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AUTHOR	Kleen, Betty; Shell, L. Wayne
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ABSTRACT

The researchers, using a variation of the SERVQUAL instrument, repeated a 1999 study to measure students' satisfaction with instructional technology tools used in their classrooms. Student satisfaction varied by course discipline, by instructional technology, by anticipated grade, and by frequency of use. Female respondents were less satisfied than male respondents. Satisfaction generally rose with frequency of use. There are significant variations of satisfaction by discipline and technology choice, but little interaction effect. Factor analysis did not reveal the five hypothesized dimensions of SERVQUAL. Overall results were generally consistent with the 1999 study. Includes two tables: number of responses by instructional technology and course discipline; and technology usage rate and its impact on satisfaction. (Contains 15 references.) (Author)

SERVQUAL-BASED MEASUREMENT OF STUDENT SATISFACTION WITH CLASSROOM INSTRUCTIONAL TECHNOLOGIES: A 2001 UPDATE

Betty Kleen
Nicholls State University

L. Wayne Shell
Nicholls State University

ABSTRACT

The researchers, using a variation of the SERVQUAL instrument, repeated a 1999 study to measure students' satisfaction with instructional technology tools used in their classrooms. Student satisfaction varied by course discipline, by instructional technology, by anticipated grade, and by frequency of use. Female respondents were less satisfied than male respondents. Satisfaction generally rose with frequency of use. There are significant variations of satisfaction by discipline and technology choice, but little interaction effect. Factor analysis did not reveal the five hypothesized dimensions of SERVQUAL. Overall results were generally consistent with the 1999 study.

INTRODUCTION

The researchers, using a variation of the SERVQUAL instrument, repeated a 1999 study and measured students' satisfaction with a broad spectrum of classroom technology tools. Classes in five academic courses Introductory MIS, Business Communication, Principles of Economics, Principles of Marketing, and Accounting Information Systems in AACSB-accredited schools nationwide, participated.

Purpose

Higher education institutions across the country are scrambling for competitive advantage, whether through distance education offerings or in their traditional "brick and mortar classrooms. High service quality is necessary to protect competitive advantage. Student satisfaction with their classroom experiences plays an important part in contributing to a school's competitive advantage. This research replicates a 1999 study (Kleen, Shell, and Cox, 1999) of a cross-disciplinary student-centered assessment of satisfaction with instructional technology being used in the business classroom. The 1999 study used an instrument inspired by SERVQUAL, a widely used instrument to measure customer service quality. The undercurrents of the research include such academic problems as limited technology dollars, questionable relevance of industry training room setups as models, and the need for classrooms to support several faculty with different teaching styles and different technology needs. This research is also inspired by the need to evaluate new and evolving technologies with uncertain cost-benefit ratios and relatively untested classroom impact.

The long-range intent of the researchers is to provide faculty with evidence to help them choose instructional tools appropriate to their classes. The current researchers elected to conduct the 2001 study for two reasons: (1) to review technologies after three years and compare whether students are now more satisfied or less satisfied with the technologies used in the classrooms than in 1999, and (2) to corroborate the results of the Kleen, Shell, and Cox 1999 study.

The Kleen, Shell, and Cox 1999 study revealed that students in the various disciplines did have different levels of satisfaction with various technologies such as overhead transparencies, computer slide shows, software demonstrations, and student in-class computer activities. The authors found that satisfaction varied little by gender or by respondent age group, although satisfaction varied with intensity of technology use in some ways. In a related study by Kleen, Shell, and Zachry (2001), the researchers found that male students in AIS classrooms were uniformly less satisfied than female students with certain technologies.

Even though the project is a replication of an earlier study, the research questions are cross sectional. What are the top rated satisfaction items for the various technologies? What are the satisfaction differences across course disciplines? Are there interactions by gender? How satisfied are the student consumers of instructional technology being used in the business classroom? When these modern technologies are used in the classroom, do students believe they learn more? Do they believe they pay attention better? Do they believe they become more confident about their learning? Do they believe they understand more? In the conclusions, parallels will be drawn between the 1999 study findings and the 2001 findings.

Literature Review

To date, a very limited amount of empirical research exists related to how students benefit (or *perceive* they benefit) from faculty use of technology tools and/or methods such as electronic slideshows, Internet activities, live software demonstrations, and hands-on student computer activities within the actual classroom.

The 22-item, two-part scale called SERVQUAL, originated by Parasuraman, Zeithaml, and Berry (1988), has become a widely used tool for measuring customer service quality. Buttle (1996) emphasized that service quality can be best assessed from the point of view of consumers; this is the approach taken by SERVQUAL. Kettinger and Lee (1997) noted its practical value as both a benchmarking tool within an industry and as a diagnostic tool. While SERVQUAL studies have covered many service sectors, Buttle (1996) found no articles that applied SERVQUAL to a classroom setting. Modifications and adaptations of the SERVQUAL instrument are widespread; in fact, even the instrument's originators have tested modified versions (Parasuraman, Zeithaml, and Berry, 1996). In 1997 Van Dyke, Kappelman, and Prybutok concluded that using a single measure of service quality across industries is not feasible, and that future research should involve development of industry-specific measures of service quality.

Kleen, Shell, and Cox (1999) focused only on perceptions of students as consumers of classroom technology, eliminating the use of gap-based scores of perception minus expectations (P-E gap scores) of the original SERVQUAL. This use of only part of the SERVQUAL structure, such as omitting expectations but leaving perceptions, is supported by Teas (1994) and Brown, Churchill, and Peter (1993). Additionally, Van Dyke, Kappelman, and Prybutok (1997) note the IS-adapted SERVQUAL instrument, utilizing difference scores, is neither a reliable nor a valid measurement for operationalizing the service quality construct for an information systems services provider.

The research and debate over the use of IS-adapted SERVQUAL instruments in the information systems construct continues (Kettinger and Lee, 1997; Pitt, Watson, and Kavan, 1997; VanDyke, Prybutok, and Kappelman, 1999). The research and debate over the use of SERVQUAL-inspired instruments in the higher education construct should do no less.

Methodology

The researchers repeated an earlier study that used an instrument containing 19 questions inspired by SERVQUAL. These items are not "difference-score based or "gap-based, but rather focus only on the *perceptions* of students as consumers of classroom instructional technology. They do not include student expectations of desired or adequate service. The original 19 satisfaction items on the questionnaire remained the same as the Kleen, Shell, and Cox 1999 study. The researchers added an explanatory variable of self-reported projected final grade in the course to the other classification variables of major, age, and gender. The 1999 study contained the classification variable, "student classification. This variable was not used in the 2001 study for its lack of explanatory power. Students in AACSB schools were the target population. The current research project received approval from the researcher University's Human Subjects Institutional Review Board.

The researchers conducted a systematic random sample of one-third of the approximately 350 AACSB-accredited schools. Department heads were contacted for each of five business courses selected for the study. Specific courses selected included the following: Management Information Systems, Business Communication, Principles of Economics, Principles of Marketing, and Accounting Information Systems. Each department head received a cover letter from the researchers and letters of invitation to distribute to the faculty teaching the course identified in the letter. Because of the known wide variance in the departments responsible for business communication, these materials were sent to deans' secretaries for routing to involved faculty. Faculty members who wished to participate after reading the letter of invitation e-mailed course name, number, and number of students to the researchers. The researchers then mailed survey instruments and response forms for each student in the classroom of participating faculty in April. Faculty members were encouraged to administer the survey near the end of the term.

The current study used only four of the seven instructional technologies of the 1999 study. The categories of overhead transparencies, videotape or television programs, and CD-ROM or multimedia presentations were eliminated from the current study because two were rarely used in 1999. The current researchers also wanted to focus on only those technologies with an electronic component. The primary focus of the instrument was on the four remaining classroom instructional technologies:

electronic slide shows
live software demonstrations
live Internet connections
student in-class computer activities

Participating instructors selected two of the four technologies used in their classes and directed students to answer the question sets for those specific technologies.

Parallel sets of 20 questions were presented for each instructional technology. Eighteen of the twenty questions were built around the five SERVQUAL dimensions of Tangibles, Reliability, Responsiveness, Assurance, and Empathy. Students responded based on a five-point Likert-type scale, assumed by the researchers to generate interval data. The 19th item was a global item. The final question (20) asked the student to estimate in what percentage of the class meetings a particular technology was used so that the researchers could determine how satisfaction varied with intensity of use.

The 20 questions students responded to for each technology are listed below. Students responded to a five-point scale, with answer options ranging from a strongly agree (1) to a strongly disagree (5).

1. The use of _________ made it easy to see the material presented.
2. The use of _________ was not appropriate in this class.
3. The use of _________ helped me learn the material presented.
4. The use of _________ was a good way to reinforce assigned reading material.
5. _________________ worked when it was supposed to.
6. The use of _________ helped me pay attention in class.
7. The use of _________ was distracting.
8. The use of _________ helped make this course more interesting.
9. The use of _________ allowed me to focus better on what the professor was saying.
10. The use of _________ was more trouble than it was worth.
11. The use of _________ made me more confident about what I was learning.
12. The use of _________ helped me to better understand fundamental course concepts.
13. The use of _________ tended to oversimplify lectures.
14. The use of _________ helped me "keep up with lecture.

15. The________________ used in this class was visually appealing.

16. The use of ________ helped me organize my lecture notes.

17. The use of _________ helped me understand the lecture material.

18. __________________ is a modern, up-to-date lecture method.

19. I wish more of my instructors used _________ in their classes.

20. __________________ was used in approximately ____ percent of the meetings of this class.

Items 2, 7, 10, and 13 were negative in nature. For purposes of analysis, absolute scores were inverted to be comparable to positively worded items.

Descriptive statistics for the 2001 data will answer a variety of investigative questions. Descriptive statistics included the mean scores for each of the 19 satisfaction-based items, in each of the technology groups, in the aggregate, and in various subgroups such as mean scores by gender, by course discipline, and by anticipated grade. Descriptive statistics also included regression as a descriptive device. These descriptive statistics were used to illustrate:

Which items get higher mean scores as they are used more frequently? Which get lower?
Which satisfaction item (among 1 18) showed the highest satisfaction in each technology group? Which the lowest?
Are the top rated items the same based on gender, technology choice, and course discipline?
Do technologies affect user satisfaction in the same manner across the five course disciplines?
Do any items (among 1-18) get higher mean scores as self-reported grade is higher?
Do any technologies score better as self-reported grade is higher?

The researchers also constructed hypothesis tests to answer each of the investigative questions above. The influence of grade and of usage on satisfaction was tested by simple and multiple regression. The impact of satisfaction of discipline and technology was tested by one-way ANOVA and two-way ANOVA. Hypotheses were constructed (overall and grouped by course discipline for each of the 18 items) to determine whether:

Student satisfaction varies with frequency of instructional technology tool use
Student satisfaction varies with gender
Student satisfaction varies with expected grade
Student satisfaction varies with course discipline

Factor analysis enabled the researchers to determine whether the clustering of 18 items matched their *a priori* expectations for classification into the five hypothesized dimensions.

FINDINGS

The findings section of the paper begins with descriptive statistics, followed by regressions, one- and two-way ANOVAs, and factor analysis.

Descriptive Statistics

A total of 280 students from 11 classrooms provided responses for the study. Class size ranged from 20 to 76. Seventy-seven percent of those indicating age were under 25 years old; 22.1% were 25 or older. Of those respondents indicating gender, 47.5% were male, and 52.5% were female. Of those indicating their anticipated grade at end of course, 37.7% anticipated an A, 35.3% a B, 13.5% a C, 2.2% a D, and 0.9% an F. On a 4.0 scale, that is an average of 2.86.

Electronic slideshow technology had the greatest number of responses (243 students, 47.5% of all responses in the study). Items for live software demonstration technology were answered by 85 respondents, 16.6% of the total. Eighty-one students (15.8%) answered items for live Internet connections, and 103 students (15.8%) answered items for student in-class computer activities. The cross tabulation of response frequencies, by course discipline and technology choice, is illustrated in Table 1.

Of the 512 total responses (most of the 280 students responded to two technologies), 64 (12.5%) were from students in business communication classes; 74 (14.5%) were in a principles of economics class. Principles of marketing contributed 73 responses (14.3%); AIS, 53 responses (10.4%); IS courses, 248 responses (48.4%).

"Made it easy to see the material presented received the lowest mean score (1.89), which provided the highest satisfaction over all technologies, all course disciplines, and all respondents. "Modern, up-to-date lecture method was next highest satisfaction with a mean score of 1.96. The items with worst mean score (lowest satisfaction) overall included "tended to oversimplify lectures, (2.74), and "helped me organize my lecture notes, (2.62).

Female respondents had higher average scores than male students, indicating lower satisfaction in 17 of the 19 satisfaction items.

In the business communication discipline, the item with the lowest mean score was "modern, up-to-date lecture method (2.02). In business communication the item that scored lowest satisfaction was "tended to oversimplify lectures (2.89). In economics, the item that scored best was "made it easy to see the material presented (1.66); the item that scored lowest satisfaction was "helped me organize my lecture notes (2.69). Within the marketing discipline, the item "made it easy to see the material presented (1.86) earned the highest satisfaction score. "Tended to oversimplify lectures earned the lowest satisfaction score (3.17). Within AIS, the highest satisfaction was for "modern, up-to-date lecture method (2.11); the lowest satisfaction was for "helped me organize my lecture notes (2.87). Within the IS discipline, the highest satisfaction was for "made it easy to see the material presented (1.83); the lowest satisfaction score was for "helped me organize my lecture notes (2.70).

When each technology was examined, differences also appeared for highest and lowest satisfaction items. For electronic slideshows, the item that had the highest satisfaction level was "made it easy to see the material presented (1.71); the item that scored worst was "tended to oversimplify lectures (2.80). For live software demonstrations, the highest satisfaction item was "made it easy to see the material presented (2.01); the item that scored worst was once again "tended to oversimplify lectures (2.70). For live Internet best was once again "made it easy to see the material presented (2.07); worst was a tie between "tended to oversimplify lectures and "helped me organize my lecture notes (2.80). The highest satisfaction item for student in-class computer activities was "modern, up-to-date lecture method (2.03). The lowest satisfaction item for this technology was "helped me organize my lecture notes (2.83). While these measures are descriptive, not test results, they point out that instructors should consider their discipline as a strong factor in choosing appropriate technology in their classroom.

Two-Factor Descriptives

In this section, the descriptive statistics are reported as a two-factor model of discipline and technology choice. This model does not include the effects of gender, of usage rate, or of grade.

These descriptive statistics use a model which has a general effect, a discipline effect, a technology effect, and an interaction effect. These effects are additive.

Satisfaction score = general effect + discipline effect + technology effect + interaction

This equation will be used to illustrate best case and worst case scores for two of the 18 satisfaction-based items. For item 3, "helped me learn the material presented, the best case is

2.107 - .610 (economics discipline) + 0 (in-class computer activities) = 1.497 (satisfaction).

The corresponding worst case is

2.107 + .393 (AIS) + .719 (live software demonstrations) = 3.219.

TABLE 1
NUMBER OF RESPONSES BY INSTRUCTIONAL TECHNOLOGY AND COURSE DISCIPLINE

Technology	Course Discipline					
	Business Communications	Principles of Economics	Marketing	Accounting Information Systems	Information Systems	Totals
Electronic Slideshows	32	37	48	25	101	243
Live Software Demonstrations	0	37	25	0	23	85
Live Internet Connections	0	0	0	14	67	81
Student In-Class Computer Activities	32	0	0	14	57	103
Totals	64	74	73	53	248	512

Similar applications for item 17, "helped me understand the lecture material, produce

2.286 - .478 (marketing) + 0 (in-class computer activities) = 1.808 (best case)

2.286 + .214 (AIS) + .453 (live software demonstrations) = 2.953 (worst case).

Impact of Anticipated Grade on Satisfaction

The researchers conducted a regression analysis on satisfaction scores of each of the 18 items for each of the four technologies, where the independent variable was anticipated grade. The vast majority of all such regressions showed no significance. However, the technology choice student in-class computer activities contained virtually all instances of significance. A typical example follows: For "helped me understand fundamental course concepts, the resulting regression equation is satisfaction = 1.601 + .442 x anticipated grade (sig. = .004, r^2 = .084). In all instances of significance, the regression slopes were positive, meaning lower grade anticipated equaled lower satisfaction.

Impact of Technology Usage Rate on Satisfaction

Item 20 contained a five-valued usage variable. A simple regression of each of items 1 through 18 was conducted with item 20 as the independent variable. This was repeated separately for all four technology choices. In all cases where the regression was significant, the calculated slope was negative, meaning higher usage led to higher satisfaction. While significant, the explanatory power of these models is limited r^2 were typically under 10% for these models. All items for which the regression was significant at the .05 level or better are identified in Table 2.

Does Satisfaction Vary by Technology?

The following section describes a one-way ANOVA to test the equality of mean satisfaction scores across the four instructional technologies. The fundamental hypothesis is

H_o = Mean satisfaction score for an item is the same across all technology choices.

H_a = At least one mean satisfaction score differs from the others.

This hypothesis is applied for all the 18 satisfaction items. H_0 was rejected for items 1, 2, 4, 5, 7, 9, 10, 14, 16, 17, and 18. In these cases, post hoc comparisons were done to determine which mean (s) differed.

For the item "made it easy to see material presented, electronic slideshow (mean = 1.71) scored higher satisfaction than both student in-class activities (2.08) and live Internet connections (2.08). A low score reflects higher satisfaction. No other paired differences were significant.

For "appropriate technology for the class, the only significant paired comparison revealed live software demonstrations (2.49) were viewed less appropriate for the class than electronic slideshows (2.00).

For the item "good way to reinforce assigned reading material, electronic slideshows (2.25) scored higher satisfaction than live software demos (2.57). No other paired differences were significant.

For the item "worked when it was supposed to, electronic slideshows (2.06) scored higher satisfaction than live Internet connections (2.55) and student in-class computer activities (2.39). For the item "technology worth the trouble, the only significant paired comparison revealed live Internet (2.58) was viewed with less satisfaction than electronic slideshows (2.20).

For the item "helped me keep up with lecture, electronic slideshows (2.24) scored higher satisfaction than live Internet (2.58). For the item "helped me organize my lecture notes, electronic slideshows (2.42) scored higher satisfaction than live Internet (2.80) and student in-class computer activities (2.83). For the item "helped me understand the lecture material, electronic slideshows (2.33) scored higher satisfaction than live Internet (2.69).

For "distracting technology, "allowed me to focus better on what the professor was saying, and "modern, up-to-date lecture method, ANOVA indicated not all items were equal, but post hoc comparisons did not reveal which.

Does Satisfaction Vary by Course Discipline?

The following section describes a one-way ANOVA to test the equality of mean satisfaction scores across the five course disciplines. The fundamental hypothesis is

H_o = Mean satisfaction score for an item is the same across all course disciplines.

H_a = At least one mean satisfaction score differs from the others.

This hypothesis applied for all 18 satisfaction items. H_o was rejected for the following items: 1, 2, 3, 5, 9, 10, 13, 15, 16, and 17. On these items follow-up tests were

TABLE 2
TECHNOLOGY USAGE RATE AND ITS IMPACT ON SATISFACTION

Item	Electronic Slideshows	Live Software Demonstrations	Live Internet Connections	Student In-Class Computer Activities
1. Made it easy to see material presented	X		X	X
2. Technology appropriate for class	X		X	X
3. Helped me learn material presented	X		X	X
4. Good way to reinforce assigned readings	X			X
5. Worked when supposed to			X	
6. Helped me pay attention in class			X	X
7. Distracting technology	X			
8. Helped make course more interesting				X
9. Allowed me to focus on what professor said				X
10. Technology more trouble than it was worth	X			
11. Made me more confident about what I was learning				X
12. Helped me better understand course concepts				X
13. Tended to oversimplify lectures				X
14. Helped me keep up with lecture				X
15. Technology visually appealing	X			X
16. Helped me organize lecture notes				X
17. Helped me understand lecture material	X			X
18. Modern, up-to-date method	X			X

conducted to see which course disciplines scored better or worse than others on each specific item.

Paired comparisons for item 1, "made it easy to see material presented, revealed that the AIS mean (2.34) was different from the mean for principles of economics (1.66) and the mean for information systems (1.83). Therefore, AIS students were much less satisfied than economics or IS students on this item. While the result was statistically significant, the researchers urge that the finding be treated with caution as AIS was the smallest of the responding groups.

For item 2, "appropriate technology for the course, marketing students (2.68) were less satisfied than economics students (2.01) and information systems students (1.93). Information systems students were more satisfied than AIS students (2.49).

For item 3, "helped me learn the material presented, AIS students (2.68) were less satisfied than information systems students (2.24).

For "worked when it was supposed to, economics students (1.85) were more satisfied than all other disciplines (all 2.23 or greater).

For "tended to oversimplify lectures, the marketing respondents were less satisfied than students in economics or information systems. For "helped me organize lecture notes, marketing students (2.23) differed from information systems (2.70) and AIS students (2.87). In this instance, marketing students were more satisfied than the other two groups.

For "allowed me to focus better on what the professor was saying, "worth the trouble, "visually appealing, and "helped me understand the lecture material, while ANOVA indicated not all means were equal, the post hoc comparisons did not reveal a distinguishable pair of means.

Factor Analysis

The researchers used the rotated component matrix within SPSS's data reduction tools. Using the same *a priori* listing as in Kleen, Shell, and Cox (1999), the researchers assigned the items to the following dimensions: Reliability, items 2, 5, and 10; Responsiveness, items 8, 9, 13, and 14; Empathy, items 12, 16, and 17; Tangibles, items 1, 7, 15, and 18; and Assurance, items 3, 4, 6, and 11.

Within the technology electronic slideshows, data reduction revealed three factors. These factors loaded as follows: Factor I included items 3, 4, 6, 8, 9, 11, 12, 14, 15, 16, 17, and 18. Factor II contained items 1, 2, 3, 4, 5, 9, and 18. Factor III contained items 2, 7, 10, and 13. Some items loaded onto more than one factor.

The technology live software demonstrations also revealed three factors, which loaded as follows: Factor I contained items 3, 4, 6, 8, 9, 11, 12, 14, 15, 16, and 17. Factor II contained items 1, 5, 15, and 18. Factor III contained items 2, 7, 10, and 13.

Within the technology live Internet connection, four factors were identified, loading as follows: Factor I contained items 3, 4, 5, 8, 9, 11, 12, 16, and 17. Factor II contained items 1, 2, 6, 11, 15, and 18. Factor III contained items 7, 10, and 13. And Factor IV contained item 14 only.

For student in-class computer activities, four factors emerged. These loaded as follows: Factor I contained items 1, 2, 3, 4, 8, 12, and 14. Factor II contained items 5, 6, 9, 11, 14, 15, 16, 17, and 18. Factor III contained items 5, 10, and 13. Factor IV contained items 2 and 7.

For electronic slideshows all items of the Assurance dimension were in Factor I. Three of the Responsiveness items were also in Factor I. All three Empathy items were in Factor I. Two of the four Tangibles items were in Factor I. Reliability was divided between Factors II and III.

For live software demonstrations, all the Assurance dimension items loaded in Factor I; likewise, all the Empathy dimension items loaded in Factor 1. Three of the four Responsiveness dimension items also loaded in this factor. Factor II contained two of four Tangibles items. Reliability was again split between Factors II and III.

For live Internet connections, three of four items in the Assurance dimension loaded in Factor I. Once again, all the Empathy dimension items loaded in this same factor. Two of the four Responsiveness items also loaded in this factor. Three of four items in Tangibles loaded in Factor II. Reliability's three elements were divided among three factors. The third factor was not associated with any dimension.

For student in-class computer activities, Factor I contained two of four Assurance items and two of the four Responsiveness items. Two of three Empathy items loaded in Factor II; two of four Tangibles items also loaded in that factor. Two of the three Reliability items loaded in Factor III.

In no case did the data reduction identify five factors, as suggested by SERVQUAL theory. The Empathy and Assurance dimensions often combined into the same factor. These two dimensions were also well identified in Kleen, Shell, and Zachry (2001). Otherwise, the data reduction results were inconclusive.

CONCLUSIONS AND RECOMMENDATIONS

The researchers attempted to identify factors affecting student satisfaction with classroom instructional technologies. The study was a replication of 1999 research, with the same instrument, but slightly different instructions, and with different sampling methods. A total of 280 responses, from 11 classrooms, revealed several interesting results.

- Satisfaction varies by course discipline.
- Satisfaction varies by instructional technology used in the classroom.
- There is no significant interaction of discipline and technology.
- Gender affects satisfaction. Females were less satisfied than males.
- Technology usage rates affect satisfaction generally; more usage equals higher satisfaction.
- Anticipated grade affects satisfaction modestly; lower grade equals lower satisfaction.
- Factor analysis did not reveal the five theoretical dimensions of SERVQUAL The researchers found at most four factors; in these the Empathy and Assurance dimensions were generally commingled. The Tangibles dimension could not generally be identified.

The 20 main service satisfaction items were unchanged from 1999 to 2001. The current study used improved instructions for the classroom administration. This aspect was successful. The researchers used a less time consuming, but less personal approach to soliciting participants, and the smaller number of responses suggests the sampling methodology was not as successful.

The researchers used improved statistical techniques with the 2001 data, so the exact time series comparisons were not made. In the 1999 results, male respondents were less satisfied than female respondents; in 2001 this finding is reversed. In 1999, economics students tended to be least satisfied; in 2001, that result fell to AIS. Otherwise, the basic nature of the two sets of results is consistent.

To remove the impact of a relatively small number of classes influencing findings, the study should be repeated with large numbers of students in each course discipline and technology group.

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