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Learning Style and Effectiveness of Online and Face-to-Face Instruction

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In this study the investigator compared two sections of the same course—one section was online and asynchronous; the other was face-to-face—by examining gender, age, learning preferences and styles, media familiarity, effectiveness of tasks, course effectiveness, test grades, and final grades. The two sections were taught by the same instructor and used the same instructional materials.

The results revealed no significant differences in test scores, assignments, participation grades, and final grades, although the online group's averages were slightly higher. Ninety-six percent of the online students found the course to be either as effective or more effective to their learning than their typical face-to-face course. There were no significant differences between learning preferences and styles and grades in either group. The study showed that equivalent learning activities can be equally effective for online and face-to-face learners.

Over the years, numerous studies of courses in which grade distributions determine the outcome measure show that students do as well through distance learning as they do in face-to-face (FTF) classes (Martin and Rainey 1993; Souder 1993; Verduin and Clark 1991). These findings continue in some of the more recent studies: There are reports of cyberlearners performing on assessments equal to or better than FTF students (Arbaugh 2000; Clark 1999; Dobrin 1999; Dutton, Dutton, and Perry 1999; Navarro and Shoemaker 1999; Trinkle 1999).

Many studies have used preselected samples of students who possess the characteristics of the effective distance learner—a strong self-starter, self-disciplined, knowledgeable of the technology requirements of the spe-

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cific format to be used, and capable of meeting in the virtual environment and not FTF (Wade 1999). Most studies have not controlled for each independent variable, thus making their usefulness for predicting learning outcomes extremely limited. Joy and Garcia (2000) suggested that studies comparing delivery media should consider the following variables in the research: sampling, size of sample, prior knowledge, ability, learning styles, media familiarity of the participants, teacher effects, time on task, and instructional method. The challenge of this study then was to design it in such a way as to address some of the criticisms of prior studies and at the same time provide a series of effective learning activities and assessment methodologies, identical for both sections, using a convenience sample of self-selected students for both groups. This study was conducted by the author, who taught two sections of a Principles of Management undergraduate course, one section online and the other FTF. This course was selected because it attracts both business and nonbusiness students, is a 200-level course, some learning outcomes are measurable by standardized means, and the FTF section is offered in the evening, the perfect section for working adults, as was the online section. Metrics included test grades, final grades, level of participation, number of discussion postings, quality of assignments, student ratings of effectiveness to learning, learning preferences and styles, and media knowledge.

Purpose of the Study

The purpose of the study, therefore, was to determine if there were significant differences in learning outcomes between two sections of the same course, one taught asynchronously online for fifteen weeks and one taught using a traditional format of FTF, three-hour classroom meetings once per week for fifteen weeks. The research questions for this study were as follows:

1. What are the demographic differences of the students in the two sections? If the differences were found to be statistically insignificant, then demographics would not be considered a factor for any differences in outcomes.
2. What are the learning preferences and styles of the students in the two sections and are there significant differences between the sections? If there were no significant differences, then differences in outcomes could not be attributed to learning preferences or styles.

3. How do the students describe the course? If the course were described the same way by the students in the two sections, it could be assumed that the two sections were perceived to be sufficiently the same, enabling the outcomes to be compared.
4. What is the precourse and postcourse computer familiarity and satisfaction of the students with online learning?
5. What are the differences in outcomes between the two sections of the course?

From these research questions emerged several null hypotheses:

1. There is no significant difference between the effectiveness of the learning activities as perceived by the two groups.
2. There are no significant differences between learning preferences/styles and success in the course for either group.
3. There is no significant difference between the descriptors used by the students of each group to describe the course.
4. There is no significant difference between the final grades and test scores of FTF and online students.
5. There is no significant difference between the effectiveness of the course as perceived by each group.

Review of Related Literature

Learning Preferences and Styles

Evolving from Carl Jung's writings and the sixteen psychological types and influenced by the thinking of such psychologists as David Katz, Kurt Kaffka, and Kurt Lewin is the work of David Keirsey, in the form of the Keirsey Character and Temperament Type instruments.

According to Keirsey and Bates (1984, 14–16), the person who needs people as a source for regenerating his/her energy can be classified as extraverted, whereas those who prefer solitude to recover energy may tend toward introversion. Introverts (I) tend to be slow to volunteer in the classroom, hesitate in sharing their ideas with others, and need privacy (Keirsey and Bates 1984, 101). The extravert (E) is ready to enter into group activities and to accept the ideas of others. Even though there is a great amount of interaction in the asynchronous online course, the student is free to leave the online environment at will and reenergize. In light of this, the descriptions of extraversion/introversion suggest that introverts might perform

better in online courses than FTF courses and find online courses more effective for their learning. Therefore, the research hypothesis was that introverted people would be more successful in online courses than extraverted individuals, and the opposite for FTF courses, and, consequently, this would have an impact on the outcomes.

Keirsey and Bates (1984, 121–128) classify four learning-style groups: sensation/perceiving (SP), sensation/judging (SJ), intuition/thinking (NT), and intuition/feeling (NF). The SP learning-style person needs physical involvement or a hands-on approach in the learning. He/she learns from media presentations and loves to be entertained. The SJ learning-style person needs structure and relies on clear instructions. He/she does not always enjoy discussion groups or small-group activities and prefers the instruction to be led by the teacher. The NT learning-style person loves to trade ideas with others and develop their own ideas. He/she focuses on technology and tends to be an independent learner. He/she is comfortable with a logical, didactic presentation of material and follows up on independent learning. James and Gardner (1995) suggest that, consequently, independent-learning students will find online learning more effective. The NF learning-style person has a built-in desire to communicate in a personal way with others. He/she likes two-way exchanges and likes personal feedback on whatever he/she produces. He/she likes interaction and participation in groups. He/she learns from the discussion method. He/she is especially responsive to learning in small groups, and to courses in which the instructor responds to and accepts the ideas of the class members. Even though there are some inconsistencies between the learning style descriptions and some attributes of online methodology, it appears that NT and NF learning styles may fit well with online learning; consequently, it was hypothesized that the SP- or SJ-style person would find the online learning less effective and might not succeed as well. The more successful online students would be more likely to be either the NF or NT type rather than the SP or SJ type.

Diaz and Cartnal (1999) suggest that if there are no differences in learning styles, then the learning activities used in the FTF classroom may be just as effective for the online course. Therefore, if it is found in this study that the learning styles are not significantly different between online and FTF groups, then the same learning activities should be effective for both groups as perceived by the students; and, consequently, the hypothesis would be that there is no significant difference in effectiveness of the learning activities between the two groups, and the differences in the outcomes are not a result of the learning styles.

The Modality Preference Inventory was used to measure the most efficient method of information intake for students. The instrument measures the strength of the visual, auditory, and kinesthetic/tactile modality for learning efficiency. A high score in the visual modality would indicate a strong visual learner who would benefit from text, charts, and graphs. A strong auditory learner would prefer FTF lectures. This suggests that a visual learner might find online learning more effective than an auditory learner, and, consequently, the learner's preference might influence the outcome.

Methodology of the Study

Both sections of the course met together for the first session in the classroom (FTF) for the course introduction and demonstration of accessing the online library databases and the Web. The FTF section then continued to meet FTF on a weekly basis. The online section "met" asynchronously the remainder of the term through WebBoard course management software and e-mail. The course was designed to use identical course activities and assessments. In order to ensure that both groups were given the same information and activities, it was necessary to use e-mail for some of the activities for the FTF group. Even though there were optional activities that were presented through e-mail for the FTF students, the only e-mail activity that was a requirement was exam taking (three exams); therefore, this section of the course may accurately be classified as an FTF course and not a Web-enhanced course (Boettcher 1999). Table 1 shows the learning activity and the site of the activity.

The discussions in the online section covered the same topics and activities as those in the FTF section. These were posted for public reading and

Table 1. Sites of Learning Activities

Learning Activity	Online	Face-to-Face
Chapter pretest	WebBoard	E-mail[a]
Lecture	WebBoard	Classroom
Thoughts for the day	WebBoard	E-mail[a]
Discussions	WebBoard	Classroom
Student presentations	WebBoard	Classroom
Chapter review	WebBoard	E-mail[a]
Chapter posttest	WebBoard	E-mail[a]
Exams	E-mail	E-mail[b]

[a]Optional. [b]Required.

interaction in the online section and were shared in small groups in the FTF section. All exams for both sections were open book, submitted individually to each student through e-mail, returned to the instructor the same way, graded within twelve hr, and returned to the student.

Statistical tests used in the analysis of the data included the *t* test, chi-square, product-moment correlation coefficient, analysis of variance, and rank order correlation coefficient.

Student Selection

Students self-selected the section in which to enroll; however, most students had little or no knowledge about online courses. Table 2 shows the gender, age, and employment information for the two groups.

Because work history (hours worked per week, age, and work experiences) might have an impact on the number of hours available to the students for participation, chi-square tests were run on the gender, age, and each set of employment variables to determine whether the two groups were significantly different. Even though the online students appeared to be a little older, with a few more years of work experience, the results showed no significant differences between the two groups.

Prior Media Knowledge

A variable that might affect whether a student selected an online course or an FTF course, as well as success in an online course, would be prior experience with technology-enhanced or online courses. Of the total 62 students, only 18 had experience with technology-enhanced courses and 6 with online courses; thus, the numbers show little experience with technology in courses among the two groups. The students were asked to assess their own competency in e-mail use, Web use, and online library database use at the beginning and end of the course. In the

Table 2. Demographics of Groups

Demographic	Face-to-Face[a]	Online[b]
Employed	92%	97%
Employed more than 10 years	41%	46%
Male/Female ratio	60/40	20/80
Nontraditional (> 22 years)	60%	73%

[a]$N = 25$. [b]$N = 37$.

precourse self-assessment, there was no significant difference in competency for e-mail or in Web use between the two groups. No one was competent in online library use at the beginning of the course. Both groups increased their competencies by 50% to 80% during the course.

Precourse and Postcourse Surveys

A precourse survey, which asked for gender, age, employment information, online experiences, and media knowledge, was administered to both sections of the course. The postcourse survey was administered anonymously through e-mail after grades had been disseminated to students. In addition to the questions mentioned earlier, the survey included questions on the effectiveness of learning in the course and student descriptions of the course.

Analysis and Results

Retention of Students

It is interesting to note that the retention rate of 84% was the same for the two sections. The reasons for withdrawal are unknown. There were no significant differences between the ages of the students in the two sections of the course at the beginning of the semester; however, by the end of the term, because of withdrawals, the percentage of nontraditional (>22 years) students had risen in the online section from 73% to 91% of the class, whereas the FTF percentage of nontraditional students saw an increase of only 3%. This would indicate that the students who withdrew from the online section were more likely to be the traditional-age students than those who withdrew in the FTF section. Both sections, however, saw the attrition rate of the traditional-age student (18–22) higher than that of the older student.

Effectiveness of Course

To get a sense of the general effectiveness of the instruction, the FTF students were asked to compare the effectiveness of this course to their learning in other typical FTF courses. As noted in Table 3, there was no significant difference between the two groups in their assessment of the learning effectiveness of the course.

Following the completion of the course, 95% of all the online students indicated a preference for online courses over FTF courses. It may be that

Table 3. Effectiveness of Course

Effectiveness	FTF	Online
This Course Was … Than Typical FTF Course	Comparison of This Course With Typical FTF Course (%)	Comparison of This Course With Typical FTF Course (%)
More effective	37	32
Same effectiveness	63	64
Less effective	0	4

Note: FTF = face-to-face. No significant differences between the two courses ($p < .05$).

the ease of use of the software, the Internet activities, and e-mail, supported by the methodology for the course, enhanced the students' attitude toward their online experiences, motivating their performance and success in the course, and, ultimately, their attitude toward taking further online courses (Atkinson and Kydd 1997; Davis 1989).

Effectiveness of Course Activities

The students were asked to evaluate the effectiveness of each major component of the course in relationship to their learning. The purpose was to ascertain any differences that might have an impact on the effectiveness of online versus FTF methodology, to investigate the relationship between learning styles and effectiveness, as well as to supply information for future course design. There was no significant difference between the two sections on the effectiveness of the various course activities, except for the pretest and the chapter review, which were found to be significantly ($p < .05$ level) more effective for the online sections. An examination of the data in Table 4 shows that in every activity, the percentage of students that rated the activity as "very effective," with the exception of discussions, was higher in the online section. A possible explanation may be that online students have little other than the posted activities to depend on for their learning, whereas the FTF students perceive that they have more informal support from their colleagues for learning. "Discussions" in the online section may not be viewed as quite as effective as FTF discussions for the students, as few of the students had prior experience with virtual discussions.

It is interesting to note that the learning activities that were submitted by e-mail (chapter pretests, thoughts for the day, chapter posttests) to the FTF students were viewed as less effective for their learning than for the online students. Even though almost all students reacted positively to their effec-

Table 4. Effectiveness of Course Activities

	Face-to-Face			Online		
Activity	Very Effective (%)	Effective (%)	Not Effective (%)	Very Effective (%)	Effective (%)	Not Effective (%)
Chapter pretests*	56	31	13	64	32	4
Lectures	75	25	0	86	14	0
Thoughts for day	31	50	19	50	45	5
Discussions	88	12	0	73	27	0
Assignments	50	50	0	73	27	0
Student presentations	32	50	18	45	45	10
Chapter reviews*	56	38	6	86	14	0
Chapter posttests	50	44	6	68	32	0

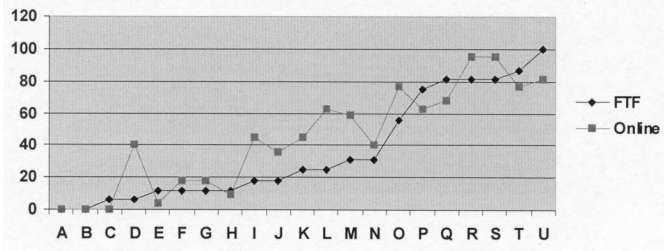
*Significant at the .05 level.

tiveness, it may have been more difficult for the FTF students to acclimate themselves to receiving instruction through e-mail rather than in handouts or orally in the classroom. Several of them remarked during the term about the tremendous volume of e-mail they were receiving, but when asked if these activities should be terminated, the answer was a resounding no.

Description of the Course

To determine the extent to which the two groups perceived the course in the same way, a list of course descriptors was compiled from ideas submitted by university instructors and culled from student evaluations of other courses. The students were given this list at the end of the course and asked to check those descriptors they felt applied to the course. They could choose as few or as many as they wished. Figure 1 shows the percentage of each group that chose each descriptor.

Both sections appeared to describe the course similarly in the descriptors used most frequently. Overall, there was a moderate correlation (r = .626) between the two groups. The five most frequently selected descriptors, selected by at least 70% of the students in both groups, were "fun," "learned a lot," "interesting," "idea sharing," and "interactive." Be-



Key for Descriptors

LETTER	DESCRIPTOR	LETTER	DESCRIPTOR
A	Little learning	L	Practical
B	Narrow in scope	M	Stimulating
C	Boring	N	Time-consuming
D	Demanding	O	Lots of information
E	Easy	P	Helped for Web skills
F	Personal	Q	Fun
G	Quantitative	R	Learned a lot
H	Theoretical	S	Interesting
I	Research-oriented	T	Idea sharing
J	Analytical	U	Interactive
K	Broad in scope		

Figure 1. Percentage of Students Selecting Each Course Descriptor (FTF = Face-to-Face)

cause of the moderate correlation, the similarity in most frequently used descriptors, and the similarity perceived in the effectiveness of the major facets of the course, we can be comfortable that both sections were equivalent in course presentation. Therefore, the comparison of test scores and final grades can be made without consideration of differences in course methodology.

Learning Preferences and Styles

To determine the effect of learning styles on success in the course, the students were asked to complete the Learning Modality Preference Inventory. Of the most successful online students (grades of A or A–), 40% had visual as their preferred or one of their preferred styles, whereas 66% chose kinesthetic as their preferred or one of their preferred styles.

Of the most successful FTF students (grades of A or A–), 43% had visual as their preferred style, whereas 43% had kinesthetic as their preferred

or one of their preferred styles. There was no relation between the preferred styles of learning and final grades in either group. It should be noted, however, that 66% of the online students and 60% of the FTF students were visual learners, whereas only three students from the entire population of students chose auditory as their preferred style.

Keirsey Temperament Inventory

The students were each asked to complete the Keirsey Temperament survey. A statistical test of final grades and learning style (NT, NF, SP, SJ) of both groups showed no significant difference between style and success at the .05 probability level. However, it is interesting to note in Table 5 that even though NTs comprised a much smaller percentage of the total online group, all of the NTs were successful (A or A– grades) students. The table also shows that about one-third of the SJs in the FTF course were successful students. Even though we statistically reject the research hypotheses for this study, that SJs would be more successful in FTF classes and NTs in online courses, the fact that all the NTs were successful in the online course and that the percentage of SJs was greater in the FTF class than in the online class, with only a third successful, points toward the necessity of further research in this area.

Statistical tests showed a low positive correlation between final grades and the introversion type for both groups. Of the online students, 49% were the introversion type, of which 53% earned A or A– grades. Fifty-three percent of the FTF group was the introversion type, of which 50% were the successful students. Because final grades are affected by participation, which may have other variables acting on it, further research should be con-

Table 5. Relation Between Learning Style and Success

	Online		Face-to-Face	
Type	Total Group (%)	Successful A/A– (%)	Total Group (%)	Successful A/A– (%)
SJ	59	59	80	33
SP	3	0	6	0
NF	24	14	7	0
NT	14	100	7	7

Note: SJ = sensation/judging; SP = sensation/perceiving; NF = intuition/feeling; NT = intuition/thinking.

ducted to determine whether there is a relation between learning type and perceived effectiveness of and satisfaction with the course.

Test Scores

The average test score was 88.1% for the online group and 86.2% for the FTF group. Even though the average test score was higher for the online group, the results of the *t* test showed no significant difference at the .05 probability level between the two groups.

Final Grades

The mean final grade was 3.5 (4.0 scale) for the online section and 3.35 for the FTF section. Again, we see the grades were actually higher in the online section but not significantly so.

Conclusions

The study compared two sections of the same course—one taught FTF and one taught online asynchronously. Even though this study did not preselect students, the demographics of age, work experience, and prior media knowledge showed no significant differences between the two groups. The retention rate of 84% was identical for the two groups; however, the attrition rate for the traditional student (18–22 years) was higher than that for the nontraditional student, especially in the online class. The results of this study support prior research findings that there is no significant difference in the major metrics—test scores, assignments, participation grades, and final grades; however, actual scores for the online group were slightly higher. Ninety-six percent of the online students found the course as or more effective to their learning than their typical FTF course, whereas 100% of the FTF students found this course as or more effective than their typical FTF course. There was no significant difference between the two groups in their assessment of the learning effectiveness of the course.

The individual course activities (chapter pretests, lectures, thoughts for the day, discussions, assignments, student presentations, chapter reviews, and chapter posttests) were assessed for effectiveness to learning by the students. No significant differences appeared between the assessments of the two groups for each activity except for two optional activities—the chapter pretests and chapter reviews. The major activities of the course were similar in effectiveness for the online and FTF groups. This may sug-

gest that FTF activities used in this course may be transferred to online courses with resulting similar learning for the students.

To ascertain learning styles of the students, two instruments were used: the Learning Modality Preference Inventory (visual, auditory, and kinesthetic/tactile preference) and the Keirsey Temperament Inventory (introversion/extraversion and NT, NF, SP, SJ styles). Approximately two-thirds of each group were visual learners, with only three of the entire population auditory learners. However, there was no significant difference between the most successful students (final grades of A or A–) and learning preference. In addition, there was no correlation found in either group between final grades and NT, NF, SP, and SJ learning types. According to the descriptions of the four types (Keirsey and Bates 1984), we could have assumed that SJs would be more successful in FTF classes and NTs and NFs more successful in online classes.

Because of the lack of significant differences of the two groups between grades and learning preferences, and low or nonexistent correlation between learning types and grades, we can assume that learning preference and type had little or no impact on final grades in this study. There was no statistical evidence that either the learning preference or type is a good predictor of success in an online or FTF course. This supports the findings that learning styles, patterns of learning toward Web-based instruction, and student characteristics do not have an effect on Web-based learning achievement (Shih et al. 1998). Because final grades are affected by participation, which is influenced by other variables such as motivation, family, and work commitments, the research study could be improved by examining the relation of learning preference and style to the effectiveness of the learning activities. Because the survey collecting the data for effectiveness was anonymous, this was impossible to determine in this study. Even though the students self-selected themselves into the online and FTF sections, no significant differences were found in the student demographics, the media knowledge, and the description of the course by the students between the two sections. The study supports the findings of many other studies in which no significant differences in final grades or test scores are found.

The results of the study must not be overgeneralized. The study demonstrated that equivalent learning activities can be equally effective for learning for online and FTF groups. However, it must be remembered that the FTF activities in this study had to be expanded to include e-mail activities to equal the richness of the online instruction. Faculty may be able to use the FTF methodologies and materials as a foundation in de-

veloping online courses but will find the media conducive to expansion of Web use for more effective learning. Likewise, once they have taught online, it is likely they will see the importance of adding Web enhancement to their FTF courses.

Finally, considering the statistically insignificant differences between the two groups of students in demographics, learning styles and preferences, perceptions of course and task effectiveness, description of the course, and technical competencies, this study provides one more addition to the growing body of literature that asserts the quality of online learning is as effective as FTF learning.

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