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A STRUCTURAL EQUATION MODEL OF PREDICTORS FOR EFFECTIVE ONLINE LEARNING

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In studying online learning, researchers should examine three critical interactions: instructor-student, student-student, and student-content. Student-content interaction may include a wide variety of pedagogical tools (e.g., streaming media, PowerPoint, and hyperlinking). Other factors that can affect the perceived quality of online learning include distance education advantages (e.g., work and family flexibility) and antecedent personal characteristics (e.g., experience and gender). The study indicated that instructor-student interaction is most important, twice that of student-student interaction; that some student-content interaction is significantly related to perceived learning; that antecedent variables are not significant; and that distance education advantages/flexibility, although significant, are less important than other interactions.

Keywords: *online learning; structural equation modeling; MBA education*

Web-based courses have become popular, with thousands of courses now offered by educational institutions ("Educators Divided Over Rush," 1999). The major driving force for this popularity is the development of new markets of nontraditional students, especially working adults (Confessore, 1999), who are geographically distant from the source but seek time and location flexibility for their education. The expectation, however, for the future is that the students taking Web-based courses will resemble more closely current traditional students (Guernsey, 1998). Yet, the rush to offer

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Web courses has left many questions about what makes them effective and satisfactory. Important issues are the perceived advantages of Web-based courses; the proper level of interactivity (both instructor to student and student to student); appropriate pedagogical tools (e.g., streaming media, PowerPoint, etc.) to facilitate student-content interaction; and the influence of antecedent characteristics (e.g., gender, experience, etc.). These issues provide the framework for this research project.

The objective of this research project is to apply structural equation modeling to evaluate the potential causative variables of instructor-student interactions, student-student interactions, student-content interactions (T. Anderson, 2003; Moore, 1976, 1989; Sherry, Fulford, & Zhang, 1998), online course advantages, personal characteristics, and online course experience of the student as they may affect learning and satisfaction with Web-based courses as perceived by students. Perceived student learning was examined because of the inconsistencies associated with measuring and assigning grades in this multiple-course, multiple-instructor study design of graduate courses. Moreover, course grades tend to have a relatively restricted range at the graduate level (Rovai, 2002). Given the relative newness of Web-based courses, student satisfaction is likely to determine whether the student takes subsequent courses in this format, in the same program, or even with the same education provider. Also, it has been used as the dependent variable in a number of online studies (Alavi, Wheeler, & Valacich, 1995; Alavi, Yoo, & Vogel, 1997; Arbaugh, 2000a; Chidambaram, 1996; Warkentin, Sayeed, & Hightower, 1997).

A major shortcoming of the majority of prior studies is that the bulk of research in the behavioral and social sciences has addressed relationships between and among theoretical constructs that are not directly observable (e.g., motivation, traits, satisfaction, ambiguity, interactivity, learning, attitude). As a consequence, if a test of theory is desired, variables that can be observed must be found to use as proxies for the unobservable constructs, or variables need to be identified to form an index to represent the construct (Hughes, Price, & Mares, 1986). A major problem inherent in both approaches is that the measured variables, even with an index, usually contain at least some moderate amounts of error. As Goldberger (1971) pointed out, when such measures are used in linear models (e.g., ANOVA, regression, and path analysis), the coefficients obtained will be biased, most often in unknown degree and direction. The same is true of research in distance education, a shortcoming described by Merisotis (1999):

> The validity and reliability of the instruments used to measure student outcomes and attitudes are questionable. An important component of good

> educational research relates to proper measurement of learning outcomes and/or student attitudes. In short, do the measurement instruments—the final examinations, quizzes, questionnaires, or attitude scales developed by the teacher—measure what they are supposed to measure? A well-conducted study would include evidence of the validity and reliability of the measurement instruments so that the reader could have confidence in the results. But in almost all of the studies reviewed, this information was lacking. (p. 13)

The purpose of this study was to eliminate many of the problems of correlational and ordinary least squares analysis by using confirmatory factor analysis (CFA) and structural equation modeling (SEM) to systematically identify plausible evaluation factors and further test the major relationships between variables (e.g., online instructor activities, student to student activities, and learning). SEM improves reliability, or the degree to which a measure is "error-free." It is difficult to measure a concept perfectly; there is always some degree of measurement error. For example, when asking about something as straightforward as household income, some people will answer incorrectly, either overstating or understating the amount, or not knowing it precisely. The answers provided have some measurement error and thus affect the estimation of the "true" structural coefficient. Measurement error is not caused just by inaccurate responses but occurs with more abstract or theoretical concepts, such as motives, personality attributes, or other psychological constructs. With concepts such as these, the researcher tries to design the best questions to measure the concept. The participants also may be somewhat unsure about how to respond or may interpret the questions in a different way from how the researcher intended. Both situations can give rise to measurement error. In SEM, interest usually focuses on latent constructs—abstract psychological variables like "intelligence" or "role ambiguity"—rather than on the manifest variables used to measure these constructs. SEM allows the researcher to use one or more variables for a single independent or dependent latent construct and then estimate the reliability. The researcher can assess the contribution of each manifest indicator variable, as well as incorporate how well the indicator variables measure the concept (reliability), and then estimate the relationships between independent and dependent latent constructs (Hair, Anderson, Tatham, & Black, 1998).

Moreover, this study has additional methodological advantages, as its sample includes students from multiple courses. Phipps and Merisotis (1999) criticized distance education research for relying too much on single-course studies. Multicourse studies like this one provide methodological benefits such as external validity, increased statistical power, and the ability to control for instructor-specific characteristics.

Literature Review and Hypothesis Development

The literature review is organized by the following topics: (a) performance and satisfaction with the Web-based learning experience, (b) advantages of Web-based courses for students, (c) instructor-student interaction in Web-based courses, (d) student-student interaction in Web-based courses, (e) studet-content interaction, (f) personal characteristics and demographics of Web-based students, and (g) experience as a predictor of student learning and satisfaction.

PERFORMANCE AND SATISFACTION WITH THE WEB-BASED LEARNING EXPERIENCE

The learning experience, a performance variable, should be directly related to satisfaction (Churchill & Surprenant, 1982; Oliver & DeSarbo, 1988; Tse & Wilton, 1988). Of course, whether satisfaction and learning are synonymous can be debated. One typical contingency outcome assumed from a successful learning experience, it can be argued, is that the student should be satisfied with the experience. Satisfaction with course activities often has been included as a dependent variable in studies of distance education, computer-mediated communication, and Web-based courses (Alavi et al., 1995, 1997; Arbaugh, 2000a; Chidambaram, 1996; Frey, Faul, & Yankelov, 2003; Warkentin et al., 1997).

One approach to understanding student satisfaction is to study students' evaluations of the course and their attitudes toward the course (Ellram & Easton, 1999). Yet, only anecdotal evidence was provided on how the satisfaction of the student was related to learning by the student. One study compared satisfaction levels between computer-supported groups and noncomputer-supported groups with both evaluating the outcomes of the sessions (Chidambaram, 1996). The perceptions of the process and the cohesiveness of the group contributed to the differences in satisfaction with the outcomes. The students completing out-of-class exercises with computer support gave high satisfaction scores for the learning experience and for the participation in the activities. In contrast, other research has indicated no differences in satisfaction levels of students for the process or outcome measures for three different types of offerings: distant videoconferencing, local telelearning, and face-to-face (Alavi et al., 1995). Nevertheless, time, place, and pace flexibility should be different in an online environment as opposed to the traditional setting and in the three settings above whereby the flexibility was reduced and, hence, should affect satisfaction levels.

ADVANTAGES OF WEB-BASED COURSES FOR STUDENTS

Convenience and flexibility often are acclaimed as the distinctive and most valuable features of Web courses (Arbaugh & Duray, 2001; Hiltz & Wellman, 1997; Hislop, 1999; Shapley, 2000; Sullivan, 2001). These benefits included the ability to enroll in a class that otherwise would be missed, finish a degree sooner, save commuting time, arrange a better work schedule, and spend more time on nonwork activities. Therefore, the following is hypothesized:

Hypothesis 1: Web-based course advantages/flexibility will be positively related to student perceived learning and satisfaction.

INSTRUCTOR-STUDENT INTERACTION IN WEB-BASED COURSES

The subject of interactivity has generated controversy among distance learning professionals who raise questions about the quality of online courses. The computer-mediated debate has occurred because many educators believe that interactivity is a vital element in the educational process. Critics usually stress that interactivity is the missing element or ingredient in distance education because classes lack traditional face-to-face interactions. However, proponents state that interactivity in distance education is just as good as, or even better than, the traditional classroom, and recent research suggests that it is a highly significant predictor of online course outcomes (Arbaugh, in press; Swan, 2003; Wagner, 1997).

This debate over interactivity, especially that traditional classroom education possesses it and distance education does not, is somewhat misleading. Even in traditional group-based classroom environments, the majority of a student's learning time is spent independently, outside of class; the standard expectation is 2 to 3 hours of study outside of class for every 1 spent in class. As Tony Bates of the University of British Columbia noted,

> There is an even greater myth that students in conventional institutions are engaged for the greater part of their time in meaningful, face-to-face interaction. The fact is that for both conventional and distance education students, by far the largest part of their studying is done alone, interacting with textbooks or other learning materials. (Twigg, 2000, p. 1)

Immediacy behaviors and their relationship to student attitudes and learning in traditional classrooms have been studied thoroughly by educational communication scholars (Christophel, 1990; Gorham, 1988; Menzel & Carrell, 1999). Originally conceptualized by Mehrabian (1971), immediacy

refers to communication behaviors that reduce social and psychological distance between people (Myers, Zhong, & Guan, 1998). At the present time, the routine demonstration of nonverbal immediacy behaviors, including emotions, over the Internet ranges from fairly difficult to almost impossible, depending on what is to be conveyed and the depth of the desired message. Therefore, these behaviors often are demonstrated via text-based messaging or emoticons (Gains, 1999; Poole, 2000; Rovai, 2001; Wang, Sierra, & Folger, 2003). However, behaviors associated with verbal immediacy (Gorham, 1988; Mehrabian, 1971) still are possible in the virtual environment. In this study, immediacy is verbal behavior the instructor makes toward students that does not necessarily require direct interaction with them. In aggregate, instructor-student interactions can include using a story or case history about the topic, encouraging discussion and feedback, or addressing students by name through discussion or e-mail (Arbaugh, 2001, 2002; Hutchins, 2003; Swan, 2002). Therefore, the following is hypothesized:

Hypothesis 2: Instructor-student interaction activities will be positively related to student perceived learning and satisfaction.

STUDENT-STUDENT INTERACTION IN WEB-BASED COURSES

Whereas instructor interaction behavior appears to be an important influence on Web-based courses, it also is becoming apparent that student interaction, such as in small discussion groups and with peer teaching opportunities, can be significant. In some studies, adequate opportunity to participate in online discussions has been associated with enhanced social presence (Gunawardena, Lowe, & Anderson, 1997) and increased satisfaction with online courses and discussion forums, particularly when courses use smaller groups within the course to facilitate discussion (Jonassen, Davidson, Collins, Campbell, & Haag, 1995; Sherry et al., 1998).

Participation in student-to-student interactions in class discussion has been shown to be greater (Arbaugh, 2000b; Arbaugh & Rau, 2002; Benbunan-Fich, Hiltz, & Turoff, 2001), more evenly distributed (Card, 2000; Strauss, 1996), a source of stronger bonding (Whipp & Schweizer, 2000), and more liberating (Wolfe, 2000) in Web-based course activities than in traditional classrooms. However, this interaction can be significantly more difficult to accomplish (Arbaugh, 2000b; Hightower & Sayeed, 1996; Yoo, Kanawattanachai, & Citurs, 2002) and less satisfying (Ocker & Yaverbaum, 1999; Piccoli, Ahmad, & Ives, 2001; Warkentin et al., 1997).

A significant question meriting research attention is whether instructor-student or student-student interaction, or a combination, best predicts student learning and/or satisfaction in Web-based courses. Leidner and Jarvenpaa

(1995) argued that Web-based courses would fit best with collaborative learning models because the software used to deliver them facilitates communication between a number of participants, either synchronously or asynchronously. Initial research on learning in computer-mediated communication environments suggested that Web-enhanced or Web-based courses support collaborative approaches better than traditional classroom courses (Alavi, 1994; Alavi et al., 1995; Chidambaram, 1996). Hiltz, Coppola, Rotter, Turoff, and Benbunan-Fich (2000) studied 26 Information Systems courses over a 3-year period and found strong evidence for the effectiveness of collaborative learning. This was supported further by a qualitative study suggesting that instructors had changed their teaching persona "to a more Socratic pedagogy, emphasizing multilogues among students" (Coppola, Hiltz, & Rotter, 2002). In another qualitative study, Brower (2003) suggested that quality classroom discussion not only was emulated using electronic bulletin board technology but also went beyond the advantages of regular classroom discussion. However, Swan (2002), in a recent study of 73 courses offered by the State University of New York Learning Network, found that the use of collaborative learning techniques was negatively associated with student learning. Swan did point out, though, that it was difficult to determine whether this relationship could be attributed to the use of collaborative learning in Web-based courses as inappropriate; or that collaborative learning is appropriate but poorly practiced; or that there are combinations of collaborative and noncollaborative activities that result in a more optimal learning experience than exclusive reliance on either one. The inconclusive nature of this research to date suggests that this topic requires extensive research before any definite conclusions can be made on the appropriateness of learning approaches.

Mason (1991) studied interactivity in a distance education class at the Open University in Great Britain and found that teachers played a major role in directing the online discussions. Instructors influenced the discussion process by encouraging new topics, sharing new material, and redirecting the conversation patterns. The project did find that student interactions were fostering learning by integrating personal experience into class discussions and by gaining insights from other students. Yet only one third of the students actively engaged in providing and receiving online feedback. The study raised additional concerns that student interactions did not promote critical thinking opportunities to seriously examine course themes. Experienced online teachers have complained that the threaded-topic design, a common technique for enabling student-student dialog, does not effectively support group learning and problem solving (Turoff & Hiltz, 1995, 2001). Threaded-topic design typically requires the cumbersome process of opening and clos-

ing many messages. There is no way for students to create in-context links from within a given message or to insert text or multimedia into any jointly prepared document. In short, the hypertext power of the Web often is conspicuously absent in threaded-topic discussions. For this reason, Docushare, a Web-based document management system that facilitates easily storing, accessing, and sharing information in a password protected environment, is being used by some universities ("What's New at LTDE?" 2003).

Notwithstanding mixed research results, as the two learning management systems, Blackboard and Lotus LearningSpace, used by the student sample in this study included threaded discussion, chat rooms, and e-mail as primary means of student-student interaction, the following was hypothesized:

Hypothesis 3: Student-student interaction will be positively related to student perceived learning and satisfaction.

Hypothesis 3a: The effect of student-student interaction will be equivalent to that of instructor-student interaction (i.e., the path coefficients will be approximately equal).

STUDENT-CONTENT INTERACTION

If an instructor's goal were simply to replicate the classroom learning environment on the Internet, it would be difficult according to media richness (Daft & Lengel, 1984) and social presence theories (Rice, 1984; Sproull & Kiesler, 1991). Two identified problems were unembellished text-based media and the elimination of nonverbal communications. To offer a higher value, the text-based online course experience could be supplemented with both useful and inexpensive traditional print media (Moore, 1987) and new media, such as videoconferencing (albeit expensive for the institution and the student) (Alavi et al., 1997), voice messaging, video clips, and/or multimedia (Bailey & Coltar, 1994; Greco, 1999). Multimedia technology can provide multisensory experiences to enhance learning. These online interactions can be as good as or better than traditional classroom lectures (Davis, 2003; Weigel, 2002). If these interactions failed to provide a better learning experience, then instructors may not need to invest the necessary and substantial time to prepare and arrange for multimedia presentations (Dumont, 1996; Neumann, 1998).

Student-content interaction refers to pedagogical tools and assignments, including PowerPoint presentations, streaming audio and video presentations (feasible but difficult for students with dial-up connections), group projects, individual projects, and embedded links in Web courses. These tools and activities represent pedagogies from a social constructivist view that students themselves are creators of knowledge with others (Benbunan-Fich,

2002; Jonassen et al., 1995). Of course, instructors must be careful not to overuse these pedagogies, as the possibilities of sensory overload and cognitive dissonance are real. Nevertheless, the following hypothesis is proposed:

Hypothesis 4: Student-content interactions will be positively related to perceived student learning and satisfaction.

PERSONAL CHARACTERISTICS AND DEMOGRAPHICS OF WEB-BASED STUDENTS

It is intuitive that personal characteristics and demographics should be related to learning and satisfaction with Web courses. Yet, research on age, gender, and GPA have provided little predictive power in determining whether the student would choose a Web-based course or an in-class course on the same topic (Parnell & Carraher, 2003; Roblyer, 1996). Whether age, GPA, and gender of the student are related to Web-based course perceptions on learning and satisfaction is still open. Age differences, with students younger than 20 years old liking Web-based instruction more than students older than 23 years old, have been found (Sanders & Morrison-Shetlar, 2001), but questions remain from the very small sample size of the older students. Gender differences in computing have been a topic of concern and comment for 20 years (Arbaugh & Duray, 2001). Do females take to the computer to the same degree as males? Are they more anxious about computing? Do they use the computer differently? Do they value different aspects of computing? Do they communicate differently when using the computer? The answers to these questions are particularly important to pursue when so many distant learners have been adult females (Hardy & Boaz, 1997; Moore & Kearsley, 1996). One study suggested that females had a more positive attitude toward a Web-based course than did males (Sanders & Morrison-Shetlar, 2001). In spite of these mixed results from previous research, using SEM with its improved reliability, the following is posited:

Hypothesis 5: Age, grade point average, and gender (male vs. female), respectively, are significantly related to student perceived learning and satisfaction.

EXPERIENCE AS A PREDICTOR OF STUDENT LEARNING AND SATISFACTION

Prior studies have shown that computing experience is a strong predictor of attitudes toward computers, computer usage (Dyck & Smither, 1994; Thompson, Higgins, & Howell, 1994; Whitley, 1997), and Internet usage (Atkinson & Kydd, 1997). In an online learning environment, this experience

has been associated with spending more time in the course, logging on to the course site more frequently, and being more likely to take additional courses via the medium in the future (Hiltz, 1994; Lee, Hong, & Ling, 2001; Smith, Ferguson, & Caris, 2001). This implies that students who spend more time on the Web-based course and/or who have prior experience with Web-based courses are more likely to be satisfied with the experience and take more ownership of the learning process, thereby increasing their own learning. In addition, as students gained experience in using the computer and the Internet in a Web-based course, they became more at ease with the course and the various components, such as bulletin boards and e-mails (Jones & Wolf, 2001). Therefore, the following hypothesis is posited:

Hypothesis 6: Prior student experience with online courses is positively related to student perceived learning and satisfaction.

Sample and Data Collection

The sample for the study was taken from the 43 class sections that were conducted using either Lotus LearningSpace or Blackboard course software platforms in the MBA program of an upper-Midwest U.S. university from summer semester 1998 through fall semester 2001. A listing of the courses and number of sections offered for each course is provided in Table 1. Nearly all students in these courses also were enrolled in the university's classroom-based MBA program. Thirteen different instructors taught the courses, with one instructor teaching three and another teaching two of the sections. This alleviates the external validity problems associated with generalizing from just one course. As mentioned earlier, a sample with multiple classes has methodological advantages (Phipps & Merisotis, 1999).

Data collection was completed in a two-step process. In the first step, students completed a survey, either in traditional classrooms or from the course Web site for online classes. In the second step, the nonresponding students were mailed a copy of the survey. The student response rate was 78.4% (a total *N* of 659).

METHOD

An initial evaluation instrument was developed, incorporating items from the factors identified in previous studies cited above as major components of Internet teaching effectiveness. These items and factors were chosen to be as exhaustive a representation as possible of the suggested aspects of distance teaching effectiveness discussed above, and appear in the appendix.

TABLE 1
Courses in the Study by Discipline or Subject Area

Discipline/Subject Area	*Number of Courses Offered*
OB/OT	6
Finance	6
General management electives[a]	6
Professional skills	5
Project management	4
International business	3
Accounting	3
Management information systems	3
Human resources	2
Operations management	2
Marketing	2
Strategy	1

NOTE: OB/OT = organizational behavior/organizational training
a. Management electives included topics such as Environmental (Green) Management, Planning for Management in the Future, and Classic and Contemporary Literature in Business.

Dependent variables. Because of the multiinstructor, multicourse, and multidisciplinary nature of the study, we were unable to develop a common measure of actual student learning. Therefore, we measured students' perceived learning using Alavi's (1994) six-item scale on issue identification, communications on the subject, and integration and generalization of the course material and additional items from Arbaugh and Duray (2001). Perceived satisfaction with the course, time and effort required, and decision to take an Internet course each was measured using Arbaugh's (2000a) seven-item scale, where 1 = *strongly disagree* and 7 = *strongly agree* (Alavi et al., 1995, 1997; Arbaugh & Duray, 2001; Chidambaram, 1996; Warkentin et al., 1997).

Independent variables. Variables related to perceived learning and satisfaction, significant in prior studies, were measured, including antecedent characteristics, instructor-student and student-student interaction, and student-content support tools. Instructor-student interaction was measured with items from Gorham's (1988) "immediacy" scale and additional items from Dillon, Hengst, and Zoller (1991); Sherry et al. (1998); and Thach and Murphy (1995), from whom student-student items also were adopted. Antecedents measured were personal characteristics, including gender (0-1 dummy coding with women represented by "1"), GPA, and experience (in terms of number of online courses completed).

TABLE 2
Descriptive Statistics

Variable	*Mean*	*Standard Deviation*
Perceived learning	5.23	1.28
Perceived satisfaction	4.83	1.75
Student-instructor interaction	4.70	1.27
Student-student interaction	3.11	1.45
Student age	31.78	6.41
Student gender	0.40	0.49
# of prior online courses taken	1.57	1.74
# of audio clips	3.73	4.73
# of video clips	0.64	2.35
# of PowerPoint/lecture notes posted	7.85	5.79
Convenience/flexibility	5.28	1.71
# of individual projects	3.21	1.36
# of group projects	0.30	0.63
# of peer teaching techniques	0.55	0.77

Student-content tools and exercises in the online courses included the number of PowerPoint presentations, streaming audio presentations, streaming video presentations, group projects, peer teaching opportunities, individual projects, and embedded links to other Web sites. Data for these measures were collected for each course either by reviewing the course Web site or asking the course instructor. We also used 0-1 dummy coding to measure whether an instructor divided the students in their course(s) into smaller discussion groups. Online advantages of convenience and flexibility included the ability to enroll in a class that otherwise would be missed, finish a degree sooner, save commuting time, arrange a better work schedule, and spend more time on nonwork activities (Arbaugh & Duray, 2001; Hiltz & Wellman, 1997; Hislop, 1999; Shapley, 2000; Sullivan, 2001). Convenience/flexibility was measured using Arbaugh's (2000a) six items, using a 7-point *strongly disagree* to *strongly agree* scale. Descriptive statistics for these variables are provided in Table 2.

In light of previous research, the theoretical model is hypothesized below (see Figure 1). Structural paths all were posited to be positive with the exception of gender because a positive or negative coefficient would not be meaningful for a nominal variable.

The data were analyzed with LISREL 8.52 (du Toit & du Toit, 2001), using the original framework for SEM developed by Joreskog and Sorbom (1993). Factor analyses, both orthogonal and oblique, initially were used to

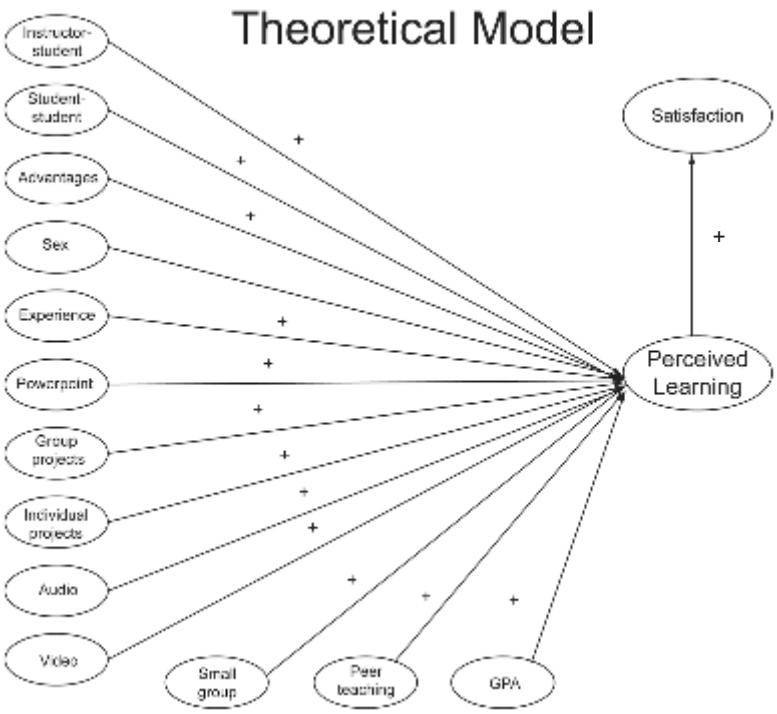

Figure 1: Theoretical Model

identify possible latent variables. Following this identification, the methodology of J. C. Anderson and Gerbing (1988)—CFA followed by SEM—was employed to determine the paths between latent variables. CFA (which, in the interest of brevity, is not discussed in this article) initially identified five latent variables: learning, instructor-to-student activities, student-to-student activities, online advantages, and satisfaction. Starting with the five-construct model of the CFA, latent variables were tested for discriminant validity by setting phi equal to one and testing for a significant change in the Chi-squared value (Bollen, 1989). At this juncture, the test for discriminant validity between satisfaction and learning failed. Students evidently cannot make a distinction between satisfaction and perceived learning. Accordingly, satisfaction was dropped from the model, and only perceived learning was retained as the single endogenous (i.e., dependent) variable.

Indicators for instructor-student activities are "the instructor frequently asked students questions," "interaction between the instructor and class was

high," and "(instructor) used personal examples or commented on experiences he/she has had outside of class." Indicators for student-student activities (reverse scored) are "the students seldom asked each other questions," "there was little interaction between students," and "students seldom answered each other's questions." Other student-student indicators included smaller discussion groups and peer teaching opportunities. (It should be noted that the last three of these items were dropped in fitting the structural equation model for lack of statistical significance.) Indicators for online advantages/flexibility are "taking this class via the Internet saved me a lot of time commuting to class," "taking this class via the Internet allowed me to arrange my work schedule more effectively," and "taking this class via the Internet allowed me to spend more time on non-work-related activities." Indicators for learning are "I learned to identify the central issues of the course," "I developed the ability to communicate clearly about the subject," and "I improved my ability to integrate facts and develop generalizations from the course material."

Single-indicator latent variables included in the analysis are gender, GPA, experience, and student-content variables, including PowerPoint presentations, streaming audio presentations, streaming video clips, group and individual projects, and embedded links in Web courses, respectively. Many of the student-content variables represent methods of trying to improve media variety, richness, and overall content (notwithstanding cost). Error variances were set at .0 or .10, depending on estimated reliability. This follows the logic of Hayduk (1987), who suggests that error variance for single indicators should be fixed depending on the estimated reliability of the measurement. Gender, for example, would be expected to have little error variance and would be fixed at .0, whereas the aggregate number of PowerPoint presentations would be less reliable and accordingly fixed at .10.

Discussion of Fitted Model

This section is organized by discussing the overall fit of the model, the insignificant variables, and the significant variables in order of the sizes of the path coefficients. We will use this information to report the results of our hypothesis tests. Hypotheses 1 through 3 suggested that flexibility, student-instructor interaction, and student-student interaction, respectively, would be significantly associated with student perceived learning/satisfaction. As detailed in Figure 2 and Tables 3a through 3c, the fit for this model with perceived learning as an endogenous latent variable was very good with a chi-square of 58.87 (P = .23), root mean square error of approximation = .014,

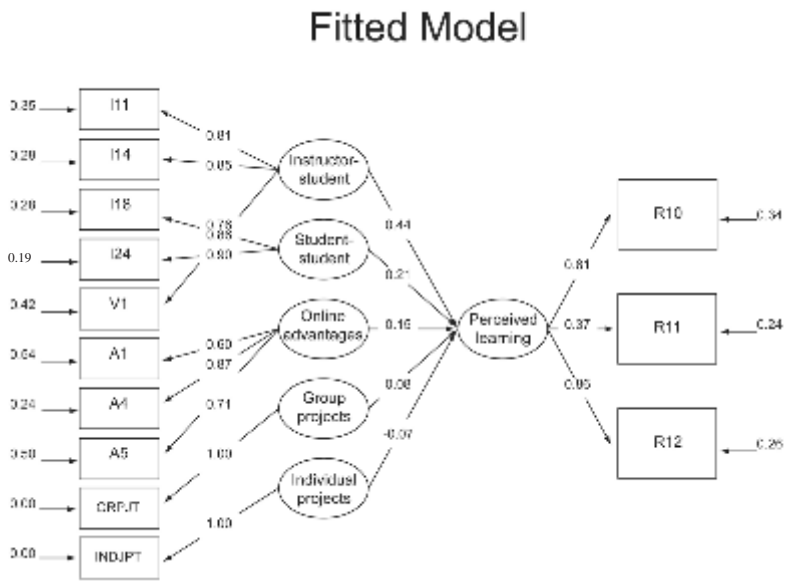

Figure 2: Fitted Model

NOTE: Variable names are as follows: I11 = "The instructor frequently asked students questions"; I14 = "Interaction between the instructor and class was high"; V1 = Instructor) used personal examples or commented outside of class"; I18 = "The students seldom asked each other questions"; I20 = "There was little interaction between students"; A3 = Taking this class via the Internet saved me a lot of time commuting to class"; A4 = "Taking this class via the Internet allowed me to more effectively arrange my work schedule"; A5 = "Taking this class via the Internet allowed me to spend more time on non-work related activities"; R10 = "I learned to identify the central issues of the course"; R11 = "I developed the ability to communicate clearly about the subject"; R12 = "I improved my ability to integrate facts and develop generalizations from the course material". GRPJT = group project; INDJPT = individual project.

Comparative Fit Index = 1.00, and Adjusted Goodness-of-Fit Index = 1.00. There is only one residual that exceeds 2.58, meeting the standard of 1 in 20 exceeding 2.58 (Hair et al., 1998). Significant paths are included in the completely standardized solution of Figure 2. With the exception of individual projects, the paths are all positive. These results indicate strong support for Hypotheses 1 through 3.

Hypotheses 4 through 6 suggest that student-content interaction, student demographic characteristics, and student experience with online learning, respectively, would be significantly associated with perceived student learning/satisfaction. However, the variables not statistically significant were gender, GPA, experience, total number of PowerPoint presentations, streaming audio

TABLES 3a-3c
Completely Standardized Structural Model (LISREL) Results With Perceived Learning as the Dependent Variable

TABLE 3a
Measurement Model, Standard Path Coefficients, and Significance Values

Item	*Std. Path Coef.*	t-*Value*
Measurement model: Exogenous variables		
Instructor-student activities		
The instructor frequently asked students questions	.81	23.50
Interaction between the instructor and class was high	.85	24.82
(Instructor) used personal examples or commented outside of class	.76	24.63
Student-student activities (reversed scoring)		
The students seldom asked each other questions	.85	23.90
There was little interaction between students	.90	25.79
Online advantages		
Taking this class via the Internet saved me a lot of time commuting to class	.68	17.75
Taking this class via the Internet allowed me to more effectively arrange my work schedule	.85	23.52
Taking this class via the Internet allowed me to spend more time on non-work-related activities	.71	18.68
Projects		
Group project	1.00 (*fixed*)	
Individual project	1.00 (*fixed*)	
Measurement model: Endogenous variables		
Perceived learning		
I learned to identify the central issues of the course	.81 (*fixed*)[a]	
I developed the ability to communicate clearly about the subject	.85	24.82
I improved my ability to integrate facts and develop generalizations from the course material	.86	24.63

a. Fixed by the program.

presentations, streaming video presentations, smaller discussion groups, peer teaching opportunities, and embedded links in Web courses. With the exception of the marginally significant individual projects (with a negative coefficient) and group projects (positive), the majority of student-content variables were insignificant; however, any conclusions from the data should only be tentative, given the low levels of usage for some of these activities.

TABLE 3b
Interfactor Correlations of the Items

Interfactor Correlation	*Correlation*	t-*Value*
Instructor and student-student activities	.64	21.55
Instructor and online advantages	.29	6.65
Instructor and group project	.00	–0.13
Instructor and individual project	–.02	–0.24
Student-student and online advantages	.32	7.66
Student-student and group project	.01	0.20
Student-student and individual project	–.06	–0.88
Online advantages and group project	.05	1.92
Online advantages and individual project	–.14	–1.92
Group project and individual project	–.06	–1.29

TABLE 3c
Lambda Path Coefficients and Overall Statistics

Lambda Path Coefficient	*Coefficient*	t-*Value*
Instructor-student activities	.44	8.07
Student-student activities	.21	3.99
Advantages of online courses	.15	3.66
Group projects	.08	2.42
Individual projects	–.07	–2.00

NOTE: Chi-square of 58.87 ($P = .23$); root mean square error of approximation = .014; Comparative Fit Index = 1.00; Adjusted Goodness-of-Fit Index = 1.00

Hence, Hypotheses 5 and 6 failed, whereas Hypothesis 4 is only partially supported.

Hypothesis 2 is supported, as instructor-student interaction is statistically significant. In fact, instructor activities have the largest path coefficient, .44, of any latent variable, meaning that Hypothesis 3a (i.e., path coefficients for instructor-student and student-student are equivalent) is not supported. It appears critical that an instructor relates to students by encouraging discussion, providing feedback, and sharing personal experiences.

Hypothesis 3 also is supported. Student-to-student activities also had a positive path coefficient of .21, implying that learning is facilitated by communication among students themselves. The fact that the coefficient is approximately half that for instructor activities suggests that faculty first should emphasize their own interactions with students in Web courses. Examination of mean values (which peaked at the *neither agree nor disagree*

scale point) for the student-student indicators implies that students desired further participation on the part of their classmates. This parallels the finding of Mason (1991), who found that only one third of students were actively engaged in providing and receiving online feedback. It also could be possible that collaborative learning is appropriate but inadequately practiced, as Swan (2002) suggested, although the relationship is positive here.

Although having a smaller path coefficient (+.15), the advantages of taking an online course are positively related to perceived learning, supporting Hypothesis 1. The ability to reduce time commuting and arrange a more effective work schedule is viewed as contributing to learning. This is similar to the findings of other studies (Arbaugh & Duray, 2001; Hiltz & Wellman, 1997; Hislop, 1999; Shapley, 2000; Sullivan, 2001). Results here from a multicourse sample add confidence to this conclusion.

Limitations

This study has limitations that should cause the reader to take conclusions drawn from it with caution. First, this study did not have measures of actual participant interaction such as the number of comments made by instructors or students. Whereas tracking the number of comments is fairly common in single-course studies with relatively small enrollments (Ahern & El-Hindi, 2000; Arbaugh, 2000b; Larson, 2002; Poole, 2000; Rovai, 2001), the authors decided to measure perceptions of participation across a broad sample of courses instead of actual participation in a small number of courses. Because research in distance education has found that perceptions of interaction may, in fact, be a better predictor than actual participation in the course (Fulford & Zhang, 1993), this approach is acceptable. Second, although the study helps to answer recent calls for multidiscipline, multisemester studies in online management education (Hiltz & Arbaugh, 2003), it is based on the findings at a single institution. Third, the students taking these courses were enrolled in the university's regular MBA program and were taking both these courses and courses in on-site classrooms. This may prevent the study's findings from being generalizable to completely online MBA programs or to online undergraduate programs.

Implications

In spite of these limitations, there are a number of potential implications from this study for online instructors, learners, and administrators of online programs. Arguably the most significant contribution of the study is that it

prioritizes the relative importance of the various types of participant interaction. By doing so, this study builds on the findings of recent studies of the effects of interaction in online courses (Arbaugh, in press; Shea, Fredericksen, Pickett, & Pelz, 2004; Swan, 2003). Therefore, our discussion of implications will focus first on the dimensions of interaction and then move to the other variables.

EFFECT OF INSTRUCTOR-STUDENT INTERACTION

Instructor behaviors toward students are the most important explanatory variable in the model. This finding provides further support for recent research on the importance of the instructor's role in an online learning environment (Arbaugh & Duray, 2001; Coppola et al., 2002; Easton, 2003; Martins & Kellermanns, 2004) and has definite implications for instructor conduct in online management education. Although much has been made of the shift of an instructor's role in an online environment from the "sage on the stage" to a "guide by the side" (Gibson, 1996), our study suggests that this role of instructor as guide certainly is not passive. The instructor's behaviors as guide reflect the importance of his or her relationships with students. Encouraging and motivating students to learn could include seeking student involvement in discussion, telling a case story about a subject to aid remembering, using positive reinforcement for successful performance, and asking questions.

More specifically, the instructor can discuss Web-based course protocols online; reinforce the importance of participation during the term (Bowman, 2001); post assignment directions, lecture notes, and grades online; and use e-mail to communicate to the students. A recent study of 18 instructor behaviors revealed that these instructor-initiated activities were the five most valued by students (Frey et al., 2003). Sanders and Morrison-Shetlar (2001) also found support for instructor-initiated communications, as students had very positive attitudes toward handling assignments and completing course work, taking quizzes, and finding their grades on the Internet. Communicating to students can start before the course begins to welcome them to the course and continue throughout the course to offer assignment directions, explain information, stimulate critical thinking, reinforce major concepts and applications, and bestow psychological rewards. E-mail for lecture notes and assignments was used most heavily by faculty, but also by students, and was considered by both as the technology causing the highest increase in their productivity (Zhao, Alexander, Perreault, & Waldman, 2003). One caution is that the instructor should not be perceived as the authoritarian master in communicating to students because of the detrimental effect on subsequent student communications (Jetton, 2003-2004).

Even the successful online instructor runs into the problem of student motivation and student interaction in the Internet learning arena. Contrary to the instructor's expectations, the students may focus on their personal experiences rather than engage in critical thinking (Angeli, Valanides, & Bonk, 2003), or they may have a lull in critical thinking and participation. Ways to solve this problem include introducing new approaches to stimulate the students such as writing letters to motivate students for enduring learning (May, 1995).

These types of activities have the potential for dramatically increasing the time an instructor spends on a Web-based course relative to a classroom-based course (Berger, 1999; Dumont, 1996). In the interest of controlling burgeoning faculty workloads, we offer two suggestions to address this concern. First, colleges and universities should make training available for faculty in online teaching that goes beyond how to use course software platforms (Alavi & Gallupe, 2003). This training should focus on skills related to self-management and online course organization. Second, the suggestions provided in previous paragraphs will help faculty members incorporate the concepts of teaching presence (Garrison, Anderson, & Archer, 2000; Shea et al., 2004) into their online courses. Teaching presence addresses issues related to course organization, facilitation of discourse, and direct instruction. In addition to the suggestions already provided, an instructor can incorporate these principles by doing such things as providing expectations for course progress and student participation in online discussions at the start of the course, including a section of "frequently asked questions," and making responsibilities for learning activities such as leading and/or summarizing class discussions part of the student's course grade. These practices can help the instructor engage in learner-instructor interaction in a more holistic manner, rather than continually dealing with each individual student, thereby helping to make the instructor's time investment in the course more manageable.

STUDENT-STUDENT INTERACTION

The effect of student-student interactivity as reported was less than expected. This may not reflect its importance as much as its practice, such as how the students are working in the small groups assigned by the instructor. Contrary to the expectations of the instructor seeking student-student interactivity on assignments, the students might be dividing the assignments among group members, resulting in limited interaction as one group member takes leadership on an assignment. This practice would explain the modest interactivity perceptions of the students. After receiving questions from stu-

dents in online courses, the instructor can either send the questions and answers to all of the group members or reply only to the sender of each question. If the latter were how the instructor communicated in the online course and students were not aware of this, then student-student interaction would not be perceived as great. Remediation of the issue could be handled by sending answers to all members of the student group or, if merited, to the class as a whole. A related question is whether students who answer questions and post to the bulletin board on a regular basis tend to do better on tests and demonstrate a greater degree of critical thinking in completing the course requirements (Baugher, Varanelli, & Weisbord, 2003; Sanders & Morrison-Shetlar, 2001).

The significance of online advantages implies that course convenience and flexibility still are important; however, the relative strength of the findings on instructor-student and student-student interactions suggests that the online advantage of convenience may be lessening as a competitive advantage over traditional courses or other forms of distance education courses (Arbaugh & Duray, 2002). Therefore, those institutions offering online courses may need to focus on enhancing the learning effectiveness and/or the cost-effectiveness of these courses if they wish to remain competitive in the future (Mayadas, Bourne, & Moore, 2002).

Using small discussion groups and student peer-teaching opportunities appears not to have an influence on perceptions of learning. In this study, the no-influence results may be due to the relatively low usage. Support for this conclusion comes from a comparison of three instructional methods, varying the use of group discussions, group activities, and personal experiences. The results suggest that two methods with either less or more group discussions and related activities had lower levels of learning than the hybrid model with moderate use of group discussions and related activities (Nadkarni, 2003). Another reason is that students may not realize the value of such activities in leading others, working with others, and developing higher level results. The part-time evening graduate students in this sample, most having 5 to 10 years of career experience, may believe that their experiences with teams and teaching others, especially subordinates, in their formal organizations may have resulted in a flat learning curve for them. It also is true that females, especially, with greater time demands at home, may see limited value to these assignments in distance education (May, 1994, 1996). Thus, much of the benefits from the small group dynamics and leadership roles in teaching other students are lost to these groups, and the real value of these types of assignments is less from the process and more from the outcome of the assignment. One solution is straightforward, with the instructor providing

explicit reasons to the students on the learning value of such assignments in online courses.

STUDENT-CONTENT INTERACTION

The use of PowerPoint presentations and embedded links in online courses has been popular due to both the desire of instructors to provide value-added content and embellish the course beyond the textbook and the ease of uploading prepared presentations and links by textbook publishers. Although intuitively these additions should enhance learning, the students do not perceive this. One reason might be the inundation of PowerPoint presentations and embedded links in virtually all business courses, both online and in class, resulting in a "so what" attitude toward them by time-constrained students with career, social, and family responsibilities. Furthermore, these additions to the course may not help learning relative to the textbook, material uploads, and other student-content tools and assignments. The instructor of the online course needs to consider ways to substitute for or complement the PowerPoint presentations and embedded links to provide enhancements to learning for students. These might include problem-based learning exercises, based on work or community interactions; creative exercises, such as using a "game show" format with follow-up answers; quizzes relating to the applications of the material; a "scavenger hunt" of relevant course topics and issues on the Internet; or a wordplay in creating a written assignment (e.g., brand name, slogan, or headline for an advertisement) for a known product. In summary, these findings suggest that behavioral and administrative factors may be more important and more cost efficient than technological factors for conducting effective online graduate courses.

The lack of significance of streaming technology might be explained by the limited number of students exposed to streaming audio and video clips, by the students having better materials for learning within the time constraints of the online course, or by the students' concept of learning. Instead of considering themselves the creators of new knowledge in the social constructivism model, students may depend on the instructor to provide knowledge to them (Lee et al., 2001; Oliver & Omari, 2001). Thus, group and individual interactions are not perceived as helpful to these students for learning.

PERSONAL CHARACTERISTICS AND DEMOGRAPHICS OF STUDENTS

The student experience variable and the demographic and personal variables of gender, age, and GPA were not related significantly to perceptions of

learning performance. Student experience was a surprise because it had been found to be significant in other studies on computer and Internet usage (Atkinson & Kydd, 1997; Whitley, 1997). However, how much online course experience for a graduate student is necessary to have an influence on learning? It is entirely possible that after a student takes one online course and learns the course management software, additional online course experience has no or very little effect on learning relative to other more important variables, such as interactivity with the instructor and other students and just finding time to complete the exercises and assignments.

Of these predictors, age is the easiest to explain because of the homogeneity in age of the students due to the night MBA program being targeted at full-time employed students with 5 to 10 years of career experience. Gender and GPA may not be useful predictors any longer, as experience with Internet courses increases. Internet courses at the graduate level have expanded from a few initial pilot courses to a rapid growth in the past few years, with many students now having completed several courses on the Internet in pursuing their degrees. Thus, demographic and personal variables may no longer provide meaningful distinctions of students and their performance.

Conclusions

Of the types of interactions, instructor behaviors toward students are the most important relationships to manage when teaching online courses for perceived learning. The instructor has to be an active participatory leader to motivate students to learn. The instructor is responsible for course organization, process management, and potential learning outcomes. Most of the work and time is managing the process with the course management software. Without a doubt, instructor-initiated communications are instrumental in creating positive attitudes of students, motivating them to learn, and in keeping them focused on the topic. Initially, the instructor using the software's tools should welcome the students to the course and discuss the syllabus, especially the expectations of success and the importance of involvement in the course. Also, the pairing of students to introduce each other has merit to start establishing communications between students and in the course (Bowman, 2001).

The instructor should seek student involvement in the course by creating interesting discussion topics, stimulating critical thinking, asking questions, and bringing in relevant points. In addition, the instructor can have the students synthesize and integrate these discussions. Some students will desire to communicate about personal issues rather than the course's topics on discus-

sion boards (Woods, 2002). Some instructors believe that discussions on personal issues contribute to the sense of the online community; thus, they may create a special discussion forum for this activity. Research has supported the relationship between the online community and learning (Rovai, 2002, 2004).

The influence of student-student interactivity was less than expected. Small discussion groups and student peer-teaching opportunities appear not to have an influence on perceptions of learning. However, the active instructor still should develop ways to increase this interactivity of groups in productive ways. Meaningfulness could be enhanced if the instructor provided explicit reasons to the student groups on the learning value of such assignments. One method is to create a question-and-answer forum for the assignment to discuss its value, to answer basic questions, and to allow all class members to raise questions and to see the answers for the benefit of all. Other ways to increase student interactivity are debates, synchronous meetings, brainstorming, opinion surveys, and guest speakers with discussion (Bowman, 2001). One problem is the tendency for some small groups to let one person in the group do all the work for the assignment and then rotate people for the next assignment. The easiest solution is to have group members evaluate each other on performance on the assignment and then to form new groups for the next one.

The use of PowerPoint presentations, embedded links, and streaming technology in online courses appears to be not helpful for explaining perceived learning. However, the use of a variety of these tools may itself be important (Arbaugh, in press). One study indicated that possibility, although the variance explained in a regression analysis was limited (Marks & Sibley, 2004). The instructor may need to rely less on technological factors and focus more on the behavioral and managerial issues.

Online courses offer much promise as instructors become more knowledgeable on how to behave toward students taking online courses and how to manage the course content to enhance perceived and actual learning. The excitement and opportunity with online courses is the continuously dynamic learning process as both instructors and students learn from more interactive experiences with online courses. Therefore, as we learn more about the effective use of this delivery medium, instructors need to continually study and apply the information generated from new research findings on online courses.

Appendix
Initial Evaluation Measures
(measured using 7-point Likert-type scales)

Course Interaction

1. It was easy to follow class discussions.
2. Classroom dynamics were not much different from those in other MBA courses I have taken.
3. The level of interaction between class participants was high.
4. In general, the instructor was effective in motivating the students to interact in this course.
5. Interaction was low in this course.
6. Once we became familiar with Blackboard, it had very little effect on the class.
7. Student-instructor interaction was more difficult than in other MBA courses I have taken.
8. The instructor frequently offered opinions to students.
9. Students often stated their opinions to the instructor.
10. Students often asked the instructor questions.
11. The instructor frequently asked the students questions.
12. Interacting with other students and the instructor via Blackboard became more natural as the course progressed.
13. The instructor frequently attempted to elicit student interaction.
14. Interaction between the instructor and the class was high.
15. The instructor seldom answered the students' questions.
16. Students seldom answered questions that the instructor asked.
17. Class discussions were more difficult to participate in than other MBA courses I have taken.
18. The students seldom asked each other questions.
19. Student-student interaction was more difficult than in other MBA courses I have taken.
20. There was little interaction between students.
21. In this class, I learned more from my fellow students than in other MBA courses.
22. I felt I had adequate opportunities to participate in class discussions.
23. In this class, students seldom stated their opinions to each other.
24. Students seldom answered each other's questions.
25. I felt that the quality of class discussions was high throughout the course.

Perceived Learning/Course Quality

1. I learned to interrelate the important issues in the course material.
2. I learned a great deal of factual material in this course.
3. I gained a good understanding of the basic concepts of the material.
4. I learned to identify the central issues of the course.

5. I developed the ability to communicate clearly about the subject.
6. I improved my ability to integrate facts and develop generalizations from the course material.
7. The quality of the course compared favorably to my other MBA courses.
8. Conducting the course over the Internet improved the quality of the course compared to other MBA courses I have taken.
9. I feel the quality of the course I took was largely unaffected by conducting it over the Internet.
10. Conducting the course over the Internet made it more difficult than other courses I have taken.

Instructor Behaviors

1. Used personal examples or commented on experiences he or she has had outside of class.
2. Asked questions or encouraged students to talk.
3. Got into discussions based on something a student brought up even when it didn't seem to be part of his or her course plan.
4. Used humor in class.
5. Addressed students by name.
6. Addressed me by my name.
7. Referred to our class as "our" class or what "we" are doing.
8. Provided feedback on my individual work through comments on papers, discussions, etc.
9. Asked students how they felt about an assignment, due date, or discussion topic.
10. Invited students to call or meet with him or her if they had questions or wanted to discuss something.
11. Asked questions that solicited viewpoints or opinions.
12. Praised students' work or comments.
13. Had discussions about things unrelated to class with individual students or the class as a whole.
14. Was addressed by his or her first name by the students.

Advantages/Flexibility

1. Taking this class via the Internet allowed me to take a class I would otherwise have to miss.
2. Taking this class via the Internet should allow me to finish my degree more quickly.
3. Taking this class via the Internet saved me a lot of time commuting to class.
4. Taking this class via the Internet allowed me to arrange my work schedule more effectively.
5. Taking this class via the Internet allowed me to spend more time on non-work-related activities.

6. Taking this class via the Internet allowed me to arrange my work for the class more effectively.
7. The advantages of taking this class via the Internet outweighed any disadvantages.
8. There were no serious disadvantages to taking this class via the Internet.

Course Satisfaction

1. I was very satisfied with this course.
2. If I had another opportunity to take another course via the Internet I would gladly do so.
3. I am satisfied with the amount of time required for this course.
4. I was disappointed with the way this course worked out.
5. I was satisfied with the amount of work required for this course.
6. I am satisfied with my decision to take this course via the Internet.
7. If I had it to do over, I would not take this course via the Internet.
8. I feel that this course served my needs well.
9. My choice to take this course via the Internet was a wise one.
10. I will take as many MBA courses via the Internet as I can.

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