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On-Line Course Effectiveness: An Analysis of Student Interactions and Perceptions of Learning

Alfred P. Rovai and Kirk T. Barnum

Abstract

Nineteen on-line graduate courses were analyzed in order to determine how perceived learning varies by course and its relationship to active and passive participation by students in on-line discussions. Study results provided evidence that significant differences existed by course, suggesting that quality assurance is an issue in Internet-based instruction. Moreover, female students felt that they learned more than their male counterparts. Only active interaction, operationalized by the number of messages posted by students per week, was a significant predictor of perceived learning. Passive interaction, analogous to listening to but not participating in discussions and operationalized by the number of accesses to the discussion boards of the e-learning system each week, was not significant.

Résumé

Dix-neuf cours en ligne de deuxième cycle ont été analysés afin de déterminer comment la perception de l'apprentissage varie selon le cours et aussi afin de définir le lien avec la participation active et passive des étudiants dans les discussions en ligne. Les résultats de l'étude ont fourni des indices sur l'existence de différences importantes selon le cours, suggérant que l'assurance de la qualité est une question importante dans la formation utilisant l'Internet. De plus, les étudiants de sexe féminin ont le sentiment d'avoir appris davantage que le pensent leurs collègues masculins. L'interaction active, opérationnalisée par le nombre de messages affichés par les étudiants par semaine, était le seul indice significatif de l'apprentissage perçu. L'interaction passive, analogue à écouter mais ne pas participer aux discussions et opérationnalisée par le nombre d'accès aux forums de discussion du système de *e-learning* chaque semaine, n'était pas significatif.

Introduction

Some people are concerned that distance education is compromising the quality of education. They believe that technology will denigrate higher education and destroy the special relationships instructors have with their students and students have with each other. They cite research evidence that suggests courses taken at a distance can be impersonal, superficial, misdirected, and potentially dehumanizing and depressing, and that they

disrupt the interactions that create a productive learning community (Nissenbaum & Walker, 1998; Phipps & Merisotis, 1999; Trinkle, 1999).

On the other hand, many researchers believe that the course delivery medium is rarely the determining factor for a variety of educational outcomes, including student satisfaction and learning (Russell, 1999) and that strong feelings of community can be developed in distance learning environments (Rovai, 2001). Moore and Thompson (1990) and Verduin and Clark (1991) suggested that teaching and studying at a distance can be as effective as traditional instruction provided: (a) the methods and technologies used are appropriate to the instructional tasks, (b) there is student-student interaction, and (c) there is timely teacher-to-student feedback. Merisotis and Phipps (1999), in a review of the research literature on the effectiveness of distance education, concluded that the technology involved "is not nearly as important as other factors, such as learning tasks, learner characteristics, student motivation and the instructor" (p. 17). Furthermore, Owston (1997) wrote, "the key to promoting improved learning with the Web appears to lie in how effectively the medium is exploited in the teaching and learning situation" (p. 29). This view supports Clark's (1983) argument that how the medium is used determines course effectiveness, not the medium itself. Thus although there remains some debate, many experts in distance education are convinced that learning at a distance can be as effective as traditional programs. The question that then arises is what does research suggest differentiates those distance courses that are more effective from those that are less so?

Jones and Paolucci (1997) reported that less than 5% of the published research since 1993 is sufficiently valid to support any conclusions about the effectiveness of using technology in teaching. Moreover, Phipps and Merisotis (1999) questioned the quality of research on the effectiveness of distance education, in particular, the validity and reliability of measurements of student outcomes. Consequently, the issue of on-line course effectiveness remains the subject of continued debate.

Carr (2000) reported significant variation in distance education dropout rates among schools, with some postsecondary schools reporting course-completion rates of more than 80% and others finding that fewer than 50% of students finished their distance education courses. Such outcomes suggest that distance education programs are not equally effective. Part of the explanation for this situation may be the variety in course designs. Boshier et al. (1997) described the design of on-line courses along a continuum ranging from "best dressed" to "worst dressed" based on attractiveness, interactivity, and accessibility. They reported that most on-line courses they examined were clustered toward the "worst dressed" end of the continuum. Such courses were particularly deficient in the area of interaction, both student-instructor and student-student.

The variety of on-line course designs makes it difficult to characterize the typical on-line program; one might as well try to characterize the typical animal in a zoo. Some on-line courses resemble the traditional lecture course, others come across as self-paced correspondence courses with no student-student interaction and limited instructor feedback, whereas others are designed to encourage interaction between students and between students and the instructor. Some on-line courses include collaborative group work and others do not, and some are taught entirely on line, whereas others include face-to-face meetings. In addition, some on-line instructors are well trained in on-line course design and teaching methods whereas others receive no training. Consequently, generalizing course effectiveness research findings across all on-line courses is a problem unless confounding variables such as course design, pedagogy, technology, and student characteristics and needs are controlled and generalizations are restricted to on-line courses with similar characteristics.

Interaction

The amount of interaction in a course appears to be an important element of course effectiveness. Wagner (1994) defined interaction as an interplay and exchange in which individuals and groups influence each other. Thus interaction focuses on the interpersonal behaviors in a learning community. The positive relationship between interaction and learning has been documented in traditional classrooms (Menzel & Carrell, 1999; Powers & Rossman, 1985). On-line distance education environments that use major e-learning systems such as Blackboard.com℠ and WebCT℠ are capable of supporting all the components of the instructional process, including interaction. If the course encourages interactions, active learning models that follow the social constructivist model of Vygotsky (1978) predict that successful learning is likely to result. These learning models require students to construct their own knowledge in a self-directing manner and to take on more responsibility for their own learning.

The research literature also suggests that instructor immediacy is positively related to learning (Christophel, 1990; McCroskey, Sallinen, Fayer, Richmond, & Barraclough, 1996). Instructor immediacy refers to communication behaviors that reduce social and psychological distance between people (Mehrabian, 1971). Instructor behaviors that promote verbal immediacy include teachers referring to students by name, employing humor in class, using self-disclosure, soliciting students' opinions, and using inclusive pronouns when referring to the class (Gorham, 1988). Instructors can also display nonverbal immediacy through such behaviors as making eye contact with students, using positive facial expressions, maintaining a relaxed body position, and employing variety in vocal inflection (Richmond, Gorham, & McCroskey, 1987). On-line instructors

can manifest verbal immediacy in an on-line learning environment, but nonverbal immediacy behaviors are more difficult in a text-based environment. Freitas, Myers, and Avtgis (1998) suggest that immediacy behaviors could also be associated with student learning in on-line courses.

Gunawardena and Zittle (1997) argued that on-line students can create social presence by projecting their identities and building on-line communities through text-based communications alone. Zirkin and Sumler (1995) reported that in a distance education environment, "The weight of evidence from the research reviewed was that increased student involvement by immediate interaction resulted in increased learning as reflected by test performance, grades, and student satisfaction" (p. 101). Moreover, Hirumi and Bermudez (1996) reported that on-line courses can be more interactive than traditional ones, providing more personal and timely feedback to meet students' needs than is possible in large traditional courses. However, student perceptions do not necessarily support the view that on-line courses can result in quality interaction and learning. Smith (1996) found that about 30% of nearly 400 commuter students attending Purdue University Calumet for at least two semesters who responded to a survey about distance learning revealed that they would definitely not select distance education because they felt that it could not provide the learning and other qualities they desired from a traditional course. Interestingly, survey results also revealed that if the respondents had the option of taking a course at a distance or in a classroom, 59% would definitely take the distance course and well over half of these were female students.

Learning

Verduin and Clark (1991) reviewed 56 studies that compared the academic achievement of students in traditional classrooms with that of students in a variety of distance learning programs and found that students using "DE methods achieve similar, if not superior, results when compared with conventional methods of teaching" (p. 213). Hiltz and Wellman (1997) reported that student grades are the most prevalent measure of learning outcomes.

The use of grades to operationalize learning may not always provide the best results. Classroom test grades or final course grades, particularly for graduate university courses, tend to have restricted ranges, that is, they tend to reflect uniformly superior achievement, thus severely limiting their use in any correlation study. Whenever the range of a variable is restricted, any correlation involving that variable is artificially reduced and the statistical results are not trustworthy. In addition, grades may have little relationship to what students have learned. Students may already know the material when they enroll or their grade may be more

related to class participation, work turned in late, or attendance than to learning. Furthermore, grades may not be a reliable measure of learning, particularly for the authentic performance tests that are valued in constructivist learning environments, as different teachers and even the same teachers over time are unlikely to assign grades consistently. Therefore, using grades as a measure of cognitive learning can be problematic.

Research evidence suggests that self-reports can be a valid measure of learning. Moreover, students' perceptions may be more important than reality, as decisions about learning are often based on perceptions. Pace (1990) supported the validity of students' self-reports of learning based on research evidence that suggested consistency of results over time and across different populations. He also found that patterns of outcomes varied for self-reports of learning across majors and length of study in the same manner, as was established through direct achievement testing. In a summary of this research, Corrallo (1994) noted that a considerable amount of literature is concerned with establishing the validity of students' self-reports of cognitive outcomes. He concluded that self-reports of cognitive gain are indicative of results obtained through more direct forms of assessment. Accordingly, the present study uses self-reports to operationalize learning.

Purpose

In the light of lingering concerns about learning outcomes in on-line courses, the purpose of this study was to ascertain how students perceived learning in a number of on-line graduate courses. Of particular interest was how perceptions varied by course when all were delivered by the same university where institutional variables such as e-learning system, course duration, and on-line support services were held constant. The extent of any differences is likely to be related to the influence of course design and pedagogy on perceived learning as well as individual student variables such as motivation. A second purpose was to determine how perceptions of learning were related to course-related interactions. Based on the constructivist philosophy of learning, one would expect that measures of interaction would be directly related to learning. However, the relationship of active and passive participation in on-line interactions to learning is not fully understood. In particular, do the learning benefits of interaction require on-line students to participate actively in discussions by posting messages, or can more passive participation by mostly reading messages (i.e., analogous to listening to a conversation) provide similar levels of learning?

Methodology

Participants

Participants in the study were 328 volunteers out of 527 graduate students enrolled in 19 on-line graduate courses, resulting in a 62.24% volunteer rate. The study included 108 (32.9%) men and 220 (67.1%) women. The ethnic breakdown was 200 (61.0%) white participants, 82 (25%) African-American participants, 1 (0.3%) Hispanic participant, 8 (2.4%) Asian participants, and 20 (6.1%) participants who classified their ethnicity as other. Ethnicity data were not provided by 17 (5.2%) of the participants. The mean age of the 315 participants who divulged this information was 39.93 (*SD*=9.22). The youngest and oldest participants were 21 and 60 years old respectively.

Setting

A total of 28 fully on-line education and leadership courses were presented by the university during the semester in which data for the present study were collected. Nineteen of these courses were used. The nine courses not sampled were organized as independent studies with enrollments of fewer than eight students each and with little to no on-line discussions. The 19 graduate courses examined by this study were delivered at a distance by an accredited nondenominational Christian university in the state of Virginia using the Blackboard.com[SM] e-learning system. This system consists of an integrated set of productivity, communication, assessment, and content management tools that allow instructors to design and present on-line instruction. All courses were one semester (i.e., 16-weeks) in duration and were taught entirely via the Internet by faculty experienced in on-line teaching who understood the importance of interactions in learning. A total of 13 courses were education courses and the remaining six were leadership courses. The education courses included titles such as School and Community Relations, Advanced Human Learning and Motivation, Educational Statistics, Multicultural Education, First and Second Language Acquisition, and Technology Integration in Curriculum and Instruction. Leadership courses included Foundations of Effective Leadership, Ethics and Values in Organizational Transformation, and Team Leadership for Organizational Optimization.

Instrumentation

Perceived learning was measured by student self-reports of their learning. The instrument employed was first used by Richmond et al. (1987) and has since been used in many studies related to learning. Participants were asked to respond to the following item (perceived learning in the present course): “On a scale of 0 to 9, how much did you learn in this course, with

0 meaning you learned nothing and 9 meaning you learned more than in any other course you've had?" McCroskey et al. (1996) reported that test-retest reliability over a five-day period was .85 in a study of 162 adult learners. They also reported that a sample of 365 university students at West Virginia University enrolled in various traditional courses responded to the perceived learning question with M=6.0 and SD=2.0.

For the present study, participants were also asked to respond to the following two items (perceived learning if taught in a traditional classroom and perceived learning if taught by the ideal instructor): (a) "On a scale of 0 to 9, with 0 meaning you learned nothing and 9 meaning you learned more than in any other course you've had, how much do you think you could have learned in this course if it had been a traditional face-to-face course that met regularly in a classroom?" (b) "On a scale of 0 to 9, with 0 meaning you learned nothing and 9 meaning you learned more than in any other course you've had, how much do you think you could have learned in this course if you had the ideal instructor?"

Interactions were recorded by the Blackboard.com[SM] e-learning system. This system allowed for the generation of reports on course usage and activity. In particular, two measures of interactivity were retrieved from the e-learning system: (a) active interaction—operationalized by the number of messages posted to the course discussion boards by students per week; and (b) passive interaction—operationalized by the number of accesses to the course discussion boards by students per week. Passive interaction represents the average number of times each week that students accessed and presumably read the various messages posted to the course discussion boards. By way of an analogy with spoken communication, active interaction represents the average number of times per week that the students spoke during the course; and passive interaction represents the average number of times per week that students listened to others during the course. However, there was no way to determine how long students spent on each posted message or whether they actually read the messages in the discussion boards that they accessed.

Procedures

The three perceived learning items, along with demographic questions regarding sex, ethnicity, and age, were made available to students via an on-line survey. Data were collected during the final three weeks of the semester and for one week following the semester so that students would have substantial exposure to their respective courses. The researcher e-mailed students on a weekly basis during the four-week data-collection effort providing directions and encouragement for completing the survey. Archived interaction data for the active and passive interaction variables

were retrieved at the end of the semester from the Blackboard.com[SM] course statistics area and the discussion boards.

Design and Data Analysis

The study used primarily ex post facto and correlational designs to respond to the following research questions: What is the perceived learning of on-line graduate students? Does perceived learning vary significantly by on-line course? What are the perceptions of on-line students regarding opportunities for learning if they had taken their course in a traditional classroom or had their ideal instructor? How is perceived learning related to active and passive interaction? The procedures used for each analysis are described in the results section below.

Results

A total of 328 study participants were measured using the three perceived learning items. Means (with standard deviations in parentheses) for perceived learning in this course, perceived learning if taught in a traditional classroom, and perceived learning if taught by the ideal instructor were, in order, 6.96 (1.63), 7.40 (1.66), and 7.69 (1.37). Table 1 displays the descriptive statistics for these variables disaggregated by course. The means by course of perceived learning if taught in a traditional course varied from a low of 5.98 to a high of 8.00. The results of paired *t*-tests, which tested perceived learning if taught in a traditional classroom and perceived learning if taught by the ideal instructor to perceived learning in the present course, are also displayed for each course.

A one-sample *t*-test was conducted to compare perceived cognitive learning in the present course to a mean of 6.0, which was reported by McCroskey et al. (1996) for a sample of 365 university students enrolled in various traditional courses. The sample mean of 6.96 (SD=1.63) was significantly higher than 6.0 ($t(327)=10.68$, $p<.001$). Cohen's measure of effect size, d=.59, suggested a medium effect size.

In addition, a one-way multivariate analysis of variance (MANOVA) was performed to evaluate the differences in perceived cognitive learning by on-line course. On-line courses, the independent variable, consisted of the 19 courses in the present study. The dependent variables were the three measures of perceived learning. Significant differences were found among the 19 courses on the dependent measures, suggesting that the on-line courses were heterogeneous regarding perceived learning (Wilks' Λ=.73, $F(54, 870)=1.82$, $p<.001$). The multivariate η^2 based on Wilks' Λ suggested a moderate effect size.

Post hoc analyses of variance (ANOVAs) on each dependent variable were also conducted. The ANOVAs using perceived learning in the present course, $F(18, 294)=2.54$, p=.001, η^2=.14, and perceived learning if

Table 1
Descriptive Statistics for Measures of Perceived Cognitive Learning by Course

	Present course		*Traditional course*		*Ideal instructor*	
Course	*M*	*SD*	*M*	*SD*	*M*	*SD*
1	7.80	.86	7.87	1.36	8.33*	.90
2	6.00	2.71	6.55	2.46	7.60*	1.23
3	6.87	1.46	8.57*	.66	8.17*	.78
4	7.54	1.45	7.31	2.43	7.85	1.63
5	6.00	2.30	6.53	2.00	6.60*	2.03
6	7.00	1.69	7.20	1.74	7.33	1.54
7	8.00	1.36	8.00	1.24	8.14	1.17
8	7.16	1.42	7.58	1.68	7.79	1.36
9	6.67	.87	7.11	1.36	7.67*	.87
10	6.71	1.60	7.86*	1.46	7.86*	1.07
11	7.46	1.61	7.62	1.61	8.15	.90
12	7.29	1.35	7.38	1.47	7.38	1.53
13	6.78	1.39	7.44	1.01	7.44	1.13
14	6.20	2.39	6.40	2.30	7.60	.55
15	6.93	1.21	7.86*	1.04	7.82*	1.33
16	7.64	1.22	7.93	1.21	7.21	2.72
17	7.28	1.65	7.25	1.83	7.65	1.42
18	7.20	1.20	6.65	1.87	7.45	1.00
19	5.98	1.50	7.00*	1.46	7.58*	1.28

Note. The perceived learning scales can range from a low of 0 to a high of 9.
*Significantly different from perceived learning in the present course, $p<.05$.

taught in a traditional classroom, $F(18, 294)=2.14$, $p=.005$, $\eta^2=.12$, were significant. Effect size as evaluated by η^2 suggested large effects. Perceived learning if taught by the ideal instructor ($F(18, 294) = 1.47$, $p=.10$, $\eta^2=.08$) was not significant. Post hoc pairwise comparisons among the 19 courses were conducted for perceived learning in the present course. Fisher's Least Significant Difference test provided evidence ($p<.05$) that significant differences existed in 22.22% of the comparisons.

A one-way within-subjects ANOVA was conducted, with the independent variable being the three items that measured perceived learning and the dependent variable being the perceived learning scores. The ANOVA results indicated a significant effect (Wilks' $\Lambda=.85$, $F(2, 311)=27.13$, $\eta^2=.15$, $p<.001$). Post hoc orthogonal polynomial contrasts were also conducted to examine the means of the three related items. The analysis revealed a significant linear effect with means increasing over the three items ($F(1, 312) = 53.68$, $\eta^2=.15$, $p<.001$). The quadratic effect was not significant. Figure 1 displays this trend line.

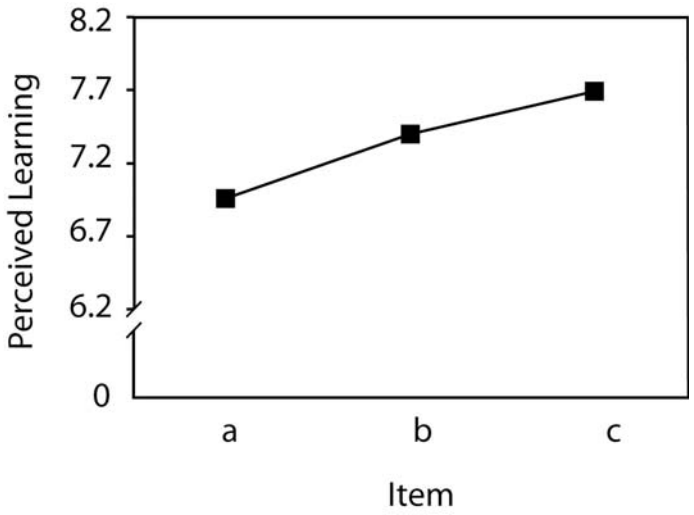

Figure 1. Trend line showing mean perceived learning response for the following related items: (a) perceived learning in the present course, (b) perceived learning if taught in a traditional classroom, and (c) perceived learning if taught by the ideal instructor.

Additional MANOVAs were conducted to determine if significant differences existed between disaggregated data. These analyses revealed that no significant differences in all three measures of perceived learning existed between the education and leadership courses and between ethnic groups. However, female participants scored significantly higher than their male counterparts (Wilks' Λ=.97, $F(3, 309) = 3.02$, p=.03). The multivariate η^2 based on Wilks' Λ was small. Table 2 displays the means and standard deviations for these two groups on each of the dependent variables.

Post hoc ANOVAs for each dependent variable were conducted to test gender differences by dependent variable. The ANOVA using perceived learning in the present course was significant ($F(1, 311) = 6.67$, p=.01, η^2= 02). In addition, perceived learning if taught in a traditional classroom ($F(1, 311) = 4.91$, p=.027, η^2= 02) and perceived learning if taught by the ideal instructor ($F(1, 311)$=4.38, p=.037, η^2=.01) were also significant. The effect size was small for all analyses.

Means (with standard deviations in parentheses) for active interaction (i.e., number of messages posted to the course discussion boards by students per week) and passive interaction (i.e., number of accesses to the course discussion boards by students per week) were, in order, 2.93 (1.82) and 80.46 (39.75). Mean number of messages posted per week ranged from

Table 2
Descriptive Statistics for Measures of Perceived Cognitive Learning by Gender

	Present course		*Traditional course*		*Ideal instructor*	
Sex	*M*	*SD*	*M*	*SD*	*M*	*SD*
Female	7.11	1.62	7.54*	1.64	7.80*	1.34
Male	6.60	1.66	7.10*	1.68	7.46*	1.41

Note. The perceived learning scales can range from a low of 0 to a high of 9.
*Significantly different from perceived learning in the present course, $p<.05$.

0.00 to 19.30. Perceived learning in the present course for the subjects who posted on average 10 or more messages per week (n=12, M=7.83, SD=1.40) was significantly higher than for the participants who posted on average only one message per week (n=24, M=6.33, SD=1.63), $t(34)=2.72$, $p=.01$, $\eta^2=.18$. The mean number of discussion board accesses per week ranged from .06 to 231.13. Perceived learning in the present course for the participants who accessed the discussion boards on average 50 or more times per week (n=46, M=7.22, SD=1.69) was significantly higher than for the participants who accessed the discussion boards on average seven or fewer times per week (n=29, M=6.17, SD=2.04), $t(73)=2.41$, $p=.02$, $\eta^2=.07$.

Correlation coefficients were computed for the two measures of interaction and the three measures of perceived learning. The results of this correlation analysis are displayed in Table 3. Seven of the 10 correlations, reflecting low to moderate relationships, were statistically significant at the .05 level. A standard multiple regression analysis was also conducted to evaluate how well active and passive interaction predicted perceived learning in the present course. The linear combination of total accesses to the discussion boards and total messages posted was significantly related to perceived learning ($F(2, 325) = 25.24$, $p<.001$. The sample coefficient of

Table 3
Intercorrelations Between Measures

Measure	*1*	*2*	*3*	*4*	*5*
1. Passive interaction	—	.41*	.20*	.14	.01
2. Active interaction		—	.36*	.05	.22*
3. Perceived learning in this course			—	.46*	.62*
4. Perceived learning if taught traditionally				—	.51*
5. Perceived learning if taught by the ideal instructor					—

Note. *$p<.05$.

multiple determination R^2 was .14, indicating that approximately 14% of the variance of perceived learning in the sample can be accounted for by the linear combination of the two interaction measures. However, only the partial correlation between active interaction and perceived learning (r=.32) was statistically significant (p<.05). It alone accounted for 11% of the variance of perceived learning, whereas passive interaction contributed only an additional 3%.

Discussion and Conclusions

The purpose of this study was to ascertain how graduate students perceived learning in a variety of on-line courses. It was assumed that such perceptions of learning were primarily related to the quantity and quality of learning experienced by students in these courses. However, only self-report measures of learning were used in the present study. It is possible that variables other than pedagogy may affect perceived learning as reported by students, such as students' educational goals, motivation to learn, and prior experiences, as well as their predispositions, beliefs, and attitudes regarding on-line learning. Moreover, research in student evaluations of teaching (Marlin & Niss, 1980) provide evidence of a significant positive relationship between grades earned and course evaluations and that some students will occasionally evaluate courses exceptionally low in response to a low course grade. Consequently, it is possible that such behavior occurred in the present study in response to the self-report perceived learning measures. Some students with low grades in course assignments may have responded to the self-report measure regarding perceived learning in the present course in a dishonestly low manner as they might do in an end-of-course evaluation.

The present study provided evidence of significant differences in perceived learning among the 19 on-line graduate courses taught by the same university. Although only three of the 19 courses were rated as equal to or less than the perceived learning mean of 6.0 as reported by McCroskey et al. (1996) for a sample of traditional course students, the scores among the 19 on-line courses in the present study showed considerable variability (SD=1.62). Moreover, the effect size as evaluated by η^2 was large. These results provide additional evidence that not all on-line programs and courses are equally effective (Carr, 2000), and that large differences in student perceptions of learning exist between on-line courses. These results provide some evidence to support the need for quality assurance in on-line learning programs. In the context of distance education, quality assurance seeks to balance course design, pedagogy, and technology with the needs of learners. Because the quality of educational programs is valued by school administrators, on-line courses should reflect a stable and repeatable process. Accordingly, adherence to an agreed-on set of

standards for monitoring, evaluating, and strengthening on-line course design, pedagogy, and technology are needed. Such an approach allows schools to demonstrate their own individuality and does not impose set standards on them.

Notwithstanding the 56 studies reviewed by Verduin and Clark (1991) in which learning in distance education equaled or surpassed learning in traditional courses, participants in the present study projected that they would have acquired greater learning had they been enrolled in traditional courses instead of on-line courses. Moreover, they projected that their learning would have been even greater if they had been taught by their ideal instructor. These differences in projected learning suggest that on-line students view pedagogy as more important to learning than the course delivery medium. Such a finding supports the views of Clark (1983), who asserted that how the medium is used determines course effectiveness, not the medium itself.

The differences in perceptions between learning in the on-line course and a traditional course is consistent with the research of Smith (1996), who found that many students would not select distance education because they felt that it could not provide the learning they desired in a traditional course. Nonetheless, the question arises, are these differences in learning perceptions real or imaginary?

The perceived learning of the 328 on-line university students sampled in this study was significantly higher than that of a normative group of 365 university students enrolled in various traditional courses as reported by McCroskey et al. (1996). These results suggest that the perceived loss in learning reported by on-line students may be more a matter of perception than of reality. However, more research is required to confirm this hypothesis.

In order to determine why the on-line students felt as they did, a sample of 10 participants who felt that they would learn more in traditional courses were asked by the researchers why they felt as they did. Responses centered on two themes. First, they felt that traditional course delivery would result in increased learning because the human energy, charisma, personality, and appeal generated by a good instructor would come through more dramatically in a face-to-face setting and inspire more learning. The second theme was that these on-line students believed a classroom creates an environment that is more responsive to their learning needs, where the instructor has more instructional tools available, such as a chalkboard, and can use them in order to clarify teaching points. They felt that in on-line settings there were delays, students were often required to find the answers themselves using available resources, and some on-line students perceived the process of socially negotiating a common understanding through text-based dialogue as tedious and inefficient,

especially without the visual imagery one is likely to experience in face-to-face discussions when the instructor uses an object or chalkboard to reinforce a point. However, the researchers felt that many of these on-line students appeared to compare their on-line course with what would be for them an idealized traditional course and instructor, with substantial time available for the types of classroom activities that they value, such as group projects and discussions. Consequently, perceptions of on-line learning pale in comparison to an individual's idealized learning environment.

Female students reported significantly higher levels of perceived learning in their on-line courses than did male students. This difference can possibly be explained by gender-related differences in communication patterns. Belenky, Clinchy, Goldberger, and Tarule (1986) theorized two paths of normal development in adult learning that result in two different communication patterns: (a) the independent voice—the independent or autonomous path, which is typical of the majority of men (and some women); and (b) the connected voice—the interdependent, relational, or connected path, which reflects the majority of women (and some men). This model suggests that many female students place emphasis on relationships and prefer to learn in an environment where cooperation is stressed over competition. The connected voice nurtures classroom community-building, whereas the independent voice does not.

Communication pattern differences by gender were previously reported in research of on-line courses (Blum 1999; Rovai, 2001). The present study provides evidence to support the hypothesis that gender-related differences in perceived learning also exist in on-line courses. This hypothesis appears reasonable given the important role of interaction in the constructivist philosophy of learning. If true, the implication for practice is that on-line instructors must recognize various student learning preferences (i.e., independent or interdependent) and make curriculum decisions to suit the preferences of their various students rather than assuming that one model fits all.

The present study also provided evidence that students' perceived that learning from on-line courses was positively related to quantitative measures of course interaction, as expected. However, judgments about the relative importance of the two interaction variables are difficult because these variables are correlated. Nonetheless, only the active interaction measure, representing the number of student message posted to discussion boards, was significant. This finding affirms the importance of providing opportunities for on-line students to learn by active interaction with each other and with the instructor (Zirkin & Sumler, 1995). Consequently, educators should develop and include highly interactive material

in distance learning and encourage students to participate in on-line discussions.

However, the data from the present study provide only limited evidence to suggest that students who participate in course discussions less than others perceive that they learn less. Other variables are also likely to be important. For example, research on brain hemisphericity (Good & Brophy, 1990) has revealed that left- or right-mode preference determines how a student receives information. These findings (Cronbach & Snow, 1977) also suggest that students tend to reach higher levels of achievement when they are taught in ways that are compatible with their right- or left-mode tendencies. Right-mode-preference individuals can be classified as imaginative or dynamic learners. Because these learners usually prefer discussing and sharing with others, it seems that these on-line students are inclined to gain the most from on-line discussions. Moreover, Sternberg (1994) suggested, "We all have a style profile, meaning we show varying amounts of each style, but we are not locked into any one profile. We can vary our styles to suit different tasks and situations" (p. 36). Consequently, it is possible that all students will benefit from on-line discussions.

Findings also suggest that passive interaction, analogous to listening to but not participating in discussions, was not a significant predictor of perceived learning in the present study. Consequently, using strategies that promote active interaction appears to lead to greater perceived learning and may result in higher levels of learner satisfaction with the on-line learning environment. However, the benefits of on-line education work only when the course is carefully designed to achieve these benefits. Technology is not self-implementing, and effective course design and pedagogy are required to achieve quality educational outcomes.

This study examined only quantitative measures of interaction. Future studies in this area should use additional measures of learning such as course grades complemented with interviews in order to provide anecdotal evidence of learning. The quality of interactions is another important aspect of communications that should be the topic of further research in which the role of cognitive content and instructor immediacy behaviors are examined. Moreover, research is required to identify the elements of on-line course design that are significantly related to learning and overall course effectiveness.

The ability to generalize findings beyond the present study is limited because only one university was sampled and the learner characteristics, course content, course design, and pedagogy used by the instructors in the present study may not be representative of other instructors and other settings. Study results may not generalize to other distance education formats such as television-based systems. In addition, all the limitations associated with ex post facto research designs also apply to this study. In

particular, the researchers exercised no experimental control over the courses examined in the present study.

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Alfred P. Rovai is an associate professor of education, Regent University, Virginia Beach, Virginia, where he teaches research, statistics, and program evaluation courses on-line in a Doctor of Education program; contact Fred at alfrrov@regent.edu.

Kirk T. Barnum is a student in the Doctor of Education program, an on-line program presented by Regent University, Virginia Beach, Virginia, and is a research assistant to Alfred Rovai; contact Kirk at kirkbar@regent.edu.