prestige	0.4208	0.1985
AF5 Belonging	0.4030	0.1483
AF6 Living Environment	0.5198	-0.1127
AF7 Add-Drop Policy	0.7876	0.1931
AF8 Curriculum and Teaching Quality	0.7588	0.0161
AF9 Campus Environment	0.7101	0.0629
AF10 Library	0.5897	0.2407
AF11 Tuition	0.6256	0.6198
Correlations Between the 'WITH' Variables and Their Canonical Variables		
Variables	W1	W2
BF1 Faculty Advising	-0.0248	0.3577
BF2 Administrative Support	-0.3976	0.2990
BF3 Campus Life and Information Service	-0.6411	0.3733
BF4 Prestige	-0.0825	0.3949
BF5 Belonging	-0.2547	0.3901
BF6 Living Environment	-0.5598	0.5151
BF7 Add-Drop Policy	-0.3343	0.3836
BF8 Curriculum and Teaching Quality	-0.2847	0.3059
BF9 Campus Environment	-0.2030	0.2675
BF10 Library	-0.0170	0.3440
BF11 Tuition	-0.4512	-0.3890

Note: W1 and V1 stand for the variates of the first canonical function. W1 (WITH) and V1 (VAR) indicate the predictor and criterion variates, respectively in SAS.

Canonical loadings may overestimate the relationship between variables because they are linked on the basis of their high loadings on the canonical variable regardless of any direct measure of correlation between them. Cross-loadings provide a more direct measure of the dependent-independent variable relationships and are most stable for reliable interpretation (Hair, Anderson, Tatham & Black, 1992; Cook, Razzano & Cappelleri, 1996).

The third question is “To what extent do variables contribute to predicting or explaining the composite of the variables in the variable set to which the variables do not belong” (Thompson, 1984)? This question can be addressed by cross-loadings. The computation of canonical cross-loadings involves correlating each of the original observed importation variables directly with the satisfaction canonical variate. For a giving of canonical variates, the cross loading of a variable is obtained by multiplying the corresponding canonical correlation coefficient and the canonical loading of that variable.

The cross-loadings results are presented in Table 4 and only the first function needs interpretation. In interpreting the first canonical function, Add-Drop Policy, Curriculum and Teaching Quality, Campus Environment, Campus Life and Information Service, and Administrative Support accounted for most of the variance in the importance set shared by the satisfaction variables. The structure coefficients were larger than 0.30. Add-Drop Policy showed highest canonical cross-loading .3560, Curriculum and Teaching Quality showed the second, then Campus Environment, Campus Life and Information Service, and Administrative Support. This meant that the importance of Add-Drop Policy, Curriculum and Teaching Quality, Campus Environment, Campus Life and Information Service, and Administrative Support all had high correlation with the student satisfaction. The cross-loadings results were similar to the canonical loadings in Table 3; however, the cross-loadings were smaller.

By squaring these terms, we may find the percentage of the variance for each of the variables explained by the satisfaction variate of the first canonical function (W1). The results showed that 13 percent of the variance in the importance of Add-Drop Policy, 12 percent of the variance in Curriculum and Teaching Quality, 10 percent in Campus Environment, 10 percent in Campus Life and Information Service, and 9 percent of the variance in Administrative Support was explained by the satisfaction variate.

The lower part of Table 4 indicated that all variables from BF1-BF11 had an inverse relationship with importance canonical variate. Campus Life and Information Service showed highest canonical cross-loading (-.2898), Living Environment (-.2531) showed the second, and then Tuition (-.2040). Faculty Advising, Prestige, Campus Environment, and Library were with cross-loadings smaller than .10, it indicated that these variables had low correlation between the satisfaction variable and its importance canonical variate. Campus Life and Information Service, Living Environment, and Tuition accounted for most of the variance in the satisfaction set with its importance canonical variate.

By squaring these terms, we found the percentage of the variance for each of the satisfaction variables explained by the importance canonical variate of the first canonical function (V1). The results showed that 8 percent of the variance in the satisfaction of Campus Life and Information Service was explained by the importance variate of Campus Life and Information Service. About 6 percent of the variance in Living Environment, and 4 percent of the variance in the satisfaction of Tuition was explained by importance variate. These results indicated that the satisfaction of each of the 11 scales accounted for very small explained

variance by the importance variate of 11 scales.

To sum up, the correlation between the measurements of importance score and satisfaction score for 11 scales were quite low. Add-Drop Policy, Curriculum and Teaching Quality, Campus Environment, Campus Life and Information Service, and Administrative Support importance variables were most strongly correlated with Campus Life and Information Service, Living Environment, and Tuition satisfaction variables.

Table 4. Canonical Cross-Loadings

Correlations Between the 'VAR' Variables and the Canonical Variables of the 'WITH' Variables		
Variables	W1	W2
AF1 Faculty Advising	0.2589	0.0632
AF2 Administrative Support	0.3025	0.0512
AF3 Campus Life and Information Service	0.3150	0.0041
AF4 Prestige	0.1902	0.0622
AF5 Belonging	0.1822	0.0465
AF6 Living Environment	0.2350	-0.0353
AF7 Add-Drop Policy	0.3560	0.0605
AF8 Curriculum and Teaching Quality	0.3430	0.0050
AF9 Campus Environment	0.3210	0.0197
AF10 Library	0.2666	0.0755
AF11 Tuition	0.2828	0.1943

Correlations Between the 'WITH' Variables and the Canonical Variables of the 'VAR' Variables		
Variables	V1	V2
BF1 Faculty Advising	-0.0112	0.1121
BF2 Administrative Support	-0.1797	0.0937
BF3 Campus Life and Information Service	-0.2898	0.1170
BF4 Prestige	-0.0373	0.1238
BF5 Belonging	-0.1151	0.1223
BF6 Living Environment	-0.2531	0.1615
BF7 Add-Drop Policy	-0.1511	0.1203
BF8 Curriculum and Teaching Quality	-0.1287	0.0959
BF9 Campus Environment	-0.0917	0.0839
BF10 Library -	-0.0077	0.1079
BF11 Tuition	-0.2040	-0.1219

Note: W1 and V1 stand for the variates of the first canonical function. W1 (WITH) and V1 (VAR) indicate the predictor and criterion variates, respectively in SAS.

Absolute Value

Finally, the absolute value of the gap between importance rating and satisfaction rating for each student was calculated. The results are reported in Table 5. ABF1=|AF1 - BF1| showed the absolute value of the gap between importance rating of Faculty Advising and satisfaction rating of Faculty Advising for each student. From ABF1 to ABF11 all showed

significant results. This indicated that all 11 factors showed differences between importance and satisfaction rating from the respondents.

Table 5. Absolute Value

N Obs	Variable	Mean	Std Error	T	Prob>|T|
972	ABF1	1.7256852	0.0330885	52.1535613	0.0001
	ABF2	2.0792344	0.0403562	51.5220343	0.0001
	ABF3	2.3147961	0.0409887	56.4739852	0.0001
	ABF4	1.6232328	0.0320950	50.5759383	0.0001
	ABF5	1.8687004	0.0382808	48.8155517	0.0001
	ABF6	2.1848342	0.0399626	54.6719954	0.0001
	ABF7	2.1398378	0.0414499	51.6246933	0.0001
	ABF8	2.4958549	0.0471286	52.9583858	0.0001
	ABF9	2.0576857	0.0412327	49.9042418	0.0001
	ABF10	1.9342650	0.0431427	44.8341526	0.0001
	ABF11	2.6224525	0.0455042	57.6310242	0.0
	AB	2.0509889	0.0308695	66.4405201	0.0

The last row AB showed the mean absolute value of the gap between importance rating of all items and satisfaction rating of all items for each student. The result was also significant. We can conclude from the absolute value result that all participants responded differently to importance and satisfaction rating. The SSI questionnaire containing both importance and satisfaction rating is still a necessary and relevant assessment.

Discussion

The purpose of this study is to empirically examine the levels of importance, levels of satisfaction, and the performance gap of college students by adapting SSI in Taiwan. This study differs from previous researches by using canonical correlation analysis (CCA) to examine the relationships between the sets of importance variables and the sets of satisfaction variables.

Findings from the study and a review of the literature emerged three conclusions from the analysis. First, the findings provide empirical support that there was a positive relationship between the importance variables and the satisfaction variables. In investigating to what extent can the importance set of variables be predicted or explained by the satisfaction set of variables, Wilk's lambda indicating 56.26% of the variance were not accounted for in the canonical correlation. Canonical functions 1 through 6 showed that there was an observed

relationship between the importance variables and the satisfaction variables. The squared canonical correlation of .2043 indicating that the first function explained 20.43% of the variance in the importance variable that was accounted for by the satisfaction variable. The redundancy index of .0801 indicated that 8 percent of the variance in the importance variables had been explained by the canonical variate for the satisfaction variable set.

Overall, 20% of the variance in the 11 importance variables was accounted for by the variance in 11 satisfaction variables, compared to 8% in the original analysis. Both canonical correlation coefficient and redundancy coefficient showed that the relationships between measurement of importance scores and satisfaction scores were significant, however, the percentages of variance accounted for from the two data sets were very low. These indicated that the importance variables set was not very well predicted by the satisfaction variables set.

Secondly, the loadings explain what contribution does a single variable make to the explanatory power of the set of variables to which the variable belongs. On the first canonical function, among the importance variables, loadings were stronger for the Add-Drop Policy, Curriculum and Teaching Quality, Campus Environment, Campus Life and Information Service, and Administrative Support. These five scales appeared to make the largest contribution to the explanatory power of the importance set of variables. Campus Life and Information Service, Living Environment, and Tuition accounted for most of the variance in the satisfaction set with its canonical variate. These three factors made the largest contribution to the explanatory power of the satisfaction set of variables.

The cross-loadings explain to what extent variables contribute to predicting or explaining the composite of the variables in the variable set to which the variables do not belong. The cross-loadings were similar to the canonical loadings. Add-Drop Policy, Curriculum and Teaching Quality, Campus Environment, Campus Life and Information Service, and Administrative Support accounted for most of the variance in the importance set shared by the satisfaction variables. Campus Life and Information Service, Living Environment, and Tuition accounted for most of the variance in the satisfaction set with its importance canonical variate.

In sum**,** Add-Drop Policy, Curriculum and Teaching Quality, Campus Environment, Campus Life and Information Service, and Administrative Support importance variables were most strongly correlated with Campus Life and Information Service, Living Environment, and Tuition satisfaction variables. However, the correlation between the measurements of importance score and satisfaction score for 11 scales were quite low. These results indicated

that the satisfaction of each of the 11 scales accounted for very small explained variance by the importance variate of 11 scales.

Finally, from the results of absolute value, the differences were statistically significant for each respondent of each scale. This study reaffirmed the complexity between student expectation and satisfaction and provided useful information that SSI was a valid instrument for measuring importance and satisfaction. These indicated that the questionnaire using both importance and satisfaction rating are still very relevant. Both importance and satisfaction results provided useful information to higher educational institutions for improving academic and administrative affair issues in higher education.

This study builds on the central themes of TQM, focusing on students as important constituents, recognizing the importance of student perceptions of their educational experiences and focusing on improving their experiences. The most significant findings from this study are that this research has shown difference from other studies in terms of analytic techniques by utilizing canonical correlation analysis. Canonical correlation analysis is the most general case of the parametric general linear model, and it subsumes all other parametric univariate and multivariate analyses (Thompson, 2000). However, the scarcity of its use by researchers shows the high degree of underutilization of this statistical technique (Cook, Razzano & Cappelleri, 1996). Moreover, the findings did not verify that relationship between importance and satisfaction could be predicted. Further research is needed by using CCA to assess that factors contribute to students' expectation and satisfaction, and to what extent these factors influence satisfaction levels.

Another important issue to address would be the generalizability for the results. Bootstrap and jack-knife techniques could be applied to evaluate generalizability (Humphries-Wadsworth, 1998). Using SSI to measure the relationship of importance and satisfaction should replicate the present study in larger and more diverse samples. Further exploratory researchers could look further into the relationship that may exist between the importance and satisfaction factors. More research is needed to further define and explain the cross-loading results between the importance variables and satisfaction variables.

Finally, this study is utilization-focused and the findings will provide direction for improvement in academic, administrative and student affairs and services, such as registration, advising, finance, campus climate, and so forth. Although SSI seems to be a reliable instrument for assessing student satisfaction in Taiwan, the findings of this study seem to cast

some doubt on the effectiveness and applicability of this questionnaire. Additional research is recommended to examine how to develop an effective assessment instrument for the purpose of Taiwanese universities instead of adapting one developed in a socioculturally different, western setting.

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An Assessment of Student Satisfaction: Canonical Correlation Analysis of Student Satisfaction Inventory

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《Abstract》

This study applies SSI in Taiwanese Universities and differs from previous studies by using canonical correlation analysis to examine the relationships between importance and satisfaction variables. The findings provide empirical support for a positive relationship between importance and satisfaction variables. However, the satisfaction of each of the 11 scales accounted for very small explained variance by the importance variate of the 11 scales. The findings did not verify that the relationship between importance and satisfaction could be predicted. These indicate that SSI using both importance and satisfaction rating are still relevant.

Key Words: canonical correlation analysis, customer satisfaction, total quality management, student satisfaction inventory

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