WEB-BASED AND FACE-TO-FACE STUDENT SATISFACTIONS WITH COURSE WEBSITE

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ABSTRACT

While a vast body of literature has been devoted to comparison of the online and traditional face-to-face courses, little research of student satisfaction with respect to course Websites differentiated between the online and face-to-face students. Our effort was aimed at identifying important predictors of the satisfaction of online students and face-to-face students. This study conducted Fisher's z transformation and test to compare correlation coefficients of each of Website features and the student satisfaction between two groups of student. Williams' T-test was performed to compare correlation coefficients, with the student satisfaction, of different Website features within one group, online or face-to-face students. The results showed that online students and face-to-face students had different focuses on Website features.

INTRODUCTION

A vast body of research was devoted to Web-based online classes. McGorry [19] identified six factors that affected student satisfaction with Web-based classes: flexibility, responsiveness and student support, student learning, interaction, technology, and technical support. Technical problems were found having negative impact on students' course performance [1] [4] [24]. Instructors' performance, such as timely feedback and interaction with students, was found more important than technology and significantly related to student satisfaction with course Websites [11] [18] [22] [28]. Thurmond et al. [28] conducted a hierarchical regression analysis and found that student satisfaction was related to quality of online classroom activities, rather than student characteristics such as computer skills, knowledge of electronic communications, and number of Web courses taken. There is also an increasing use of course Websites in traditional face-to-face classes. Ballard et al. [3] found that the majority of students "chose course information rather than online communication as the most helpful feature of course Websites." Students found that course Websites enhance the understanding of course content [5].

The existing studies compared student satisfaction with courses in face-to-face and Web-based settings, rather than student satisfaction with course Websites. Some researchers found no significant difference between the online and the face-to-face students in terms of students' course performance, quality of course work, and satisfaction with effectiveness of course delivery [1] [4] [24] [27] [29] [30] [32]. However, some studies found that the face-to-face classes had significantly higher mean scores for courses content, delivery [21], interaction, and support [15]. Summers et al. [26] found that the online students were significantly less satisfied with the course in terms of class discussion, quality of questions and problems, and evaluation and grading, while no significant difference existed in grades of the online and the face-to-face students. There were no consistent conclusions found in studies.

This study conducted Fisher's z transformation and test [25] to compare between two groups of student the correlation coefficients of each of Website features and the student satisfaction with course Websites. Williams' T-test [31] was performed to compare correlation coefficients, with the student satisfaction, of different Website features within online or face-to-face students. The results, from comparisons between two samples and comparisons within the same sample, showed that online students and face-to-face students had different focuses on Website features.

DATA AND METHODOLOGY

Data were supplied by a sample of 102 traditional face-to-face students and a sample of 231 Web-based distance learning students from public and private higher education institutes in North America. The samples contained business students working on degree programs in various fields. The survey form (Appendix) included nine questions and employed a five-point Likert scale ranging from Strongly Disagree (1 point) to Strongly Agree (5 points). The last question in the survey form assessed the dependent variable "student satisfaction with the course Website". To reveal relationship between Website features and student satisfaction with course Websites, the Pearson correlation coefficients were computed. The differences were further investigated by using Williams' T-test [25] and Fisher's z-transformation and test [7]. Steiger [25] examined methods of comparing correlation coefficients from the same sample (Pearson and Filton's Z-test, Hotelling's T-test, Williams' T-test, and Dunn and Clark's Z*-test). It was found that Williams' T-test was perhaps the best all-around choice when the null hypothesis of interest was $\rho_{jk} = \rho_{jh}$. The formulas from Williams' T-test [31] are shown as follows:

$$T = (r_{jk} - r_{jh})\sqrt{\frac{(n-1)(1+r_{kh})}{2(\frac{n-1}{n-3})|R| + \bar{r}^2(1-r_{kh})^3}} \quad (1)$$

where $|R| = (1 - r_{jk}^2 - r_{jh}^2 - r_{kh}^2) + (2r_{jk}r_{jh}r_{kh})$ and $\bar{r} = \frac{1}{2}(r_{jk} + r_{jh})$. T has a t distribution with df = n-3.

Fisher's z-test has gained popularity for providing a methodology of comparing two correlation coefficients. Successful applications have been seen in many research areas such as business, education, psychology, biology, and medical science. The z-test for comparison of correlation coefficients form two independent samples has formulas as follows [7]:

$$Z = \frac{z_1 - z_2}{\sqrt{\frac{1}{n_1 - 3} + \frac{1}{n_2 - 3}}} \quad (2)$$

where

$$z_1 = .5\log_e(\frac{1+r_1}{1-r_1}) \quad (3)$$

$$z_2 = .5\log_e(\frac{1+r_2}{1-r_2}) \quad (4)$$

In order to control the experimentwise Type I error rate in the multiple-comparison tests, a variable reduction technique was utilized. The principal component analysis with orthogonal rotation reduced eight independent variables into a smaller number of principal components (the underlying dimensions) while those components still accounted for most of the variance in those eight observed variables. The multiple-comparison tests were applied to a smaller number of components. The orthogonal rotation resulted in uncorrelated principal components and made easier interpretation of those factors. The number of components in this study was determined by a combination of four approaches – the eigenvalue-one criterion [16], the scree test [6], the proportion of variance accounted for [17], and the interpretability criterion [6].

RESULTS

In Stage 1, the principal component analysis was performed on the first eight survey items. The number of components initially extracted by the principal component analysis was equal to the number of the variables (8) being analyzed. A combination of four approaches (the eigenvalue-one criterion, the scree test, the proportion of variance accounted for, and the interpretability criterion) was used in determining the number of components that should be retained. The first three components have eigenvalues greater than one, and three components may be retained according to the eigenvalue-one criterion [16]. Cattell [6] suggested finding the place in the "scree test" where the curve made an "elbow". In Figure 1, the smooth decrease of eigenvalues appears to level off to the right of the fourth variable and, therefore, four components may be retained by the scree test. The approach of "proportion of variance accounted for" retains a component if it accounts for a specified percentage of total variance in the variables being analyzed. The critical values usually used in practice were 10% for individual components and 70%-80% for the combined components [13]. The first four components account for approximately 81% of the total variance while three components each account for more than 10% with the fourth one slightly below 10% (9.4%). It again suggests that four components may be retained. The most important criterion is perhaps the interpretability criterion. The result of orthogonal rotation in the following paragraph suggests that four components can be retained. Combining all four approaches, this study identified four components.

The orthogonal rotation results in uncorrelated principal components that are easier to interpret. Table 1 shows the loadings on components and communalities of observed variables from the orthogonal rotation. For description of variables 1 through 8 in Table 1, readers are referred to Appendix. The loadings are equivalent to bivariate correlation between the observed variables and the components, and communality refers to the amount of variance in an observed variable that is accounted for by the retained components [13]. Nunnally [20] recommended: "A common rule of thumb for assessing construct validity is that individual items should have a factor loading of at least 0.6 on their hypothesized construct (for convergent validity) and less than 0.3 loading on all other constructs (for discriminant validity)." According to Nunnally, items 1 and 2 loaded on component 4. In the survey form (Appendix), questions 1 and 2 appeared to deal with "useful course information", and therefore component 4 was labeled the "Course Information" component. Items 3 and 4 loaded on component 2. Questions 3 and 4 appeared to deal with "System Responsiveness", and component 2 was labeled the "Response" component. Questions 5 and 6 loaded on component 3. Questions 5 and 6 appeared to deal with "timely and quality learner-instructor interaction", and component 3 was labeled the "Interaction" component. Questions 7 and 8 loaded on component 1. Questions 7 and 8 appeared to deal with "easiness of learning and using course Web-sites", and component 1 was labeled the "Ease" component. Thus, the clear-cut four-component structure shown in Table 1 was easily interpretable. In addition, communality refers to the amount of variance in an item that is accounted for by the retained components. The four components accounted for 81% (6.5/8) of the total variance in the eight variables being originally analyzed.

In Stage 2, the reliability of constructs was assessed by calculating Cronbach's α. The reliability reflected how well the observed scores collected by the survey instrument were related to the true scores of constructs [14]. Cronbach's α reliability estimates were 0.74, 0.77, 0.75, and 0.79 for the Course Information, Response, Interaction, and Ease of Use scales, respectively. Reliability estimates all exceeded the minimum value of 0.70 recommended by Nunnally [20].

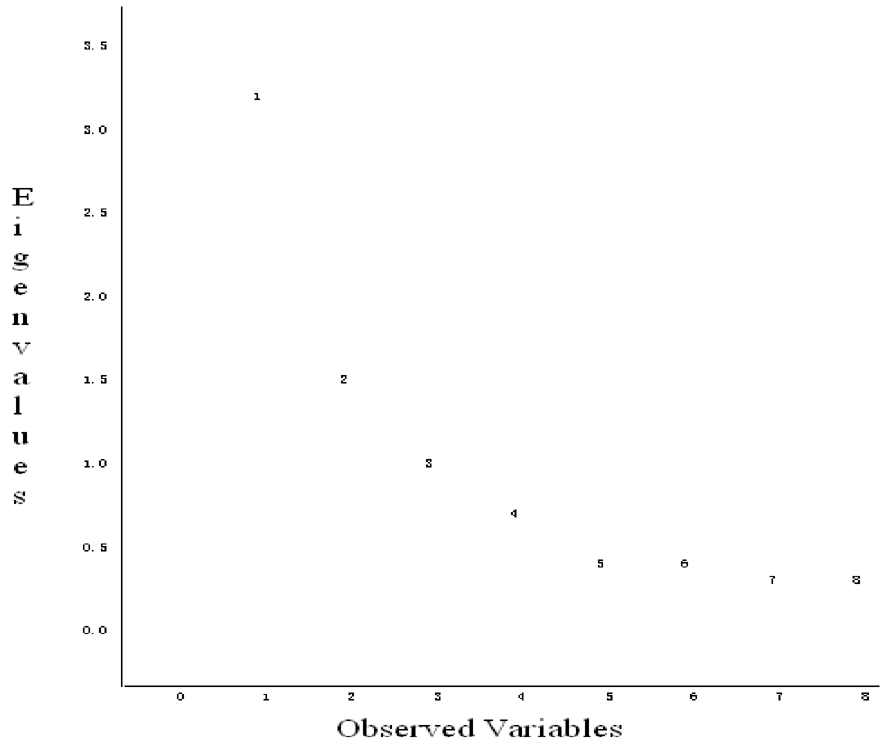

Figure 1 Scree Plot of Eigenvalues

Variable	1	2	3	4	5	6	7	8	Variance Explained by Each Component
Component 1	.20	.25	.13	.02	.14	.15	**.86**	**.87**	1.66
Component 2	.06	.08	**.90**	**.89**	.11	.00	.06	.10	1.64
Component 3	.18	.24	.01	.10	**.87**	**.85**	.13	.16	1.62
Component 4	**.86**	**.80**	-.02	.15	.16	.24	.25	.18	1.58
Communality	.81	.77	.83	.82	.81	.80	.82	.83	6.50

Table 1 Loadings and Final Communality Estimates from Orthogonal Rotation

In Stage 3, the scores of four components were calculated by averaging scores of survey items for each component, and the bivariate correlation coefficients between each of the components and the student satisfaction were then computed and used to assess the marginal importance of each component in terms of improving the student satisfaction with course Websites. The sample means of component scores were shown in Table 2. The correlation coefficients and their p-values (H_0: ρ=0) were shown in Table 3 for face-to-face students and Web-based online students, respectively. All components were significantly correlated with the student satisfaction for both student groups except for statistical insignificance of component "Response" for online students (p=.6877). Next, Fisher's z-test was performed to compare correlation coefficients from two student groups, and the p-values of tests are shown in the bottom of Table 3. Components "system responsiveness" and "ease of use" had a significantly higher correlation with the student satisfaction for face-to-face students than that for online students. Lastly, Williams' T-test was used to compare correlation coefficients from the same sample. Tables 4 and 5 show T values and p-values of Williams' T-test for the face-to-face students and online students, respectively. For face-to-face students, component "ease of use" had a significantly higher correlation with the student satisfaction than any other components, and component "timely and quality learner-instructor interaction" had a significantly higher correlation with the student satisfaction than component "system responsiveness". For online students, components of "course information" and "timely and quality learner-instructor interaction" had a significantly higher correlation with the student satisfaction than components of "ease of use" and "system responsiveness" while component "ease of use" had a significantly higher correlation with the student satisfaction than component "system responsiveness".

	Course Info	Response	Interaction	Ease
F2F	3.52	3.52	3.37	3.65
Web-Based	3.73	3.27	3.66	4.16

Table 2 Sample Means of Component Scores

	Course Info	Response	Interaction	Ease
F2F	.550 p<.0001*	.442 p<.0001*	.647 p<.0001*	.755 p<.0001*
Web-Based	.609 p<.0001*	.027 p=.6877	.514 p<.0001*	.323 p<.0001*
p-value	0.4576	0.0002*	0.0941	<0.0001*

Table 3 F2F vs. Web-Based: Comparison of Correlation Coefficients

	Course Info	Response	Interaction	Ease
Response	1.318 .191	-		
Interaction	-1.435 .154	-2.985 .004*	-	
Ease	-3.505 .001*	-4.538 <.001*	-2.103 .038*	-

Table 4 Williams' T-test for F2F Students: T value and p value (H0: T = 0, Ha: T ≠ 0)

	Course Info	Response	Interaction	Ease
Response	7.542 <.001*	-		
Interaction	1.714 .088	-5.856 <.001*	-	
Ease	4.977 <.001*	-3.442 .001*	2.569 .011*	-

Table 5 Williams' T-test for Web-Based Students: T value and p value (H0: T = 0, Ha: T ≠ 0)

DISCUSSION AND SUMMARY

The results of Fisher's z-test showed that components "system responsiveness" and "ease of use" had a significantly higher correlation with the student satisfaction for the face-to-face students than that for Web-based online students. The results of William's T-test showed that component "ease of use" was the most important course Web-site feature for the face-to-face students but it was less important for the online students. For both the face-to-face and online students, components "course information" and "timely and quality learner-instructor interaction" were found important while component "system responsiveness" the least important.

The findings can be explained by an extended version [12] of the technology acceptance model (TAM). TAM tried to reveal causal relationships between factors (perceived usefulness and perceived ease of use) and the information system usage [9] [10]. When TAM was applied to Web-based online learning, acceptance of Web-based online learning system was found multidimensional and TAM should be extended to incorporate a wide variety of variables [8] [23]. Gefen et al. [12] have revealed that the perceived ease of use directly influenced IT acceptance only if the task was intrinsic to the IT. Tasks that were intrinsic to the IT were defined as tasks where the IT itself provided the end product or service while tasks that were extrinsic to the IT were defined as tasks in which the IT was only the means [12]. This theory explained the finding in this study that component "ease of use" was a more important factor to student satisfaction for the face-to-face students than for the Web-based online students. For the face-to-face students, tasks of using course Websites were intrinsic to course Websites because the course Websites provided the end services such as downloading course related information, interacting with instructors, and so forth. For the Web-based online students, tasks of using course Websites were extrinsic to course Websites because the service for which the course Websites were ultimately being used by students was taking a course. For the Web-based online students, many tasks of using course Websites, such as downloading course related information, interacting with instructors and etc., were only the means of taking a course.

The findings can also be explained by the theory of learning curves. "Learning-by-doing" is a central concept of the learning curve theory. According to the theory of learning curves, individuals or teams improved performance as a task was repeated [2]. The frequency and length of time of using course Websites by the Web-based online students were considerably higher than by the face-to-face students. Furthermore, the course Websites for the Web-based online students had more consistent user interfaces because those course Websites were usually created by using commercial systems and maintained by dedicated system administrators while course Websites for the face-to-face students were mostly created and maintained by individual instructors. Thus, it was reasonable to assume that the surveyed online students had reached the later stage of the learning curve and completed learning how to use the course Websites. Thus, component "ease of use" was a less important factor for the Web-based online students than for the face-to-face students.

Under the constraints of limited budget and time, educational administrators, instructors, and system developers need to know which Website features are more important with respect to student satisfaction. The findings of this study have extended knowledge beyond the simple statistics, as that has been done in previous studies, of responses to the items in the questionnaire. Multiple comparisons of correlation coefficients showed significant difference of the same correlation coefficient from two student groups and different patterns of significance for two student groups. Therefore, for course Websites used by different student groups, educational administrators, instructors, and system developers might apply constrained resources on improvement of the more important Website features to efficiently increase student satisfaction.

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Appendix: Survey Form

To better serve you, we would like to know your opinion of the quality of my course Website. Please indicate the extent to which you agree or disagree with the following statements. Circle the appropriate number using the scale below.

1 – I strongly disagree with this statement (SD).
2 – I disagree with this statement (D).
3 – I neither agree nor disagree with this statement (N).
4 – I agree with this statement (A).
5 – I strongly agree with this statement (SA).

	SD	D	N	A	SA
1. The information on the course Website contained what I needed to improve my course performance.	1	2	3	4	5
2. The information contained on the course Website was sufficiently detailed to help me understand the course subjects.	1	2	3	4	5
3. I waited a short period of time to get help when I had a problem to use the course Website.	1	2	3	4	5
4. I waited a short period of time before a requested Web page showed up.	1	2	3	4	5
5. The instructor was quick to respond when I sent him/her message through the course Website.	1	2	3	4	5
6. The quality of assistance the instructor gave me in the “Chat room” was high.	1	2	3	4	5
7. I was able to learn how to use the course Website in a short amount of time.	1	2	3	4	5
8. The course Website was easy to use.	1	2	3	4	5
9. I am very satisfied with the course Website.	1	2	3	4	5