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Enhancing User Satisfaction with University Computing Center Services

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Abstract

To provide quality education, a university needs to make available a well-equipped computing center. However, such centers are expensive, and their provision is a problem for administrators when budgets are tight. Hence, it is important that money be invested in services that will enhance user satisfaction the most. This study explores the relationship between service quality and user satisfaction in a university computing center. Two hundred and seventy-four successful questionnaires were collected from faculty members, staff, and students of Soochow University in Taiwan. Analysis of the data revealed that network infrastructure, consultancy and maintenance, and system quality are particularly important, and should be considered core services of a computing center. Other services, such as network function, classroom management, and administrative procedure are considered supporting services.

Background

Providing good quality computing services is an important task for a university (Debreceny & Ellis, 1998). Services such as computer room management, networking, and consultancy are normally assigned to a computing center. However, the investment in such centers is a heavy financial burden for universities. Nevertheless, it is quite often the case that spending in university computing centers is not justified based on return of investment. Thus, the centers normally do not earn sufficient support from users (Wall & Turban, 1991). Most current practices to elevate the performance of computing centers relate to checking equipment utilization. But the re-engineering of a computing center does not directly enhance user satisfaction (Bergeron, Rivard, & Serre, 1990; Rainer & Carr, 1992). Users of computing services often do not have adequate hardware and software knowledge to manage their work, and need help from the center staff. Therefore, it is important to develop a new measure of services at such centers that balances both user satisfaction and equipment uses so that good quality services are maintained (Mirani & King, 1994a; Nord & Nord, 1994; Temponi, 2005). The university computing centers users include faculty members, staff members, students, and outside entities; and the services include computer networks, computing systems, consultancy, and others (Peppard, 2003).

The concept of Balanced Scorecard introduced by Kaplan and Norton (2001a, 2001b) that specifies the critical elements to organization growth strategies is adopted in this study. The Balanced Scorecard links performance objectives, i.e. user satisfaction, and measures, i.e. service quality, to corporate strategies. They found the strategies of creating values are high-quality and responsive operating processes, skills and knowledge of workforce, information technology that supports the work force and links the firm to its customers and suppliers, and others.

This study is an exploratory study to measure the relationship between user satisfaction and service quality in a computing center, with the aim of suggesting service enhancements to improve user satisfaction. A literature review is provided on satisfaction and service quality, and the expected services are then identified. The way in which the expected services contribute to user satisfaction is identified using the case study of Soochow University for illustration.

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Literature on Satisfaction and Service Quality

Satisfaction describes the evaluation of an emotion in terms of a user's expectation (Brady, Cronin, & Brand, 2002). For years, significant attention was paid in the literature to user satisfaction, and yet there is no consensus on the definition of user satisfaction, which is also known as customer satisfaction, consumer satisfaction (with purchase), or user satisfaction (without purchase) (Beerli, Martân, & Quintana, 2004). User satisfaction measures the evaluation of users after the acceptance of a service or purchase of a product. It can be divided into three parts: general satisfaction, confirmation of expectations, and distance from the customer's hypothetical ideal product or service (Fornell, 1992).

A definite conceptualization and measurement of the perception of service quality has yet to be successfully achieved (Brady & Cronin, 2001). Considerable research was done on the measurement of service quality, but few advances were made on what to measure. The model most commonly referred to in the measurement of service quality by the analysis of the gap between performance perceptions and performance expectation is SERVQUAL, in which five components are considered: tangibility, reliability, responsiveness, assurance, and empathy (Parasuraman, Berry, & Zeithaml, 1988). In 1992, this model was developed into SERVPERF, which is an instrument for performance-only measures. SERVPERF is reported to outperform SERVQUAL in the analysis of banking, pest control, dry cleaning, and fast food services (Cronin & Taylor, 1992). Cronin and Taylor argued that the service quality measurement of customer expectations is unnecessary, although Parasuraman, Zeithaml, and Berry (1994) disagreed with the arguments. Another commonly adopted model for the service quality measurement is Gronroos (1984), which comprises two service quality dimensions: functional quality, which defines customer perceptions of the interaction that takes place during service delivery, and technical quality, which reflects what the customer receives in the service encounter (Brady & Cronin, 2001).

Studies on the correlation between service quality and user satisfaction are found throughout the literature. Previous literature considers perceived quality to be an antecedent of customer satisfaction (Cronin & Taylor, 1992; Beerli, Martân, & Quintana, 2004; Brady, Cronin, & Brand, 2002). Another way of expressing this is that satisfaction is an affective reaction to a service encounter (Oliver, 1997; Choi, Cho, Lee, Lee, & Kim, 2004) or that service quality is a cognitive process that results from factors such as satisfaction (Rust & Oliver, 1994). A study conducted by Brady and Cronin (2001) found the notion that service quality causes satisfaction holds well across diverse cultures, and they suggested that service practitioners should provide quality service as a means of improving satisfaction judgments. This is also the standpoint of this study.

As suggested by Kotler (2000), user satisfaction is a user's comparison of service encounters and expectations. To apply the same ideal to the management of a computing center, it is important that the center provide good quality and diverse services to users (Carr, Rainer, & Young, 1993). However, how to achieve this is often the concern of university administrators (Brancheau, Janz, & Wetherbe, 1996), as the appropriate management of such centers can improve the productivity and efficiency of a university (Guimaraes, 1996). To achieve this target, a computing center should provide good classroom management services, such as the maintenance of multimedia classrooms (Deadman, Hall, Bain, Elliot, & Dudycha, 2000; Winer & Cooperstock, 2002) and the provision of computers in regular classrooms (Muir-Herzig, 2004; Powell, Aeby, & Carpenter-Aeby, 2003). Designing computing systems to enhance university administration and the maintenance of high-speed and stable network infrastructures would also be welcomed (Telem, 2001; Younis, 2002; Zenios, Goodyear, & Jones, 2004). This study invites users and administrators to identify the essential services that should be provided by a computing center.

DeLone and McLean (1992) suggested that utilization, response time, and reliability were the keys to the measurement of computing center performance. However, in a university, some uses are not voluntary; therefore, resource planning may be misleading if it is based solely on performance indices. Another way to measure performance and the allocation of resources is to use a user satisfaction measurement (Mahmood, Burn, Gemoets, & Jacquez, 2000; Igbaria & Nachman, 1990; Lee, Kim, & Lee, 1995; Magal, 1991; Mirani & King, 1994b), which is the approach this study takes.

Research Method and Data Analysis

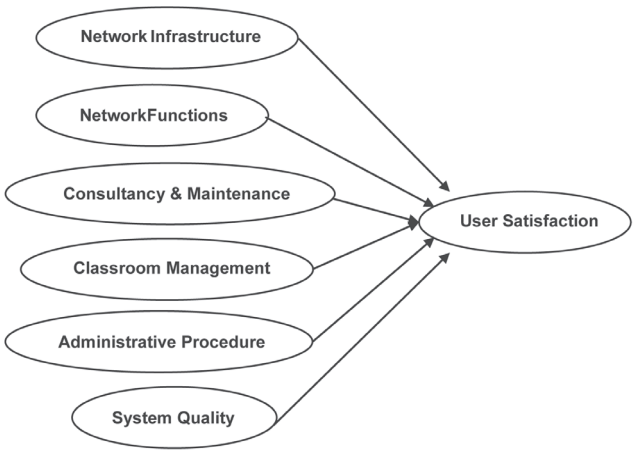
This research comprises an exploratory study to investigate user satisfaction with the services provided by a university computing center. Before designing the questionnaire used in the study, two current and past center directors and three division supervisors were invited to form a focus group and to share their experiences on the provision of computing services. Six categories of services were identified in this group discussion: network infrastructure, network functions, consultancy and maintenance, classroom management, administrative procedure, and system quality. Three representatives of the identified user groups (faculty members, staff members, and students) were invited to identify individual service items. Thirty-five service items were agreed upon, and are listed in Table 1. Finally, as suggested by Fornell (1992), user satisfaction was measured in terms of general satisfaction, confirmation of expectations, and distance from the hypothetical ideal product.

Table 1
The Research Instrument

Construct	Item (Please indicate your satisfaction with …)	Mean	Cronbach alpha
Independent Variables			
Network Infrastructure	I1: Campus network stability.	2.71	0.93
	I2: Campus network speed.	2.60	
	I3: Off campus network stability.	2.75	
	I4: Off campus network speed.	2.73	
Network Functions	I5: Campus wireless LAN service.	2.43	0.89
	I6: Campus e-mail service.	2.19	
	I7: Campus BBS service.	2.54	
	I8: Campus Web browsing service.	2.32	
	I9: Campus Telnet service.	2.54	
	I10: Campus dial-up service.	2.68	
	I11: Campus FTP service.	2.59	
Consultancy and Maintenance	I12: The duration of acknowledgement in hardware repair requests.	2.61	0.94
	I13: The duration of hardware repair.	2.58	
	I14: The quality of hardware repair.	2.51	
	I15: The duration of response to software consultancy requests.	2.51	
	I16: The quality of the software consulting service in reliability, consistency, and dependability.	2.54	
	I17: The service attitude of the center employees (approachable, polite, courteous, and respectable).	2.38	
	I18: The competency of the center employees (ability to answer questions).	2.43	
Classroom Management	I19: Computer classroom hardware.	2.33	0.90
	I20: Computer classroom software.	2.35	
	I21: Computer classroom projector and screen facilities.	2.38	
	I22: Computer classroom printing service.	2.55	
	I23: Computer classroom desks, chairs, and lighting.	2.42	
	I24: Computer classroom management.	2.42	
Administrative Procedure	I25: The transparency of the center's administration.	2.46	0.91
	I26: The ease of use of application forms.	2.43	
	I27: The duration of process of my applications.	2.52	
	I28: The workflow of the applications.	2.47	
System Quality	I29: The usefulness of system functions.	2.43	0.93
	I30: The friendliness of user interfaces.	2.47	
	I31: The up-to-date of platforms.	2.55	
	I32: The necessity of system functions.	2.46	
	I33: The stability of systems.	2.57	
	I34: The response time of systems.	2.57	
	I35: The duration of system update.	2.68	
Dependent Variable			
User Satisfaction	D1: The service in general.	2.37	0.91
	D2: The fulfillment of service expectations.	2.49	
	D3: The goodliness of services.	2.67	

The research model uses six categories of services to study the relationship between user satisfaction and the provided services, as shown in Figure 1. Three hundred and fifty questionnaires were distributed to the three groups of users: faculty members, staff members, and students. The interviewees were told that the feedback would be used to improve the quality of future computing services and were given a souvenir. This improved the response rate (78%), and meant that 274 questionnaires were collected. Half of the respondents were students (51.5%), the next largest group was staff members (29.6%), and the smallest group was faculty members (18.9%). The survey was conducted at the end of the term to ensure all of the interviewees had at least one year's experience with the services. Each question was measured with the Likert five-point scale, in which 5 represents "completely satisfied" and 1 represents "completely dissatisfied". From the mean of items listed in Table 1 we noticed that the respondents were displeased with the university performance. The score below 3.0, the average score, in all items indicates room for improvement.

Figure 1
Research Model for the Measurement of User Satisfaction in a University Computing Center



The collected responses were used to analyze the following seven hypotheses.

H1: Network infrastructure positively affects user satisfaction with a computing center.

H2: Network functions positively affect user satisfaction with a computing center.

H3: Consultancy and maintenance positively affect user satisfaction with a computing center.

H4: The quality of classroom management positively affects user satisfaction with a computing center.

H5: The administrative procedure positively affects user satisfaction with a computing center.

H6: System quality positively affects user satisfaction with a computing center.

H7: Overall service quality positively affects user satisfaction with a computing center.

The reliability of the measures that were used to operationalize the constructs of interest are shown in Table 1, in which the Cronbach alpha values are between 0.89 (network functions) and 0.94 (consultancy and maintenance), and are within the acceptable range (0.7) that is recommend by Nunnally (1978). We then further applied convergent validity and discriminant validity analysis to measure the validity of the constructs, as suggested by Straub (1989). As convergent validity measures the consistency of a particular variable (item) with other variables (items) in the same construct and the change in validity when a particular item is deleted, the Corrected Item-Total Correlation and Alpha if Item Deleted (Table 2) were used for this purpose. The values of the Corrected Item-Total Correlation of all of the items are between 0.55 and 0.88. This result meets the minimum requirement of 0.4 that was recommended by Park and Kim (2003). Similarly, the value of the Alpha if Item Deleted of each measurement item is lower than the Cronbach alpha of its belonged construct, which shows that all of the items were well selected.

Divergent validity examines the degree to which a construct is dissimilar to other constructs. This can be viewed by using exploratory factor analysis. The Bartlett test of sphericity is significant ($p < 0.001$) and the Kaiser-Meyer-Olkin (KMO) test, which measures the sampling adequacy produced values of 0.96 and 0.73 for service constructs (independent variables) and user satisfaction (dependent variable), respectively, which showed that exploratory factor analysis was suitable for use. The KMO test should be greater than 0.5 for a satisfactory factor analysis to be carried out (Kaiser, 1958). Principal Component Analysis was used to select the factors with eigenvalues that are greater than 1 for the service constructs and these were rotated using the Varimax rotation criterion. In the initial extraction, six factors had eigenvalues that are greater than 1 with the largest, 18.05, accounting for 51% of the variance. Loadings for the six factors after rotation are shown in Table 2 along with item factor correlation. The factor loadings that are greater than 0.44 are shown and there were no items with high loadings on multiple constructs. This shows that the six constructs have a good divergence. The cumulative variance of the loadings for the six factors of 73.15% shows that these factors represent the majority of the variance in the items. A Principal Components Analysis was also performed on the three measures of satisfaction. There was a single factor for the three satisfaction items measuring the dependent variables. The variance accounted for by this single dimension of user satisfaction is 85.55%. The factor loadings of

Table 2
Factor Characteristics of the Constructs

Construct	Item	Eigenvalue after rotation	Factor loading	Corrected item-total correlation	Alpha if item deleted	Variance explained percentage	Cumulative percentage
Factor Analysis 1							
Independent Variables							
Network Infrastructure	I1	3.80	0.75	0.78	0.92	10.87	10.87
	I2		0.78	0.86	0.90		
	I3		0.81	0.87	0.89		
	I4		0.76	0.81	0.91		
Network Functions	I5	4.22	0.44	0.55	0.89	12.07	22.94
	I6		0.44	0.58	0.89		
	I7		0.63	0.68	0.87		
	I8		0.71	0.75	0.86		
	I9		0.80	0.79	0.86		
	I10		0.68	0.69	0.87		
	I11		0.71	0.75	0.86		
Consultancy and Maintenance	I12	4.81	0.78	0.79	0.93	13.75	36.69
	I13		0.76	0.80	0.93		
	I14		0.72	0.79	0.93		
	I15		0.67	0.82	0.92		
	I16		0.63	0.82	0.92		
	I17		0.56	0.77	0.93		
	I18		0.56	0.77	0.93		
Classroom Management	I19	4.40	0.76	0.79	0.87	12.57	49.26
	I20		0.74	0.80	0.87		
	I21		0.68	0.73	0.88		
	I22		0.61	0.64	0.90		
	I23		0.69	0.72	0.88		
	I24		0.55	0.71	0.88		
Administrative Procedure	I25	3.63	0.60	0.73	0.91	10.37	59.63
	I26		0.70	0.76	0.90		
	I27		0.70	0.86	0.86		
	I28		0.68	0.86	0.87		
System Quality	I29	4.73	0.69	0.81	0.92	13.52	73.15
	I30		0.69	0.83	0.92		
	I31		0.68	0.81	0.92		
	I32		0.66	0.80	0.92		
	I33		0.67	0.79	0.92		
	I34		0.60	0.79	0.92		
	I35		0.52	0.71	0.93		
Factor Analysis 2							
Dependent Variable							
User Satisfaction	D1	2.57	0.92	0.82	0.88	85.55	85.55
	D2		0.95	0.88	0.83		
	D3		0.90	0.79	0.91		

satisfaction items are all higher than 0.90. This indicates that the items explain the dimension of user satisfaction.

The Pearson Correlation Matrix was used to measure whether or not the relationship between service quality and user satisfaction was significant. Table 3 shows the correlation matrix of each construct. It is shown that all six services have a positive relationship with user satisfaction, which means that hypotheses 1 to 6 are all supported.

Table 3
Correlation Matrix for the Constructs

Construct	1	2	3	4	5	6	7	Average	Standard Deviation
(1) Network Infrastructure	1							2.70	0.90
(2) Network Functions	0.62	1						2.47	0.65
(3) Consultancy and Maintenance	0.63	0.67	1					2.51	0.72
(4) Classroom Management	0.57	0.67	0.61	1				2.41	0.66
(5) Administrative Procedure	0.54	0.64	0.75	0.66	1			2.47	0.71
(6) System Quality	0.66	0.70	0.74	0.73	0.70	1		2.53	0.67
(7) User Satisfaction	0.67	0.64	0.78	0.62	0.66	0.75	1	2.51	0.78

Note: All correlations are significant at $p < 0.001$.

As we have noticed the means are below 3.0 in Table 1, we identified the percentages of satisfaction and dissatisfaction of different groups of respondents to each construct by separating them from the middle of the five-point Likert scale, i.e. 3.0 in this case, for further information. Table 4 shows the results in which the majority of respondents in a group chose the score higher than 3.0, which is considered a satisfactory group to a construct whereas below 3.0 is considered a dissatisfactory group to the construct.

First, we looked into the six constructs of independent variables. For all respondents, the highest score (41.24%) of satisfaction is the network infrastructure. This reflects the recent network infrastructure enhancement in our computer center. The lowest score lays on the network functions (24.09%). It is consistent with the low use of these functions. For the faculty group, the highest score is the classroom management (32.69%). That means teachers noticed the improvement of facilities in computer rooms. Similar to all users, faculty are dissatisfied with the network functions most (21.15%). To the staff group, the highest satisfaction construct is the network infrastructure (37.04%) and the lowest is the administrative procedure (19.75%). That shows the large number of staff members are not pleased with the administrative procedure. Finally, to the student group, the highest satisfaction percentage is network infrastructure (47.52%) while the lowest is classroom management (24.11%). This response may be because the students compared the services at their university with the services their friends received at other universities or with the services available through off-campus use of the Internet.

From the user satisfaction construct, a dependent variable, we can see the highest score is given by the student group (41.13%), and then the staff group (37.04%). The lowest score (28.85%) is the faculty group. In all, the satisfaction is only 37.59%. That means the computing center needs to put more efforts to enhance service quality.

Table 4
Satisfaction and Dissatisfaction Percentages of Faculty Members, Staff Members, and Students for Each Construct

Construct	All		Faculty Members		Staff		Students	
	Sat.	Dissat.	Sat.	Dissat.	Sat.	Dissat.	Sat.	Dissat.
Network Infrastructure	41.24	58.76	30.77	69.23	37.04	62.96	47.52	52.48
Network Functions	24.09	75.91	21.15	78.85	22.22	77.78	26.24	73.76
Consultancy and Maintenance	33.21	66.79	23.08	76.92	23.46	76.54	42.55	57.45
Classroom Management	25.91	74.09	32.69	67.31	24.69	75.31	24.11	75.89
Administrative Procedure	33.21	66.79	23.08	76.92	19.75	80.25	44.68	55.32
System Quality	32.48	67.52	25.00	75.00	34.57	65.43	34.04	65.96
User Satisfaction	37.59	62.41	28.85	71.15	37.04	62.96	41.13	58.87

(unit: percentage)

When we used a multiple regression analysis to analyze the contribution of individual services to user satisfaction by considering the different groups of users, the F values were significant ($p < 0.001$) for the faculty member group, the staff group, the student group, and the entire group, as shown in Table 5. This indicates that provided services do effect user satisfaction, and thus hypothesis 7 is supported.

Table 5
Multiple Regression Analysis of User Satisfaction of Faculty Members, Staff Members, and Students

Construct	All [1, 2] (n = 274)		Faculty Members (n = 52)		Staff (n = 81)		Students (n = 141)	
	β	T [3]	β	T	β	T	β	T
Network Infrastructure	0.19	3.85***	0.28	2.19*	0.04	0.42	0.22	3.29**
Network Functions	0.03	0.51	0.09	0.67	0.09	0.85	-0.01	-0.07
Consultancy and Maintenance	0.41	6.79***	0.43	3.17**	0.42	3.97***	0.35	3.79***
Classroom Management	0.06	1.01	0.02	0.09	0.07	0.76	0.10	1.18
Administrative Procedure	0.02	0.37	-0.07	-0.37	0.03	0.23	0.06	0.75
System Quality	0.24	3.87***	0.18	1.29	0.32	2.68**	0.22	2.23*

Note: (1) R^2 value, All = 0.69, Faculty Members = 0.65, Staff = 0.74, Students = 0.67
(2) F value, All = 100.54***, Faculty Members = 13.92***, Staff = 34.84***, Students = 46.02***
(3) *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

However, by further examining the relationship between individual services and user satisfaction, it is noticed that only network infrastructure, consultancy and maintenance, and system quality are significant when all the users are

considered. Based on the β-value, the sequence in descending order of importance is consultancy and maintenance (0.41), system quality (0.24), and network infrastructure (0.19). This means that the consultancy and maintenance service contributes to user satisfaction the most. Similar results were found when the users were separated into faculty member, staff member, and student groups.

In the faculty member group, only network infrastructure and consultancy and maintenance have a significant impact on user satisfaction. It is interesting to note that, unlike staff and students, faculty members pay less attention to system quality (β = 0.18, T = 1.29). This is probably because computing systems are normally developed for university administrative purposes, and faculty members normally do not use these systems. Moreover, although the T-values of network infrastructure (2.19) are smaller than the value for the complete sample (3.85), the β-value (0.28) is much higher than the other categories (0.04 for staff and 0.22 for students). This indicates faculty members think that a stable network infrastructure is the more important service compared with staff and students.

In the staff group, we found only consultancy and maintenance and system quality to be significant. To staff, a high quality of consultancy and maintenance is the greatest concern (β = 0.42), and having a reliable system is crucial for them to carry out their work (β = 0.32, which is higher than the other categories).

For the student group, network infrastructure, consultancy and maintenance, and system quality are all important. Similar to the faculty members and staff members, consultancy and maintenance is the most important service (β = 0.35) for students, followed by network infrastructure (β = 0.22) and system quality (β = 0.22). This indicates that students desire good quality networks and systems to help them to complete various operations, such as online registration and grade inquiry.

The R^2 for the entire group of respondents is 0.69, for the faculty member group it is 0.65, for the staff member group it is 0.74, and for the student group it is 0.67. This indicates that the model is well formed, and that the six service constructs have a significant impact on user satisfaction. However, as was discussed, network infrastructure, consultancy and maintenance, and system quality are particularly important, and should be considered as the core services of a computing center. Other services, such as network functions, classroom management, and administrative procedure, should be defined as supporting services. The user satisfaction can be enhanced when the supporting services are maintained together with the good quality core services. This is an important finding for university administrators in the determination of resource allocation.

Conclusion

The study of service quality highlights the appropriateness of service content and the results of this content. In a computing center, the content of the services offered forces the recognition of users, and the results contribute to user satisfaction. In this study, we found a high correlation between the service constructs and user satisfaction in a university computing center. We also found that network infrastructure, consultancy and maintenance, and system quality are the most relevant for user satisfaction. However, the degree of connotation depends on the type of user, which indicates that different types of users have different expectations of the services.

Moreover, it was found that consultancy and maintenance is the most important construct for user satisfaction, because the regression analysis indicates that it is the determinant factor. This is especially crucial to the faculty group and the staff group because the score of satisfaction is 23.08% and 23.46%, respectively; whereas the impact (β value) is 0.43 and 0.42, respectively. Note that this construct is the construct expecting the most interface between humans. A manager should pay more attention on such an important factor with low satisfaction.

This study provides a model for the measurement of user satisfaction with computing center management. Administrators of such centers can follow the model to identify the most important factors that affect service quality and user satisfaction to help them to correctly allocate resources. However, the study does not involve a cost-benefit analysis, which means that it is possible that some of the services that were highlighted as important are very expensive, although it must be remembered that the provision of such services can enhance user satisfaction significantly. It is recommended that future studies include cost-benefit analyses. It is also noticed that the sample size is rather small for factor analysis but that the methodology was used with the understanding that the results would be somewhat limited in generalizability because of the limited sample.

Finally, a computing center is one unit of a university. Various management strategies and concerns are found in different departments. These intertwined strategies may not always consistently contribute to the quality of a school. A future study may be building a holistic view of school performance measurement.

Editor's Notes

This article makes multiple contributions to the capabilities for doing institutional research. First we are provided a fairly thorough discussion of the issues of user satisfaction. Particularly interesting is the discussion between a definition of service as perceived quality versus service as evaluated performance. SERVQUAL was initially developed around components such as reliability and responsiveness. The extension of the model to

SERVPERF was done by a competing set of individuals and challenged the importance of perceived quality with the importance of evaluated performance. The authors comment that there was some disagreement that relates to a fairly full and vigorous professional discussion between these two groups of beliefs. While it is beyond the scope of this article or commentary to describe the aspects of these beliefs, those who do research in the area of assessing service will be well served by looking at the various articles and research projects done by these two groups.

A second key aspect is that the research represents a fairly classical methodology of researching perceived satisfaction with service. The authors start with a focus group of knowledgeable individuals to identify the specific services provided by a university Computing Center at their universities. One particularly appealing aspect of this focus group process was that categories were developed that then gave a conceptual framework to the service discussion. The specificity was provided by having items nested within these categories. The survey was then used with what appears to be a properly segmented sample where the site lots of students, staff, and faculty represent the primary "customers" for the services of the Computing Center. Analyses then looked at the reliability and validity of the instrument. Comparisons and interpretations were made based on the results of the survey. A typical difficulty at this point in survey research is the discussion of the importance of the different complements. The use of standardized regression weights is one of the alternatives for looking at importance. The correlations presented in Table 3 might be another way to look at the importance of the six complements. Of course the challenge in the conclusions is the inevitable question of the relationship between correlation and causality.

A third key aspect is its focuses on a key, and as the author notes, expensive element of our universities – university computing services. Oftentimes our computing services are viewed from a limited perspective based on the needs and wants of a specific type of user. Perceptions of quality are too often given with a general statement expressing pleasure or displeasure. As this research reminds us however, progress requires looking at specific aspects of activities. If someone says that the Network Functions are no good, what are the specific aspects of this category that management needs to look at in more detail? This research indicates that in this case it is in fact the campus e-mail that is perceived with the least satisfaction in Network Functions and it is the campus Telnet service that is most highly associated with an overall perception of Network Functions. Such specificity can help shape the discussion on improving the satisfactions with service provided by the university Computing Center.

Obviously the specifics will vary by institution and by type of institution, but this gives an excellent starting point for the conceptual discussion of what is important to measure (performance vs. perceived quality), what are the components of the discussion (particularly for computer services) and how do we do this research (with steps from the concept to the conclusions).

References

Beerli, A., Martân, J., & Quintana, A. (2004). A model of customer loyalty in the retail banking market. *European Journal of Marketing*, 38(1/2), 253-275.

Bergeron, F., Rivard, S., & Serre, L. D. (1990). Investigating the support role of the information center. *MIS Quarterly*, 14(3), 247-260.

Brady, M. K., & Cronin, J. J. (2001). Some new thoughts on conceptualizing perceived service quality: A hierarchical approach. *Journal of Marketing*, 65(3), 34-49.

Brady, M. K., Cronin, J. J., & Brand, R. R. (2002). Performance-only measurement of service quality: A replication and extension. *Journal of Business Research,* 55(1), 17-31.

Brancheau, J. C., Janz, B. D., & Wetherbe, J. C. (1996). Key issues in information systems: 1994-95 SIM delphi results. *MIS Quarterly*, 20(2), 225-242.

Carr, H. H., Rainer, R. K., & Young, D. (1993). The state of information center services: An empirical study. *Information Systems Management,* 10(1), 54-58.

Choi, K., Cho, W., Lee, S., Lee, H., & Kim, C. (2004). The relationships among quality, value, satisfaction and behavioral intention in health care provider choice: A South Korean study. *Journal of Business Research,* 57(8), 913-921.

Cronin, J., & Taylor, S. (1992). Measuring service quality: A reexamination and extension. *Journal of Marketing,* 56(3), 55-68.

Deadman, P., Hall, G. B., Bain, T., Elliot, L., & Dudycha, D. (2000). Interactive GIS instruction using a multimedia classroom. *Journal of Geography in Higher Education,* 24(3), 365-380.

Debreceny, R., & Ellis, A. (1998). Managing student access to university information networks – the Australian experience. *Campus-Wide Information Systems*, 15(2), 48-53.

DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research,* 3(1), 60-95.

Fornell, C. (1992). A national customer satisfaction barometer: The Swedish experience. *Journal of Marketing,* 56(1), 6-21.

Gronroos, C. (1984). A service quality model and its marketing implications. *European Journal of Marketing*, 18(4), 36-44.

Guimaraes, T. (1996). Assessing the impact of information centers on end-user computing and company

performance. *Information Resources Management Journal*, 9(1), 6-15.

Igbaria, M., & Nachman, S. (1990). Correlates of user satisfaction with end-user computing: An exploratory study. *Information & Management*, 19(2), 73-82.

Kaiser, H. F. (1958). The varimax criterion for analysis rotation in factor analysis. *Psychometrika,* 23(3), 187-200.

Kaplan, R. S., & Norton, D. P. (2001a). Transforming the balanced scorecard from performance measurement to strategic management: Part I. *Accounting Horizons*, 15(1), 87-104.

Kaplan, R. S., & Norton, D. P. (2001b). Transforming the balanced scorecard from performance measurement to strategic management: Part II. *Accounting Horizons,* 15(2), 147-160.

Kotler, P. (2000). *Marketing Management*. New Jersey: Prentice-Hall, Inc.

Lee, S. M., Kim, Y. R., & Lee, J. (1995). An empirical study of the relationships among end-user information systems acceptance, training, and effectiveness. *Journal of Management Information Systems,* 12(2), 189-202.

Magal, S. R. (1991). A model for evaluating information center success. *Journal of Management Information Systems,* 8(1), 91-106.

Mahmood, M. A., Burn, J. M., Gemoets, L. A., & Jacquez, C. (2000). Variables affecting information technology end-user satisfaction: A meta-analysis of the empirical literature. *International Journal of Human-Computer Studies*, 52(4), 751-771.

Mirani, R., & King, W. R. (1994a). The development of a measure for end-user computing support. *Decision Science*, 25(4), 481-498.

Mirani, R., & King, W. R. (1994b). Impacts of end-user and information center characteristics on end-user computing support. *Journal of Management Information Systems*, 11(1), 141-166.

Muir-Herzig, R. G. (2004). Technology and its impact in the classroom. *Computers and Education,* 42(2), 111-131.

Nord, G. D., & Nord, J. H. (1994). Perceptions and attitudes of end users on technology issues. *Journal of System Management*, 45(11), 12-15.

Nunnally, J. C. (1978). *Psychometric Theory*. 2nd ed., New York: McGraw-Hill.

Oliver, R. L. (1997). *Satisfaction: A Behavioral Perspective on the Consumer*. New York, NY: McGraw-Hill.

Parasuraman, A, Zeithaml, V. A., & Berry, L. L. (1994). Reassessment of expectations as a comparison standard in measuring service quality: Implications for further research. *Journal of Marketing*, 58(1), 111-124.

Parasuraman, A., Berry, L. L., & Zeithaml, V. A. (1988). SERVQUAL: A multiple-item scale for measuring customer perceptions of service quality. *Journal of Retailing*, 64(1), 12-40.

Park, C. H., & Kim, Y. G. (2003). Identifying key factors affecting consumer purchase behavior in an online shopping context. *International Journal of Retail & Distribution Management,* 31(1), 16-29.

Peppard, J. (2003). Managing IT as a portfolio of services. *European Management Journal*, 21(4), 467-483.

Powell, J. V., Aeby, V. G. Jr., & Carpenter-Aeby, T. (2003). A comparison of student outcomes with and without teacher facilitated computer-based instruction. *Computers and Education,* 40(2), 183-191.

Rainer, R. K., & Carr, H. H. (1992), Are information centers responsive to user needs? *Information & Management,* 22(2), 113-121.

Rust, R. T., & Oliver, R. L. (1994). Service quality: Insights and managerial implications from the frontier. In Rust, R. T., & Oliver, R. L. (eds). Service Quality: New Directions in Theory and Practice. Thousand Oaks, CA: Sage Publications, 72-94.

Straub, D. W. (1989). Validating instruments in MIS research. *MIS Quarterly,* 13(2), 147-169.

Telem, M. (2001). Computerization of school administration: Impact on the principal's role – a case study. *Computers and Education,* 37(3/4), 345-362.

Temponi, C. (2005). Continuous improvement framework: Implications for academia. *Quality Assurance in Education*, 13(1), 17-36.

Walls, J., & Turban, E. (1991). Information center management control measures: A survey and comparison. *IEEE Transactions on Engineering Management*, 38(4), 336-343.

Winer, L. R., & Cooperstock, J. (2002). The 'Intelligent Classroom': Changing teaching and learning with an evolving technological environment. *Computers and Education*, 38(1/3), 253-266.

Younis, A. R. M. (2002). The perception and administrative effect of Internet usage in Jordanian university libraries. *Online Information Review*, 26 (3), 193-208.

Zenios, M., Goodyear, P., & Jones, C. (2004). Researching the impact of the networked information environment on learning and teaching. *Computers and Education,* 43(1/2), 205-213.

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