Measurement of Computing Services Effectiveness for the University of Wisconsin-La Crosse

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ABSTRACT

Information Technology (IT) provides computing facilities and a variety of computing services to the University of Wisconsin, La Crosse campus. The purpose of this study is to measure the effectiveness of IT in various areas on campus by measuring the difference between users' expectations of IT and IT's perceived performance in these areas. The size and direction of the discrepancies (or gaps) between expectations and performance are good indicators of the overall attitude to the IT function. A positive gap will indicate the perceived performance is below expectation, and a negative gap will indicate that the perceived performance exceeds expectation. The use of this user-satisfaction (US) method is recognized by many IT researchers as an appropriate surrogate for effectiveness. A survey consisting of three parts will be administered to students, faculty, and staff. The first section asks the respondent to rate her or his expectations of sixteen attributes of IT. The second section asks the respondent to rate IT's performance for these same attributes. The final section asks the respondent for an overall rating of IT and for any additional comments or concerns. The results of the study will provide IT with knowledge of their strengths and weaknesses and possible improvements IT can make to increase its benefits.

INTRODUCTION

Computing technology has been one of the most rapidly growing human endeavors in history. Colleges and universities especially take advantage of this technology; students, faculty and staff utilize personal computers to aid in problem solving, make complex computations, and produce professional reports and presentational aids. The Information Technology Services (ITS) office is responsible for providing computing services to the University of Wisconsin, La Crosse campus. ITS, Computing Services branch provides computer labs and classrooms, TARG-IT Center sales, documentation, institutional records, campus infrastructure, and servers (responsible for Internet, e-mail, etc.) and computer training opportunities. These can be very difficult tasks due to the current nature of computing technology; not only is the technology proliferating, but users' needs and purposes are expanding as well. The purpose of this research is to measure the effectiveness of Computing Services in a number of areas in order for them to continue to provide a good service to the University. However, it is

difficult to measure the effectiveness of an information system, due to the lack of clarity in the definition of effectiveness; therefore a user-satisfaction approach will be used. Many Information Technology researchers recognize user satisfaction as an appropriate surrogate for effectiveness. Baroudi and Orlikowski (1988) state that user satisfaction has become a pervasive measure of the success or effectiveness of information systems. According to Newman (1989), 43% of North American and 26% of European firms conduct user satisfaction surveys. The results of the study identifies for ITS what their most successful services are, as well as information about their weaknesses and possible approaches to take to improve their services.

OBJECTIVES

This study provides a measure of Computing Services' effectiveness of this campus. This was accomplished with a survey that measures the user satisfaction for sixteen attributes of Computing Services. These attributes include availability to computing facilities, adequate academic software applications, minimal downtime, competence of TARG-IT center help, user confidence in computing services, system's responsiveness to user needs, data security and privacy, network transfer speeds, user training, response time of systems support staff, ability to produce professional reports, positive attitude of support staff, availability of computing services, ability to improve personal productivity, enhancement of students' learning experience, and documentation to support users. This study measures the user satisfaction of each of these attributes, provides a measure of how each of these attributes correlate to the overall user satisfaction, and discovers correlation between measures of these attributes and the profile of the respondents. Thus it measures the pertinence of the services ITS provides, obtains information regarding the effectiveness of Computing Services toward individuals of different profiles, and provides a complete measure of Computing Services' effectiveness.

RESEARCH METHODOLOGY

This study was conducted by administering a self-completion survey to the faculty, staff, and graduate and undergraduate students. The survey consists of four parts. The first part is an introduction and obtains personal profile information from the respondent. The following sections, labeled Part A, Part B, and Part C measure the effectiveness of Computing Services. Parts A and B obtain measures of the effectiveness of the sixteen attributes mentioned above on a five point scale, categorized "Very Poor", "Poor", "Average", "Good", and "Very Good". Part A asks for the respondent's expectations of these attributes and Part B asks for her or his perception of Computing Services' performance concerning these topics. The final section asks the respondent to rate the overall performance of Computing Services and to write any additional comments or concerns.

Once the surveys had been completed, the first part of the analysis was to find descriptive statistics of the respondent's profiles. Statistics were computing regarding the respondents' classification, years of experience they had with personal computers and the Internet, whether they own a personal computer, whether they are employed by ITS, and the types of services they utilize at UW-L.

Next the mean differences (or gaps) between expectations and performance, and the correlation between these gaps and the overall performance were computed. Thus attributes with high correlation with the overall performance must be aspects of Computing Services that are

more central to their function.

To better understand the perception scores, a factor analysis was performed on the performance data. The factor analysis technique reduces the sixteen attributes by grouping similar items into basic components, or factors. A regression analysis was finally performed

Table 1 **Attribute descriptive statistics**

Attribute	Performances		Expectations		Gap (Perf. – Expect)		Gap Correlation with total satisfaction	
	Mean	SD	Mean	SD	Mean	SD	R	p-value
4. Technical competence of TARG-IT Center Help Desk	3.6	.89	4.02	.85	-.43	.98	.3284	.000*
15. Ability of the system to enhance learning experience	3.57	.78	4.02	.79	-.44	.88	.2785	.000*
11. Flexibility of the system to produce professional reports	3.56	.69	4.00	.70	-.43	.77	.3170	.000*
12. Positive attitude of information systems support staff	3.55	.85	4.02	.77	-.47	.94	.2925	.000*
2. Adequate academic software applications	3.5	.80	3.93	.79	-.42	.88	.2988	.000*
7. Data security and privacy	3.5	.79	4.02	.81	-.50	.90	.2291	.000*
14. Ability of the system to improve personal productivity	3.49	.77	3.89	.75	-.39	.85	.2586	.000*
5. User confidence in using Computing Services	3.45	.75	3.97	.71	-.53	.89	.2851	.000*
6. System's responsiveness to changing user needs	3.38	.81	3.86	.78	-.46	.97	.3538	.000*
10. Response time from support staff to remedy problems	3.36	.86	3.86	.83	-.49	1.06	.3402	.000*
8. Network data transfer speeds	3.35	.82	3.80	.86	-.45	.88	.2783	.000*
3. Low percentage of GCA hardware and software downtime	3.31	.79	3.76	.85	-.45	.89	.2494	.000*
1. Availability to GCA computing facilities	3.28	.83	3.83	.85	-.54	1.02	.3154	.000*
9. Extent of user training	3.27	.84	3.66	.82	-.39	1.00	.2144	.001*
13. Users' understanding of availability of Computing Services	3.27	.80	3.73	.78	-.47	.99	.1594	.011*
16. Documentation to support users.	3.23	.82	3.72	.80	-.48	.94	.2780	.000*

* Significant (p-value < 0.05)

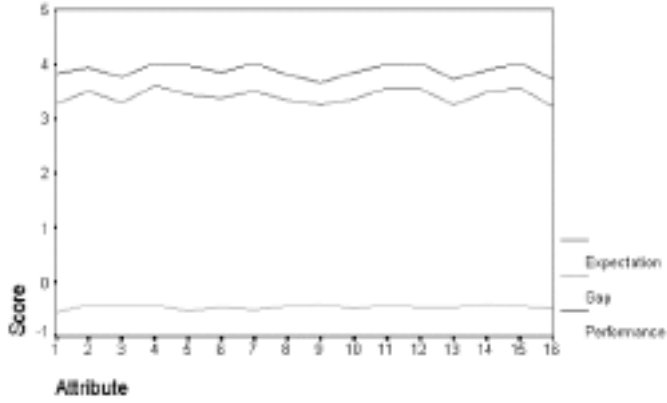

Figure 1: Mean expectation, performance, and gap score for each attribute. A negative gap score indicates performance was less than the expectation.

to establish which factors are key in explaining the respondents' overall perception of Computing Services. A full and stepwise regression was performed with this data using the SPSS statistical package.

RESULTS

The first step of this study was to compute basic descriptive statistics concerning the performances, expectations, and gaps (performance score - expectation score) for each attribute. Table 1 lists the means and standard deviations of the performance, expectation, and gap for each attribute. Figure 1 shows a plot of these scores. The consistant negative gap seen in the graph indicates expectations exceeded performance for all the attributes. The last column displays the correlation between the gap for the given attribute and the overall satisfaction the users have for Computing Services. The following observations may be worth noting:

1) None of the mean performances are as high as 4 (4 = good), yet none of the means are lower than 3 (3 = acceptable).
2) The highest mean performance was attribute number 4 (technical competence of TARG-IT Center help desk student consultants), while the lowest mean performance was attribute #16 (documentation to support computing users).
3) The highest expectations users have in Computing Services was the ability of the system to enhance the learning experience of the students (attribute #15), which had the second highest performance rating.
4) The lowest mean expectation was the extent of user training (attribute #9), which consequently had the lowest gap.
5) The gaps for all the attributes were negative (performance of Computing may be short of users expectations), yet none of these gaps were significant with a p-value < .05. The largest gap was attribute #1 (Availability of GCA computing facilities).
6) Attribute #6 (System's responsiveness to changing user needs) had the highest correlation with the users overall satisfaction with computing services (R = .3538). The mean expectation for this attribute was 3.86 (close to good), while the mean perceived performance was 3.38 (just above acceptable).

Analysis of Variance

The next step in this study was to perform one-way analysis of variance (ANOVA) tests to find out if overall satisfaction differs among individuals with different profiles. The groups of individuals studied include student classifications, employee classifications (faculty vs. staff), years experience with a computer, and whether or not the individuals owned a computer. The first test concluded there is no significant difference in overall satisfaction among the student classifications (freshmen, sophomores, juniors, seniors, and graduate students. This analysis of variance test had the following result:

$F(4,216) = 1.451$ P-value = .218

Secondly, the means of overall satisfaction between faculty and staff were tested for any difference, and again no significant difference was found. The analysis of variance results were the following:

$F(1,36) = 1.554$ P-value = .158

The next interest was whether or not there was a difference in overall satisfaction among groups of individuals with varied computer experience. The respondents were categorized according to the following classification:

Group 1: 0 to 5 years experience
Group 2: 6 to 9 years experience
Group 3: 10 to 12 years experience
Group 4: 13 or more years experience

This test concluded there is a significant difference among students with different amounts of experience. Specifically, post-hoc analysis concluded that the mean overall satisfaction of Group 4 is significantly lower than the other three groups (95% confidence). That is, individuals with the most background in computing are the least satisfied with computing services' performance. The means for the overall satisfaction for these groups are the following:

Group 1: 3.54
Group 2: 3.44
Group 3: 3.45
Group 4: 3.12

Note that despite the difference between group 4 and the rest, all the means for the overall satisfaction among these groups are between acceptable (3.00) and good (4.00). The analysis of variance yielded this final result:

$F(3,253) = 1.54$ P-value = .016

The final analysis of variance test concerned individuals who owned a computer, versus individuals who did not. The mean overall satisfaction for those who owned a computer (3.35) was lower than the mean of those who did not own a computer (3.52), but the test was not significant at a 95% confidence. This finding is in agreement with the result of the ANOVA test discussed above which concluded individuals with more computing experience gave lower overall satisfaction scores, since it is probable that individuals that own a computer have more years of experience with computing. The result of the analysis of variance is the following:

$F(1,257) = 3.57$ P-value = .060

Factor Identification

The final interest of this study was to estimate the relationship between the performance scores of the sixteen attributes and the overall satisfaction the individuals had in Computing Services. Instead of estimating a regression equation including all sixteen attrib-

utes as the independent variables, a factor analysis using the principle component procedure to extract the factors followed by a varimax rotation was performed on the performance scores of the sixteen attributes. This technique reduces the information from the sixteen variables to only a few factors. The factor analysis was computed with the SPSS® (Statistical Software for the Social Sciences) software package. The analysis extracted three factors with eigenvalues greater than 1, accounting for 59.7% of the overall variance of the performance scores. These factors and their associated attributes are the following:

Factor 1: ***Confidence in ITS and its ability to meet users' needs***

- Q5. Users confidence in using Computing Services
- Q6. System's responsiveness to changing user needs.
- Q7. Data security and privacy
- Q8. Network data transfer speeds
- Q9. Extent of user training
- Q11. Flexibility of the system to produce professional reports
- Q13. Users' understanding of the availability of Computing Services
- Q14. Ability to enhance the learning experience of the students
- Q16. Documentation to support computing users

Factor 2: ***Availability***

- Q1. Availability to GCA computing facilities
- Q2. Adequate number of and type of academic software applications
- Q3. Low percentage of GCA hardware and software downtime
- Q8. Network data transfer speeds

Table 2 **Output from the factor analysis**

Factor	Attribute	Factor Loading	Attribute gap correlation with overall satisfaction
Factor 1	Q13	.780	.1594
	Q14	.741	.2586
	Q5	.717	.2851
	Q15	.663	.2785
	Q6	.645	.3538
	Q16	.627	.2780
	Q9	.615	.2144
	Q11	.478	.3170
	Q7	.423	.2291
Factor 2	Q3	.769	.2494
	Q2	.768	.2988
	Q1	.759	.3154
	Q8	.506	.2783
Factor 3	Q12	.806	.2925
	Q10	.784	.3402
	Q4	.741	.3284

Table 3 **Correlations with overall performance**

Variable	Correlation	p-value
Factor 1	.2607	.000*
Factor 2	.2854	.000*
Factor 3	.2304	.000*
Years experience	-.1733	.005*
Own a PC	.1171	.060 .

* Significant (p-value < .05)

Table 4 **Output from the regression**

Variable	Coefficient	p-value
Constant	3.565	.000*
Factor 1	0.300	.000*
Factor 2	0.320	.000*
Factor 3	0.230	.000*
Years experience	-0.016	.000*
	R^2 = .567	**F = 53.868, p-value = .000***

* Significant (p-value < .05)

Factor 3: ***Technical support***

Q4. Technical competence of TARG-IT Center help desk consultants

Q10. Fast response time from systems support staff to remedy problems

Q12. Positive attitude of information systems support staff

The results of the factor analysis are displayed in Table 2. Only those statements with a factor loading of 0.4 or more are included in the table.

Regression:

Finally, a stepwise regression was performed to predict overall satisfaction. The initial independent variables included the three factors extracted from the factor analysis, years experience with a computer, and whether or not the individual owned a computer. The correlation between these variables and the overall performance is listed in Table 3. The stepwise regression eliminated the last variable. The fitted model explains about 57% (R2 = .567) of the variability of the overall satisfaction. Table 4 shows the output from the regression. The four remaining variables were all significant at a 95% confidence. The variable with the most effect on overall satisfaction was factor 2 (availability of Computing Services), followed closely by factor 1 (confidence in ITS and its ability to meet users' needs).

CONCLUSION

Although none of the gap scores were statistically significantly different from zero (expectations and performance were not significantly different), all the gap scores were less than zero, possibly indicating Computing Services could do more to improve these attributes of their service, but the current effectiveness is not below average. Attribute #6 (system's responsiveness to changing user needs) was the attribute whose gap was the most correlated with the overall performance, signifying this is one of the more important attributes to give attention to when concerning overall performance. The analysis of variance tests found the profile of users who were least satisfied with Computing Services' performance. It concluded that the most experienced users and those who presently own a computer had the lowest performance scores, which implies that the more experienced users are more difficult to satisfy. Finally, the factor identification and subsequent regression identified the relationship between overall performance and the three factors and years experience with a computer. It indicated that the overall performance could be mostly affected by factor 2 (availability). However, the developed model explained only 57% of the variability of the overall satisfaction, which indicated that there are probably other factors that have not been included in this study that have an impact on overall satisfaction. To conclude, the performance is just above average, and they cannot be said to be ineffective, but this study illustrates relationships of the above sixteen attributes to the overall performance that can assist the decision making of Computing Services.

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