ASSESSMENT OF E-LEARNING SATISFACTION FROM CRITICAL INCIDENTS PERSPECTIVE

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Abstract: Understanding learner satisfaction and its factors is very important for E-learning quality development. In this study, we describe an E-learning satisfaction assessment model based on the negative critical incidents perspective and examine if critical incidents affect E-learning satisfaction. The model is tested using an empirical study of 230 online learners at NSYSU Cyber-University. The results show that the model is valid and it can provide 71% of explanatory power for overall cumulative satisfaction for E-learning in our empirical case. The critical incidents that affect E-learning satisfaction can be classified into four categories: administration, functionality, instruction and interaction. Among them, interaction and functionality are found to be the most important factors.

1 INTRODUCTION

E-learning is an essential trend in education for the 21st century. Many institutions of higher education and corporate training are resorting to E-learning as a means of solving learning and performance problems (Govindasamy, 2002).

An important step that is typically required prior to implementing E-learning is the selection of a suitable learning management system (LMS) (Govindasamy, 2002). Like any other information system, the success of learning management systems largely depends on user satisfaction (Bharati, 2003; DeLone and McLean, 1992; Doll and Torkzadeh, 1992; Seddon, 1997) and other such factors. Stokes (2001) indicated that the issue of learner satisfaction in the digital environment is very important. A high level of learner satisfaction reflects that the students are more willing to continue in online programs evidenced by lower attrition rates, more referrals from enrolled students, greater motivation, better learning achievement and increased commitment to the program (Tallman, 1994; Biner et al., 1994; Chute et al., 1999).

The critical incident technique (CIT) is frequently used to obtain information for improving a service (Friman and Garling, 2001). CIT has been used in our study to collect data about the user satisfaction. It was originally developed by Flanagan (1954), and has been used in a variety of disciplines, including marketing (Grove and Raymond, 1997; Iacobucci, et al., 1995; Keaveney, 1995; Meuter et al., 2000) public transport services (Bejou and Edwardson, 1996; Friman and Garling, 2001) and education (Barth, 1975; Carter et al., 1968; Copas, 1984). A critical incident is an encounter of a customer that is particularly satisfying or dissatisfying of service/product (Bitner et al., 1990). Friman , Edvardsson and Garling (2001) found that a critical incident is one that can be described in detail and that deviates considerably, either positively or negatively, from what is normal or expected.

Negative critical incidents refer to customer encounters that do not proceed normally, but create friction, irritation, and dissatisfaction (Edvardsson, 1992). Customers may reconsider their attitudes and expectations based on negative critical incidents caused by the faults encountered during service delivery. To improve quality, and build trust and strong customer relationships, it is important to attend to faulty details that would result in negative critical incidents in service production (Edvardsson, 1990).

Frequency of information stored in human memory also influences judgments (Hastie, and Park, 1986). However, customers are unlikely to remember specific critical incidents for a long time. Yet, they are found to accurately judge the

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frequency of the critical incidents (Greene, 1984) because such events stand out (Fisk and Schneider, 1984; Woodley and Ellis, 1989). From the viewpoint of events, Greene (1984) and Jonides and Naveh-Benjamin (1987) indicated that the frequency of events is remembered. Hence, overall satisfaction may be influenced by the strength of the positive and/or negative emotions aroused by a critical incident (Mano and Oliver, 1993). Thus, although overall satisfaction probably is directly affected by experiences of critical incidents, it appears more plausible to assume that cumulative satisfaction is related to the memory for the frequency of critical incidents (Friman et al., 2001).

With the increasing popularity of E-learning, it is imperative that managers and researchers will identify factors that affect learner satisfaction. This has direct managerial implications in supporting well-designed E-learning programs and promotion of running successful E-learning courses. From the above discussion, it can be noted that negative critical incidents are more important than positive critical incidents in management implications. If an E-learning manager can solve negative critical problems, learner satisfaction would significantly increase. Past studies have heavily concentrated on positive critical incidents to obtain information, yet few of them focused on negative critical incidents or explored the relationship between negative and positive critical incidents. How the interplay between both incidents affects overall satisfaction is still missing in the discussions. The objective of this study is twofold: (1) to discuss a theoretical framework for evaluating E-learning satisfaction from the negative and positive critical incident perspective and provide empirical evidence of the theoretical model; (2) to explore the relationship between negative and positive critical incidents through satisfaction model assessment.

2 HYPOTHESES

Friman's model has been found useful in assessing user satisfaction in the public transport services (Friman et al., 2001). We have modified Friman's model to create SAFE (Satisfaction Assessment from Frequency of negative critical incidents perspective for E-learning) model in this study (Figure 1). The model consists of three sets of latent variables: (1) Frequency of negative critical incidents for E-learning (FNCI) -- negative critical incidents perspective, (2) Attribute-specific cumulative satisfaction for E-learning (ASCS) -- positive critical incidents perspective, and (3) Overall cumulative satisfaction for E-learning (OCS).

The relationships among the negative critical incident frequency, attribute-specific cumulative satisfaction, and overall cumulative E-learning satisfaction (see Figure 1) can be summarized in terms of the following hypotheses:

H1: The frequency of negative critical incidents for E-learning directly and negatively influences the attribute-specific cumulative satisfaction for E-learning.

H2: Attribute-specific cumulative satisfaction for E-learning directly and positively influences the overall cumulative satisfaction for E-learning.

H3: The frequency of negative critical incidents for E-learning indirectly and negatively influences the overall cumulative satisfaction for E-learning.

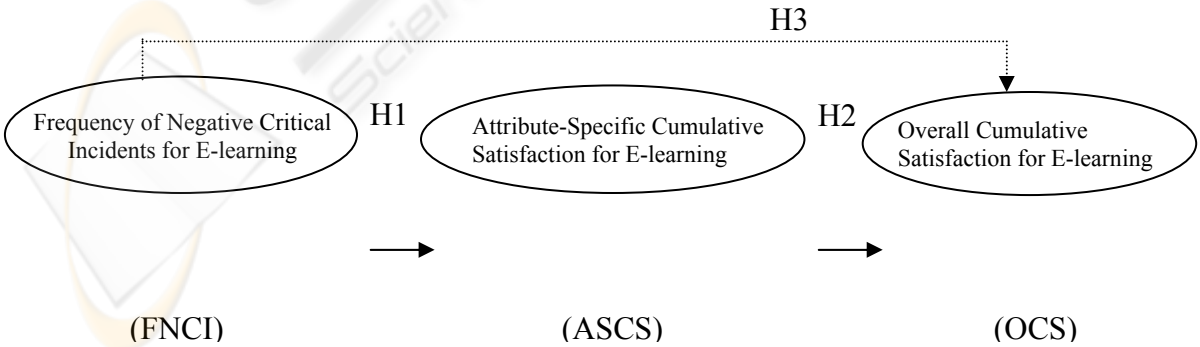


Figure 1: The SAFE (Satisfaction Assessment from requency of negative critical incidents perspective for E-learning) model

3 METHOD

The subjects for this research were 230 students taking master's online credit course programs at NSYSU Cyber-University (http://cu.nsysu.edu.tw). These students were enrolled in the sixth term online credit courses program provided by the Department of Information Management, National Sun Yat-sen University in 2002. To increase the response rate, all enrolled students were given the anonymous questionnaire while they were physically sitting for the mid-term examination. The anonymous questionnaire used in this study was adopted from the previous studies (Friman et al., 2001; Lin and Chen, 2001; 2002) with suitable revisions for E-learning. Two domain experts reviewed and revised the questionnaire draft for clarity, content, and adequateness of the questions.

To verify the content validity, a pilot study was conducted by administering the questionnaire to 50 students enrolled in the online classes. Students in this pilot study were explicitly made aware of the anonymous nature of the questionnaire in order to avoid any effects on the validity of the responses.

The questionnaire consisted of three parts A, B and C. In part A respondents were asked to rank their overall cumulative satisfaction (OCS) and attribute-specific cumulative satisfaction (ASCS) about E-learning. Based on Lin and Chen (2001; 2002), the questions were divided into four categories: administration, functionality, instruction, and interaction. For each question, a seven-point scale ranging from "strongly unsatisfied" to "strongly satisfied" was given. Part B consisted of a description of the frequency of negative critical incidents. The FNCIs were exemplars of the four types which the previous research (Lin and Chen, 2001; 2002) had indicated as major problems encountered by the learners in E-learning: administration (e.g., inappropriate treatment of learners by employees of administration); functionality (e.g., inadequate design of LMS functions); instruction (e.g., improper instructional design); and interaction (e.g., hard to reach group consensus). For each question, respondents checked a five-point scale ranging from "never" to "always". In Part C respondents answered demographic questions.

4 RESULTS

The main purpose of this study was to propose and validate an E-learning satisfaction assessment model from frequency of negative critical incidents perspective. As described earlier, we looked for the relationships among the negative critical incident frequency, attribute-specific cumulative satisfaction and overall cumulative E-learning satisfaction. Following sub-sections discuss the findings of the study.

4.1 Learner satisfaction

Table 1 presents the means for the main problem categories. The overall cumulative satisfaction mean was 5.68. Learner satisfaction was between "satisfied" and "very satisfied" about E-learning. In the attribute-specific cumulative satisfaction (ASCS) comparison of the means shows that functionality has a lower value than others (administration, instruction, and interaction). The functionality satisfaction mean was 4.82. This implies that learner satisfaction fell between "no comments" and "satisfied". In the frequency of negative critical incidents (FNCI), a comparison of the means shows that functionality has a higher value than others. The functionality mean was 3.6. The frequency of negative critical incidents was between "sometimes" and "often".

4.2 Measurement model

LISREL was used for statistical analysis. LISREL consists of two distinct parts: the measurement model (or confirmatory factor model) and the structural equation model. In the measurement model, the standardized parameter estimates, t-statistics, construct reliability coefficients, and the average variance extraction measure of the research model presented in Table 2. The results indicate that the composite reliability coefficients were all above the 0.6 thresholds (Fornell and Larcker, 1981) with an acceptable level of reliability. Another index of reliability is the variance extraction measure. This measure reflects the overall variance in the indicators accounted for by the latent construct. Fornell and Larcker (1981) suggested that construct exhibit estimates of 0.5 or larger is desirable. However, Jiang et al. (2002) pointed out that this index is quite conservative. Normally, variance extracted estimates will be below 0.5 even when reliabilities are acceptable. Thus, the two constructs: FNCI-administration and FNCI-functionality, both with estimates below 0.5 in this study, are included for further analysis.

Table 1: Means for the main problem categories

Code: Latent	Mean	Scale
		Frequency
FNCI 1: Administration	2.99	1:Never
FNCI 2: Functionality	3.60	2:Seldom
FNCI 3: Instruction	2.92	3:Somtime
FNCI 4: Interaction	3.06	4:Often 5:Always
		Satisfaction
ASCS 1: Administration	5.08	1:Strongly unsatisfied
ASCS 2: Functionality	4.82	2:Very unsatisfied
ASCS 3: Instruction	5.32	3:Unsatisfied
ASCS 4: Interaction	5.26	4:No comment
OCS: Overall satisfaction	5.68	5:Satisfied 6:Very satisfied 7:Strongly satisfied

Table 2: Standardized Parameter Estimates (SPE), t-value, Composite Reliability (CR), Average Variance Extraction (AVE), Means (M), Standard Deviations (SD) of the estimated model

Code: Latent Code : Variable	SPE	t-value	CR	AVE	M	SD
FNCI 1: Administration			0.65	0.49	2.99	0.98
X1: Overall program design doesn't meet learner's need	0.69	10.44			3.10	1.04
X2: Bad quality of administration service	0.70	10.64			2.88	1.11
FNCI 2: Functionality			0.60	0.44	3.60	1.06
X3: Bad response time of the LMS	0.71	9.48			3.57	1.11
X4: Bad stability of the LMS	0.60	7.96			3.63	1.19
FNCI 3: Instruction			0.95	0.65	2.92	0.91
X5: Course material doesn't meet learner's need	0.87	16.36			3.03	0.97
X6: Course material is boring	0.82	15.09			2.85	1.08
X7: Recorded lecture doesn't meet learner's need	0.81	14.94			2.89	1.11
X8: Recorded lecture is boring	0.80	14.42			2.81	1.04
X9: Bad design of learning activity	0.82	15.17			2.97	1.06
X10: Bad design of assessment	0.84	15.51			2.97	1.09
X11: Bad adaptation of teaching methods	0.75	13.35			2.93	1.17
FNCI 4: Interaction			0.79	0.56	3.06	1.03
X12: Hard to reach group consensus because of bad communication	0.70	11.43			3.05	1.29
X13: Online interaction is prone to misunderstanding	0.73	11.82			3.03	1.16
X14: Interaction for class discussion board is not good	0.81	13.85			3.10	1.14
ASCS 1: Administration			0.86	0.68	5.08	0.80
Y1: The overall enrollment plan(promotion, registration, tuition, enrollment)	0.84	10.97			5.01	0.90
Y2: The overall curriculum program planning and design	0.86	11.25			5.14	0.91
Y3: The quality of administration services	0.78	12.24			5.08	0.88
ASCS 2: Functionality			0.87	0.7	4.82	1.01
Y4: The functional completeness of the LMS	0.82	11.45			5.02	1.02
Y5: The functional effectiveness of the LMS	0.94	11.76			4.87	1.16
Y6: The functional stability of the LMS	0.73	10.65			4.58	1.24
ASCS 3: Instruction			0.94	0.72	5.32	0.87
Y7: The course planning and design	0.83	14.73			5.25	0.96
Y8: The course scheduling	0.83	14.36			5.28	0.94
Y9: The course materials	0.91	16.77			5.34	1.02
Y10: The course recorded lecturing	0.89	16.03			5.47	1.04
Y11: The course learning activities design	0.86	15.26			5.36	0.99
Y12: The course assessment	0.79	13.79			5.20	1.01
ASCS 4: Interaction			0.90	0.69	5.26	0.93
Y13: The interaction among classmates	0.85	15.30			5.24	1.06
Y14: The interaction for class discussion board	0.94	16.60			5.33	0.97
Y15: The interaction for office-hour	0.73	12.29			5.23	1.12
Y16: The interaction for issue-based discussion board	0.78	12.95			5.53	1.04
OCS: Overall satisfaction			0.74	0.59	5.68	0.83
Y17: My overall impression about E-learning	0.88	7.50			5.53	0.92
Y18: My overall feeling about continually using the LMS for online learning	0.64	7.62			5.83	0.92

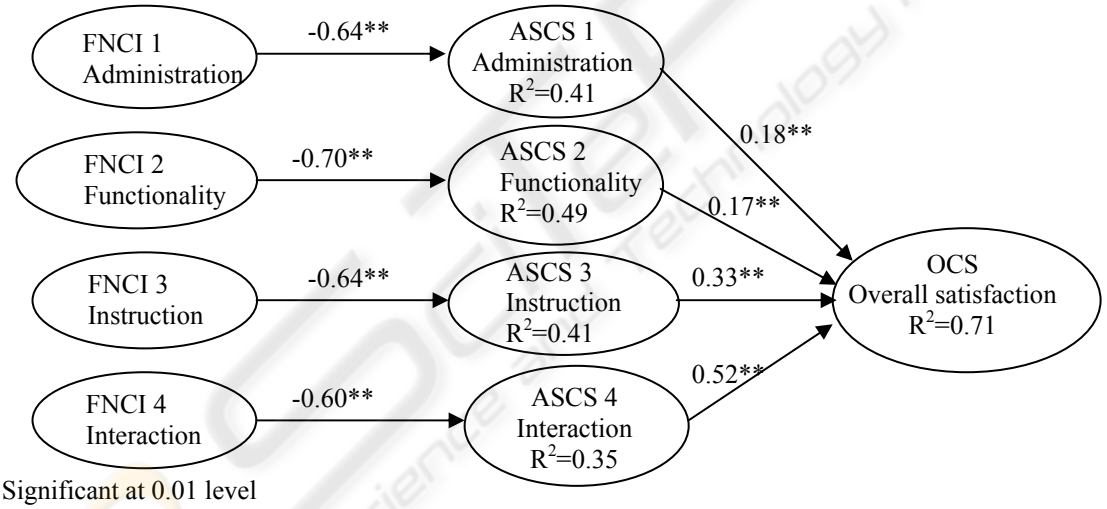
4.3 Overall Model Fitness

The chi-square test provides a statistical test for the null hypothesis that the model fits the data, but it is too sensitive to sample size differences, especially for the cases in which the sample size exceeds 200 respondents (Hair et al., 1998). Bagozzi and Yi (1988) suggested a chi-square per degrees of freedom instead. Based on the suggestions from Bagozzi and Yi (1988) and Joreskog and Sorbom (1992), we adopted the recommended fits including the goodness of fit index (GFI), adjusted goodness of fit index (AGFI), normed fit index (NFI), the non-normed fit index (NNFI) and the root-mean-square error of approximation (RMSEA) as indexes for evaluating the overall model fitness.

The fit-indices, NNFI=0.96, NFI=0.91, GFI=0.86, AGFI=0.81 and RMSEA=0.047, came from the LISREL analysis. All of these values show a good model fit that is well within the accepted thresholds, above 0.90, 0.90, 0.80, 0.80, and below 0.05 (Hair et al., 1998) respectively. Another fit-index is χ^2(DF=387,N=230) = 586.88, P<0.01. The ratio of χ^2 to the degree of freedom (1.52) is also well below the recommended maximum ratio of 3:1 (Chin and Todd, 1995). In summary, the all fit indices indicate that the model has a good fit.

4.4 Structural model

The structural model and hypotheses are tested by examining whether the significance of path coefficients (which are standardized betas). In addition to the individual path tests, the explained variance in the dependent constructs was assessed as an indication of the overall predictive power of the model (Compeau and Higgins, 1999). The path coefficients are shown in Figure 2. They are all significant at 0.01 levels.



** Significant at 0.01 level

Figure 2: Structural Model

Table 3: Direct, indirect and total effect

Dependent Latent Variables	Independent Latent Variables	Direct effect	Indirect effect	Total effect	t-value
ASCS Administration	FNCI Administration	-0.64		-0.64	-7.32**
ASCS Functionality	FNCI Functionality	-0.70		-0.70	-6.22**
ASCS Instruction	FNCI Instruction	-0.64		-0.64	-8.86**
ASCS Interaction	FNCI Interaction	-0.60		-0.60	-7.42**
OCS Overall satisfaction	ASCS Administration	0.18		0.18	2.87**
	ASCS Functionality	0.17		0.17	2.89**
	ASCS Instruction	0.33		0.33	4.61**
	ASCS Interaction	0.52		0.52	5.73**
	FNCI Administration		-0.11	-0.11	-2.73**
	FNCI Functionality		-0.12	-0.12	-2.81**
	FNCI Instruction		-0.21	-0.21	-4.29**
	FNCI Interaction		-0.31	-0.31	-4.97**

** Significant at 0.01 level

Figure 2 and Table 3 reveal that the results of this study support hypothesis (H2). That is, the overall cumulative satisfactions are directly affected by the attribute-specific cumulative satisfaction for E-learning. Moreover, the attribute-specific cumulative satisfaction for E-learning is directly and negatively affected by the frequency of negative critical incidents (H1). The frequency of negative critical incidents shows only indirect influence on overall satisfaction (H3). In summary, the data analysis for the model provides significant support for all three hypotheses. The results have confirmed that overall cumulative satisfaction (OCS) about E-learning is not directly affected by the remembered frequency of negative critical incidents (FNCIs). However, it is affected indirectly through cumulative satisfaction with quality or performance attributes. The SMC (Squared Multiple Correlation) values show that the model explained 41% of the variance for administration, 49% for functionality, 41% for instruction, 35% for interaction and 71% for overall satisfaction.

We can conclude from the proposed SAFE model that the frequency of negative critical incidents directly and negatively affects positive critical incidents satisfaction; positive critical incidents satisfaction further directly and positively affects overall satisfaction; and the frequency of negative critical incidents indirectly and negatively affects overall satisfaction in E-learning.

5 DISCUSSION AND IMPLICATION

This study described the SAFE model to assess E-learning satisfaction from frequency of negative critical incidents perspective. FNCIs include four categories: administration, functionality, instruction and interaction. From administration perspective, the result showed that "the overall program design does not meet learner's need" and "bad quality of administrative service" have significant influence on learner satisfaction. From the functionality perspective, the result were affected by the learning management system (LMS) and revealed that "bad response time of the LMS" and "bad stability of the LMS" has significant influence on learner satisfaction. From the instructional point of view, the result showed that "course material doesn't meet learner's need", "course material is boring", "recorded lecture doesn't meet learner's need", "recorded lecture is boring", " bad design of learning activity", "bad design of assessment" and "bad adaptation of teaching methods" have a significant influence on learner satisfaction. From the interaction point of view, the result revealed that "hard to reach group consensus because of bad communication", "online interaction is prone to misunderstanding" and "Interaction for class discussion board is not good" have significant influence on learner satisfaction.

For positive critical incidents part, overall cumulative satisfaction (OCS) about E-learning is affected by satisfaction with administration, functionality, instruction, and interaction. From administration perspective, the result showed that the overall enrollment plan (promotion, registration, tuition, and enrollment), the overall curriculum program planning and design and the administrative service quality are the significant factors affecting learner satisfaction. From functionality perspective, the functional completeness, effectiveness and stability of the LMS have great influence on learner satisfaction. LMS is the most crucial and fundamental support of E-learning, learners highly rely on LMS for support of all online learning activities. Hence, LMS stability and effectiveness are very important factors for improving learner satisfaction. From instruction perspective, the course planning, design, materials, lecturing, and learning activities design and assessment have significant influence on learner satisfaction.

From interaction point of view, a comparison of the standardized path coefficients shows that interaction has a stronger effect on overall satisfaction than the others. This implies that improving interaction is an important issue for E-learning. The research in Burnett (2001) and Parker (1999) also pointed out that learners expect and demand instruction with high levels of interaction between the learners and instructor. The demand for interactivity has placed a new focus on instructional design and the relevant technologies. The results in our study found that "the interaction among classmates" and "the interaction for class discussion board", "the interaction for office-hour" and "the interaction for the issue-based discussion board" have significant influence on learner satisfaction. It is important to effectively manage these different discussion boards to better facilitate interaction among learner-learner, learner-teacher and learner-content.

6 CONCLUSION

Learner satisfaction is a critical factor that influences the future development of E-learning. To understand learner satisfaction and how critical incidents affect students is a very important research issue for E-learning. However, there is little research that

discussed whether overall cumulative satisfaction in E-learning is related to the remembered frequency of negative critical incidents.

The major contribution of this study was to propose and validate the SAFE model – assessing E-learning satisfaction from negative critical incidents perspective. Meanwhile, the SAFE model offers 71% explanatory power for overall cumulative satisfaction in our empirical study, which is significantly higher than Al-gahtani and King (1999; 18%) and Baker and Crompton (2000; 60%).

This result shows that negative critical incidents directly affect positive critical incidents but only indirectly affect overall satisfaction through positive critical incidents. However, negative critical incidents are more important in from the perspective of management implications because manager can resolve the most frequency incidents straight away to improve satisfaction. Through negative and positive perspectives, we can confirm finding of the critical incidents that influence satisfaction in E-learning. Result of this study and its further development will contribute to the evaluation and improvement of E-learning environment.

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