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Comparative Analysis of Learner Satisfaction and Learning Outcomes in Online and Face-to-Face Learning Environments

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This empirical study compared a graduate online course with an equivalent course taught in a traditional face-to-face format on a variety of outcome measures. Comparisons included student ratings of instructor and course quality; assessment of course interaction, structure, and support; and learning outcome measures such as course grades and student self-assessment of their ability to perform various Instructional Systems Design (ISD) tasks. Results revealed that the students in the face-to-face course held slightly more positive perceptions about the instructor and overall course quality although there was no difference between the two course formats in several measures of learning outcomes. The findings have direct implications for the creation, development, and delivery of online instruction.

Traditional or face-to-face instructional environments have been criticized because they encourage passive learning, ignore individual differences and needs of the learners, and do not pay attention to problem solving, critical thinking, or other higher order thinking skills (Banathy, 1994; Hannum & Briggs, 1982). New advances in Internet-based technology have brought challenges and opportunities to education and training, in particular through online instruction. Online instruction is a form of distance education delivered over the Internet. For many, this type of instruction is perceived as a

major breakthrough in teaching and learning because it facilitates the exchange of information and expertise while providing opportunities for all types of learners in distant or disadvantaged locations (Hill, 1997; Webster & Hackey, 1997).

While online instruction is gaining popularity, it is not free from criticism. Many educators and trainers do not support online instruction because they do not believe it actually solves difficult teaching and learning problems (Conlon, 1997) while others are concerned about the many barriers that hinder effective online teaching and learning. These concerns include the changing nature of technology, the complexity of networked systems, the lack of stability in online learning environments, and the limited understanding of how much students and instructors need to know to successfully participate (Brandt, 1996). Online instruction also threatens to commercialize education, isolate students and faculty, and may reduce standards or even devalue university degrees (Gallick, 1998). While these concerns may be unwarranted, there is little research to accurately determine the benefits and pitfalls of online instruction, particularly when compared to the more traditional face-to-face learning environment. Researchers and educators are unsure how students' online experiences differ from their experiences in face-to-face learning environments. Gaining knowledge about the processes and outcomes of online instruction as compared to traditional face-to-face environments will help educators and researchers make more informed decisions about future online course development and implementation.

PROBLEM STATEMENT

Although the growth of online programs has been significant in recent years, the capabilities and efficacy of such programs have yet to be fully investigated. Most effort in this area has been devoted to program development while examinations of program quality and effectiveness have been anecdotal in nature. With little empirical knowledge about Internet-based education outcomes, the need for research in this area is not only timely, but also imperative.

The primary purpose of this exploratory empirical study was to compare an online course with an equivalent course taught in a traditional face-to-face format. Comparisons included student ratings of instructor and course quality; assessment of course interaction, structure, and support; and learning outcomes such as course projects, grades, and student self-assessment of their ability to perform various ISD tasks.

Attempts to compare online and face-to-face learning environments are often discounted because of the great dissimilarity between the two learning environments. This is a classic example of comparing apples to oranges. Studies of this type should not attempt to determine if one fruit is better than the other, instead they should demonstrate that, if grown properly, different fruits can be equal in terms of taste and nutritional value. This study is an attempt to determine if properly designed environments that differ on many characteristics, can be equivalent in terms learning and satisfaction. Studies of this type are also important because many faculty who are being asked to design and teach Internet-based courses are wondering if students actually learn in these new online environments. As the evidence mounts in support of the effectiveness of online learning environments, educational research can tackle the more fundamental question of how to optimize instructional designs to maximize learning opportunities and achievement in both the online and face-to-face environments.

RESEARCH QUESTIONS

This study was designed to answer the following research questions.

1. What differences exist in satisfaction with the learning experience of students enrolled in online versus face-to-face learning environments?
2. What differences exist in student perceptions of student/instructor interaction, course structure, and course support between students enrolled in online versus face-to-face learning environments?
3. What differences exist in the learning outcomes (i.e., perceived content knowledge, quality of course projects, and final course grades) of students enrolled in online versus face-to-face learning environments?

BACKGROUND

Advocates of Internet-based education are largely positive and optimistic (Relan & Gillani, 1997) about its potential. But before it can be fully accepted by the mainstream public and educational community, many challenges must be addressed (Hill, 1997). Primary among these challenges is how to meet the expectations and needs of both the instructor and the student and how to design online courses so they provide a satisfying and effective learning environment. From program developer and instructor perspectives, understanding these issues is critical for the development and implementation of quality online instruction.

While few experimental studies have compared the effectiveness of online instruction to the more traditional face-to-face offering, two recent studies provide encouraging results for developers of online instruction. Schutte (1997) conducted a small-scale experiment in which he divided a class of 33 students into a traditional section and a virtual section taught on the World Wide Web (WWW). Although his study was flawed due to lack of control over teaching methods and amount of student interaction, his results showed that instruction provided online can result in improved performance. LaRose, Gregg, and Eastin (1998) conducted a similar study that compared the learning outcomes of students in a traditional lecture section to the performance of students who participated in a course section that provided prerecorded audio via the WWW along with detailed course outlines and related course pages accessed on the Web. Results showed that the Web group had test scores and student attitude ratings equal to those of the traditional section. While these types of quasi-experimental studies present methodological challenges (e.g., dealing with small sample sizes, the effect of prior knowledge, etc.), they do provide an important first step into better understanding the effect of online instruction on learning outcomes and student satisfaction.

Satisfaction relates to perceptions of being able to achieve success and feelings about the achieved outcomes (Keller, 1983). From this perspective, several studies have explored student satisfaction with online programs (Debourgh, 1998; Enockson, 1997; Johanson, 1996; McCabe, 1997). For example, Enockson (1997), in a study assessing distance education in a university setting, found that students were satisfied with online instruction because it provided flexibility and responsiveness to their learning requirements and expectations. Similarly, Johanson (1996), based on her study of an online classroom, concluded that students' satisfaction is positively impacted when (a) the technology is transparent and functions both reliably and conveniently, (b) the course is specifically designed to support learner-centered instructional strategies, (c) the instructor's role is that of a facilitator and coach, and (d) there is a reasonable level of flexibility. In contrast, Debourgh (1998) found that student satisfaction depends more on the quality and effectiveness of the instructor and the instruction than on the technology.

Studies of learner satisfaction are typically limited to one-dimensional post-training perceptions of learners. Operationally, learner satisfaction is too often measured with "happy sheets" that ask learners to rate how satisfied they were with their overall learning experience. To provide effective measures that guide improvements in instructional design for online programs, the notion of learner satisfaction must be explored through a multidimensional analysis of a wide variety of critical variables. Harrison, Seeman,

Behm, Saba, Molise, and Williams (1991) identified four major components of effectiveness in distance education programs: instruction, management, telecommuting, and support. Within each of these broad categories are two to five subcomponents. Another example of a validated approach to assessing a deeper degree of satisfaction has been provided by Jegede, Fraser, and Curtin (1995) who identified eight components of effective learning environments: interactivity, institutional support, task orientation, teacher support, negotiation, flexibility, technological support, and ergonomics. By building on these valid and reliable measures of effective learning environments, a more significant assessment of learner satisfaction and outcomes can be obtained.

METHOD

Subjects

This exploratory empirical study compared outcome data obtained from students enrolled in one of two versions of a graduate level instructional design course for human resource development professionals. One version of the course was taught on the campus of a large Midwestern university through a traditional face-to-face format while the other version of the same course was offered totally online, with no direct face-to-face contact between the instructor and the students. Both courses were taught by the same instructor, delivered by the same department, and required the same content, activities, and projects. Nineteen students, most of whom are pursuing a graduate degree in Human Resource Development (HRD), were enrolled in the on-campus course. These students can be viewed as traditional university students who are actively pursuing an advanced degree through full time study on campus. Nineteen students were also enrolled in the online version of the course. These students are also pursuing a graduate degree in HRD through a degree program that is taught completely online. The online group can be viewed as nontraditional students because they are able to complete their advanced degree without ever setting foot on campus.

An important consideration for this type of comparison study is the equivalence of the groups prior to the start of instruction. Official university student records were reviewed to obtain a variety of demographic and academic data for comparison. As shown in Table 1, the slight differences between the two groups in age, the year they received their baccalaureate degree, undergraduate GPA, and years of work experience were non-significant. In addition to these general demographic comparisons, the students

were asked to respond to three questions regarding their degree of prior training and experience in the instructional design area. The results of this short questionnaire revealed that both groups of students had very little formal experience in instructional design prior to enrolling in this course. Because the majority of the online group was working full time while they completed the instructional design course, a few of them did have opportunities to design training courses as a part of their jobs. Four of the face-to-face students and eleven of the online students had previous experience designing courses. Of this experience, the majority of the students indicated they had designed two or fewer courses that were less than one-half day in length. Although several online students had prior experience designing courses, only three of them indicated they had formal training in the instructional design process; one as part of his undergraduate coursework and the other two through a 3-day seminar. Three students in the face-to-face group had also indicated previous instructional design training through university courses and workshops.

Table 1
Demographic Comparison of Students

	Face-to-Face		Online		
	Mean	***SD***	***Mean***	***SD***	***t****
Age	33.08	11.34	36.76	7.96	-1.029
Year of Baccalaureate Graduation	1989.50	8.44	1988.35	8.29	0.364
Baccalaureate GPA	3.37	0.27	3.09	0.54	1.655
Work Experience (yrs.)	10.17	10.65	11.18	6.70	-0.314
T & D Experience (yrs.)	2.75	8.60	3.53	4.62	-0.316

Note: *All comparisons are non-significant at a = .05.

Instrumentation

A modification of three established instruments was used to assess student perceptions of course quality, interaction, structure, and support. First, the university's *Instructor and Course Evaluation System* (ICES) was used to obtain general student perceptions of the quality of their learning experience. ICES is a validated instructor rating system comprised of multiple Likert type items. Two global items that assess the instructor's overall teaching effectiveness and the overall quality of the course were used for this study.

Second, the *Distance and Open Learning Scale* (DOLES) and the *Dimensions of Distance Education* (DDE) instruments were identified as appropriate starting points for the creation of an assessment tool for online instruction (Harrison, Seeman, Behm, Saba, Molise, & Williams, 1991; Jegede, Fraser, & Curtin, 1995). These instruments were chosen because they were grounded in educational theory and have undergone thorough statistical testing. The authors of the two instruments were contacted to obtain copies as well as the necessary permission to use their instruments. DOLES assesses student perceptions of their learning experience related to the eight components of effective learning environments: interactivity, institutional support, task orientation, teacher support, negotiation, flexibility, technological support, and ergonomics (Jegede, Fraser, & Curtin, 1995). Since the DOLES instrument does not fully emphasize instructor to student and student to student interaction, a second instrument was needed. The DDE provides a further assessment of the learning environment (Harrison, et al., 1991). DDE consists of 94 items grouped by the broad categories of instruction, management, telecommuting, and support; the four broad categories are further subdivided into fourteen sub-components of effectiveness of distance education programs.

The selection of appropriate items for online instruction from the DDE and DOLES distance learning instruments was guided by the opinion of content experts. Selected items were reviewed by content experts in the field of education to ensure that the instrument was sufficiently general to be useful for traditional face-to-face and online environments. The content experts identified a total of 50 items for the dialog, structure, and support categories. The instrument was pilot tested in an undergraduate engineering course (43 students) and two graduate education courses (25 students).

Factor analysis procedures were used to establish the construct validity of the hybrid instrument called the *Course Interaction, Structure, and Support* (CISS) instrument. The principal component analysis method was used to assess the factor structure of items relating to each of the constructs. The results from the Scree plot and an eigenvalue greater than or equal to one was used to determine the appropriate number of factors to retain. A 0.50 cutoff criterion was used to define salient factor loading (Comrey & Lee, 1992; Kim & Mueller, 1978). For all sections that were identified with multiple factors, a varimax (orthogonal) rotation method was initially performed. Next, an oblique (non-orthogonal) transformation using the direct oblimin method was performed with deltas set at 0.0, 0.1, 0.3, and 0.5 to determine if there was an improvement in the factor solutions. The factor solution obtained by the varimax rotation was retained where there was no advantage to the simple

structure and if no additional information could assist in the interpretability of the solution.

Based on factor and reliability analyses, a total of 24 items were selected from the 50 items comprising the original instrument. Four items were added to measure the perceptions of the students' psychological and communicational distance. Three more items were added to the course structure section. The final CISS instrument consists of 11 items for the dialog construct, 8 items for support, 8 items for course structure, and 4 items for transactional distance.

Instructional Context

Success in the instructional design course was based on the application of strategies and techniques versus theoretical frameworks. Therefore, both versions of the course were designed to promote application of the different instructional design strategies and techniques through various simulated activities and ultimately the development of a training package that could be implemented within an organizational setting. The same content was covered in both the face-to-face and online settings and the instructional treatment of each topic followed the same organization.

On average, one topic or module was introduced and covered each week. Each module began with an overview of the topic followed by a discussion of its application as related to the instructional design process. Within the face-to-face setting, this information was delivered during a three hour class session using live lectures, *PowerPoint* presentations, and handouts; while in the online setting the information was delivered through prerecorded streamed audio lectures, *PowerPoint* presentations that were synchronized with the lecture, and handouts posted on the course web site. The lecture content, *PowerPoint* presentations, and handouts were identical for both settings. The instructor facilitated discussion and students were encouraged to raise questions, issues, comments, and concerns that would aid them in better understanding the application of the topic. For the online students, these discussions took place once a week through a one-hour synchronous chat session where the instructor broadcast his voice over the Internet in real time and the students responded using a text-based chat system. Approximately one-third of each module was spent on these instructor-led activities.

The second third of the module was devoted to the application of the topic to simulated activities. Working primarily in groups, students conducted analyses and design activities using case studies, videos, and simulated

training packages. The purpose of these activities was to provide students the opportunity to apply the different strategies and techniques in simulated settings and to receive feedback from the instructor prior to applying them to their own personal projects. Through the group work, students were able to collaborate, problem solve, and receive input from their peers. Again, the application activities were identical for both groups.

The final third of the module was devoted to the students working on their own instructional design packages. The intent was to spend one-third of each module on the new topic and its application, one-third on the application of the topic to simulated activities, and the final third on the application of the topic to personal projects. The goal of this design was to provide adequate practice and repetition in order to master the instructional design skills.

Each module, for both face-to-face as well as online, was designed to contain content and assigned activities equivalent to three hours of contact time per week. For the face-to-face students, the information was delivered and activities completed during a three-hour class session each week. For the online students, access to the material was given one week prior to the synchronous hour. Although the online material was designed to require three hours of time on task, the online students had the flexibility of completing the work at any time during the week.

Procedures

All data were collected at or near the end of the semester. CISS was administered individually to the on-campus students using paper versions of the instruments while the online students completed an online version of the instrument since they were distributed across the country. The online version was identical to the paper version in both format and content. Online students were sent an e-mail message that asked them to complete the instrument within a set time frame and included a web address so they could locate the instrument using their web browser. The online students completed the forms and submitted their results electronically. All instrument data were entered into a statistical analysis package for later analysis. Statistical analysis was conducted using independent sample t-tests and supported with a non-parametric Mann-Whitney *U* test. All statistical tests reported in this paper were conducted with a significance level of a = .05.

The search for distinguishable differences in learning outcomes (i.e., content knowledge and quality of course assignments and projects) between students enrolled in online versus face-to-face learning environments was conducted using two primary sources of data. The quality of a major

course project was the first indicator of learning outcomes. Students in both courses were required to design a complete training package that represented six to eight hours of instruction. The packages were to include all training materials and instructional aids as well as all student materials needed to conduct the training. The package had to be complete enough so that another instructor, with a similar background to that of the designer, could deliver the course with minimal preparation. A blind review process was used to evaluate the quality of the course projects. Three HRD doctoral students with instructional design experience were asked to independently evaluate each project in terms of the presentation quality, course organization, degree of detail provided, and overall quality. The reviewers were not told that the purpose of the review was to compare the two course formats and they did not know which projects resulted from the online or face-to face sections. The reviewers rated each project on a four-point scale for each of the four quality characteristics. Analysis of variance was used to examine ratings of the projects. The final course grades that were assigned to each student by the instructor were used as a second indicator of learning outcomes.

A self-assessment instrument was also administered at the end of the course. This instrument asked students to rate their level of comfort at performing various ISD tasks. A total of 29 items were developed from the course objectives. Individual *t*-tests were conducted to examine differences between the groups on each of the task items.

RESULTS

The following results are organized around the research questions and include comparisons of the face-to-face and the online students' perceptions in the areas of satisfaction, course interaction, course structure, and support. Further analysis compares student learning outcomes in terms of course project quality, course grades, and a self-assessment of their ability to perform various ISD tasks.

Student Satisfaction

Student satisfaction was assessed using two items on the CISS instrument that corresponded to the global items included in the university's Instructor and Course Evaluation System (ICES), which is used to evaluate all campus courses. These items asked students to rate, on a five point Likert scale (5 = exceptionally high rating), the overall quality of the instruction and the course.

On the student satisfaction indicators, instructor quality and course quality, both groups provided positive ratings, although the face-to-face group displayed more positive views than the online group. The mean rating for the instructor's overall teaching effectiveness for the face-to-face group was 4.21 (SD = .79) while the online students' mean rating was 3.58 (SD = 1.07). While this difference was significant, $t(36) = 2.07$, $p < .05$, the calculated p-value of .046 highlights the need for further research in this area. A similar, though non-significant, difference was found for the overall course quality rating, with the face-to-face group (M = 4.32, SD = .73) providing a slightly more positive rating than the online group (M = 3.79, SD = .92), $t(36) = 1.94$, $p > .05$.

Perceptions of Course Interaction, Structure, and Support

The CISS instrument assessed student perceptions regarding course interaction, structure, and support throughout the semester. Using a four point Likert scale, the students indicated the degree to which they Agreed (4) or Disagreed (1) with various statements. Overall, both groups of students had positive perceptions, with the face-to-face students having significantly more positive views for interaction and support.

Due to the exploratory nature of the CISS research, the following analysis should be interpreted with caution for two reasons. First, the composition of the students and the small sample size makes it difficult to interpret the two groups. Secondly, the CISS instrument is still in its early developmental stage and has not completed a full analysis to ensure reliability and full construct validity. At best the analysis provides information on students' perceptions on various characteristics of the online and face-to-face environments that contribute to the emerging field of online training and learning. These results provide course instructors, developers, and program administrators with relevant and timely information to make appropriate changes to accommodate the learning needs of the students.

Student to student interactions. Interaction among the students was assessed using 5 items that represented characteristics of a learning environment that supports student communications, shared learning experiences, teamwork, building a sense of community, and promoting an increase in student contacts. The mean for the interaction category was 3.23 for the face-to-face course and 2.65 for the online course. As shown in Table 2, there was a significant difference between the two course formats, $t(33) = 3.847$, $p < .05$.

Students enrolled in the face-to-face course had a more favorable opinion of the amount and type of interactions among the students. Analysis of the individual items revealed no difference in the amount of contact among the students but a significant difference in terms of communication with other students in the class, sharing learning experiences with other students, perceptions of a sense of community, and being able to work in teams.

Table 2

Perceptions of Course Interaction, Structure, and Support

CISS Instrument Sections	Face-to-Face*	Online*	*t*
Student Interactions	3.23 (.51)	2.65 (.37)	3.847**
Student & Instructor Interactions	3.11 (.49)	2.74 (.41)	2.455**
Course Structure	3.16 (.41)	2.94 (.40)	1.641
Instructor Support	3.17 (.43)	2.75 (.53)	2.690**
Departmental Support	2.15 (.56)	2.66 (.46)	-2.921**

Note: *Group means determined using a 4 point Likert scale ranging from Strongly Agree (4) to Strongly Disagree (1). Mean value above 2.5 indicates a positive perception among the students. A positive *t* value indicates a more positive perception among the face-to-face students. Standard deviations in parentheses. **$p < .05$

***Student and instructor interactions*.** Interaction between the instructor and the students was assessed using 6 items covering teaching style, interaction with the instructor during and outside of class, instructor feedback on student progress, and the instructor's treatment of the students. The mean for this category was 3.11 for the face-to-face course and 2.74 for the online course. This difference was significant, $t(35) = 2.455$, $p < .05$ (see Table 2). Analysis of the individual items for this section revealed a significant difference in the items relating to students being informed about their progress in the course, student and instructor interactions during the course, and the treatment of the students in the course, with a lower rating by the online students. For the remaining items in this category there was no significant difference in the means between the two course formats.

Course structure. There was no difference in the variable that examined issues of students being allowed to work at their own pace, quality of the course syllabus, structure of class activities, organization of the content, student input in the topics selection, teaching methods, and student assessment. The mean for this category was 3.16 for the face-to-face course and

2.94 for the online course. The difference in the means was not significant, $t(35) = 1.641$, $p > 0.05$ (Table 2).

Instructor support. Perceptions of the comprehensiveness and usefulness of feedback, student encouragement, and the instructor being able to help students identify problem areas with their studies determined instructor support. The mean for this category was 3.17 for the face-to-face course and 2.75 for the online course. The difference in the means was significant, $t(36) = 2.690$, $p < .05$ (Table 2). The students in the face-to-face course formats rated the instructor relatively higher for instructor support than the online students. Analysis of individual items for this section showed no difference in the amount of encouragement the instructor provided to the students. These differences related to the characteristics of instructor feedback and the ability of the instructor to assist students to identify weaknesses in their course preparation.

Departmental support. Departmental support was determined by student perceptions regarding the information the department provided to them, inquiring about their learning needs, and providing a communication link between the students and the instructor. The online students rated the departmental support significantly higher than did the students enrolled in the face-to-face course. The mean for this category was 2.15 for the face-to-face course and 2.66 for the online course. The difference in the means was significant, $t(33) = -2.921$, $p < .05$ (Table 2). Analysis of individual items showed no difference in the departmental staff inquiring about the student satisfaction with the services provided and the departmental staff serving as facilitators between the instructor and the students. The differences related to students being informed about the support services, and about their learning support needs.

Student Learning Outcomes

Although student perceptions are important, the ultimate indicator of course effectiveness is the degree to which students reach the learning objectives. The following analysis examined differences in the quality of the final course projects, course grades, and the students' self-assessment of their ability to perform each element of the ISD process.

Blind review of course projects. A primary outcome of the instructional design course was the completion of a training package that represented six

to eight hours of instruction. The completion of this package served as evidence that students had gained the knowledge and skills required of instructional designers. Since some of the students choose to work together on this project, the total number of projects produced does not match the class enrollments. The face-to-face class produced 13 training packages while the online class produced17. A blind review process was used to evaluate the quality of the course projects and to compare the outcomes across the two courses.

Overall, the 30 projects were rated very favorably (M = 3.43, SD = .60) on a four-point scale. The overall mean rating of the face-to-face class projects was 3.47 (SD = .60) and the mean rating for the online class projects was 3.40 (SD = .61). The difference in the project ratings for the two groups was not significant (Table 3).

Table 3
Analysis of Variance for Major Course Project

Source	*df*	Sum of Squares	Mean Square	*F*-ratio	Prob
Delivery Format	1	0.11	0.11	0.30	0.58
Error	88	31.96	0.36		
Total	89	32.07			

Course grades. Each section of the course consisted of 19 students. The grades were, for the most part, equally distributed between both groups (Table 4). A total of five students (two online and three face-to-face) requested an "incomplete" for the course.

Using the distribution from Table 2, 68% of the students fell within the "A" range, 8% fell into the "B" range and 11% fell into the "C" range. Students requesting an incomplete made up the remaining 13% of the distribution.

Table 4
Grade Distribution for Face-to-Face versus Online Groups

		Course Grade							
Course Format	n	A	%	B	%	C	%	I	%
Face-to-Face	19	13	68%	2	11%	2	11%	2	11%
Online	19	13	68%	1	6%	2	11%	3	16%
Total	38	26	68%	3	8%	4	11%	5	13%

Self-assessment. A self-assessment instrument collected students' reported levels of comfort at performing various instructional design tasks. Each task was rated on a four-point scale from Very Comfortable (4) to Very Uncomfortable (1). Significant differences were found on only five of the 29 items on the self-assessment instrument. Only the tasks where differences occurred are reported below.

- *Distinguishing among various ISD models*. One of the first course activities asked students to compare eight different instructional design models. The purpose of this activity was to illustrate that while the models do vary, the major components of analysis, design, development, implementation, and evaluation serve as the foundation for all instructional design models. The mean for the face-to-face group was 2.33 and the mean for the online group was 2.79. The mean difference between the two groups was significant, $t(32) = -2.378$, $p < .05$. This analysis indicates that the online group felt more comfortable than the face-to-face group when distinguishing among various ISD models.
- *Preparing a learner analysis*. The learner analysis is designed to help the instructional designer understand the target population for whom the instruction is being developed. The learner analysis was to address components such as demographic characteristics, physiological condition, work experience, learning style, aptitude, knowledge, and attitudes. The mean for this item was 3.80 for the face-to-face group and 3.32 for the online group. The mean difference between the two groups was significant, $t(32) = 2.830$, $p < .05$. This analysis shows that the face-to-face group felt more comfortable performing the learner analysis in comparison to the online group upon completion of the course.
- *Preparing a content analysis*. Content analysis outlines the essential knowledge, skills, and attitudes that need to be included in the instructional design package. It is the final task conducted as part of the analysis phase of the ISD process. The accuracy and completeness of this analysis is based on the quality of the previous analyses (i.e., needs assessment, job/task, and work setting). The mean for this item was 3.80 for the face-to-face group and 3.26 for the online group. The mean difference between the two groups was significant, $t(32) = 3.205$, $p < .05$. This analysis shows that the face-to-face group felt more comfortable preparing a content analysis in comparison to the online group upon completion of the course.
- *Writing goal statements*. Goal statements are expressions of the general results desired from instruction. They describe the intended outcome of

the instruction rather than the process. Unlike performance objectives, goals are not measurable. The goal statement is developed from the content analysis. The mean for the face-to-face group was 3.80 and the mean for the online group was 3.42. The mean difference between the two groups was significant, $t(31) = 2.159$, $p < .05$. This analysis indicates that the face-to-face group felt more comfortable writing instructional goal statements in comparison to the online group upon completion of the course.

- *Writing terminal objectives.* Terminal objectives state what learners should be able to know, do, or feel at the end of the training. These are distinguished from enabling objectives that state what participants will do during the training that will help or enable them to achieve the terminal objectives. The terminal objectives should be clearly measurable and should represent a hierarchy of learning. The terminal objectives are derived from the major categories of the content analysis. The mean for the face-to-face group was 3.67 and the mean for the online group was 3.22. The mean difference between the two groups was significant, $t(31) = 2.247$, $p < .05$. This analysis indicates that the face-to-face group felt more comfortable writing terminal objectives in comparison to the online group upon completion of the course.

DISCUSSION

As discussed in the opening sections of this paper, the effectiveness of online instruction has been criticized from many perspectives—one being whether or not it is as effective as traditional face-to-face instruction. The results of this study show that student satisfaction with their learning experience tends to be slightly more positive for students in a traditional course format although there is no difference in the quality of the learning that takes place. These results support the argument that online instruction can be designed to be as effective as traditional face-to-face instruction.

Students from both groups provided positive ratings of the quality of the instruction and the course. Although the face-to-face group provided a slightly more positive rating of the quality of the instructor than the online group, the reasons for this difference are not evident. It is possible that the instructor was more effective in the traditional format, although the lack of difference in the learning outcomes does not support this. Another possible explanation is that student ratings may tend to be higher when there is a personal connection between the instructor and the students, something that may not occur in an online course. Another possibility is that the response

set of online students tends to be lower than the response set of students in a traditional format. Clearly, additional study of the influence of online instruction on student ratings is needed.

A variety of characteristics of quality learning environments were examined in this study, including interaction among students and the instructor, course structure, and instructor and departmental support. The face-to-face students did have the ability to dialogue with the instructor about the content as it was presented. They also had the opportunity to receive multiple examples and illustrations from the instructor. For the online students, this "dialogue" came in the form of e-mails, IRC chat discussions, phone calls, and synchronous hour discussions. While every attempt was made to provide appropriate and adequate examples and illustrations within the online content, it appears that designers of online environments need to devote much more effort to this area.

Generally, the face-to-face students indicated a more positive perspective on these learning environment characteristics than did the online students. Considering the fact that the face-to-face class met in person once a week for a 3-hour period throughout the semester, the differences in student interaction levels are to be expected. Students in face-to-face courses can more easily get together at least once a week for an extended period of time to discuss class projects, work out any differences of opinion, and build social relationships. In contrast, the online students do not have similar opportunities, although the technology provides a surrogate form for similar interactions. This suggests that the online environment may lack the strong social dimension that is beneficial to face-to-face classroom experiences.

Several reasons may account for the more positive perception of the face-to-face group on the quality of instructor and student interaction. One possibility is that, because of proximity reasons, online students do not enjoy the same amount, type, or timeliness of communications about the course as the face-to-face students. Another possibility could be that the online students' expectations with regard to student progress and instructor interaction are most likely based on experiences formulated in face-to-face settings through many years of schooling. Even though the amount of interaction may have been adequate to support their learning, it may not have been equal to what was expected. Also, it is reasonable to assume that the relationship between student progress and student/instructor interaction is among the most important for students. Students are often chiefly concerned with grades and student progress is an important indicator for them in this respect. In terms of learning, the frequency or depth of exclusive student/instructor interaction may have some bearing on how much students feel they have gleaned from the course.

Differences between the online and the face-to-face groups were also significant for the dimensions of instructor and departmental support. Students in the face-to-face course reported higher levels of instructor support than did the online students. Across both classes, students reported the same levels of instructor encouragement. A more detailed item analysis reflected that the differences stemmed from the characteristics of instructor feedback. This makes sense in view of the differing contexts of the two classes. The face-to-face setting allowed the instructor to vary the nature and type of feedback as the dynamics of student/instructor interactions would demand. In the online course however, the instructor feedback was limited largely to e-mail, fax, uploaded files, and periodic telephone conversations as a means of delivering feedback. The face-to-face students received live and dynamic forms of support from the instructor while the online group received support in a form of one way static communication. In terms of departmental support, the online students reported higher ratings than did the face-to-face students. This difference is easily explained by the fact that the face-to-face class had direct contact with the instructor and a part time teaching assistant, therefore they had little need for support from the department. In contrast, given the complexities of online technologies, the online class had more need for technical support, a service that was provided by the department.

The lack of difference in the learning outcomes from the two course formats supports the continued development of online instruction programs. Using a blind review process to judge the quality of the major course projects, the ratings of three independent reviewers showed no difference in the quality of the projects across the two course formats. In addition, the distributions of course grades for both the online and face-to-face classes were to a large extent equally distributed. While there were significant differences on five of the 29 self-assessment items, examination of the results as a whole indicate the students in both groups are equally comfortable in performing the instructional design tasks. Four of the sets of means fell between the “comfortable—very comfortable” range and one set of means fell between the “uncomfortable—comfortable” range. Overall, both groups indicated a level of comfort at performing the tasks. It is worth devoting some discussion as to why these few differences did exist. In comparing the instructional design models, the online students had up to one week to discuss the models and address the discussion questions provided. The face-to-face students were provided 30 minutes of class time for this same activity. It is a logical conclusion that having more time for online discussion and reflection related to the models would lead to greater insights, interpretation,

and a higher level of comfort with the various components. For the learner analysis, content analysis, goal statements, and terminal objectives, it has been one of the author's experience from teaching this course multiple times over several years, that these topics are the most difficult for students to grasp. Historically, these topic areas require the most attention and practice for learning to occur. It is also interesting to note that these four task areas are similar in nature and were all covered in sequential modules in the course. Further analysis of the way these tasks were taught in the two environments is needed.

Implications for Future Online Programs

The ultimate question for educational research is how to optimize instructional designs to maximize learning opportunities and achievements in both online and face-to-face environments. The findings of this study show that online learning can be as effective as face-to-face learning in many respects in spite of the fact that students in online programs may be less satisfied with their experience than students in more traditional learning environments. In view of these findings, several implications emerge pertaining to future online program development.

First, this analysis suggests that the development and use of online programs should continue. Further effort is needed to improve overall student/instructor communication, especially in the area of instructor feedback and student progress. This will require identifying and implementing new communication strategies to facilitate student/instructor communication at appropriate points in the course. Second, a better understanding of why online learners report lower levels of comfort with their learning is needed so specific strategies for increasing student confidence levels in online programs can be developed. Finally, educational practitioners who develop online courses need to be familiar with the limitations of online programs. Such awareness will ensure that the expectations of learners are met and the intended course goals can be attained. For instance, the findings in this study suggest that online instruction may not be suitable for courses that require high degrees of student instructor interaction and feedback, such as performance-based training methods courses that rely on considerable mentoring and coaching. Until the technologies for online instruction better simulate real time interaction, program developers may need to avoid courses that require frequent verbal and behavioral communication between students and the instructor.

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