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Abstract

This literature review summarizes research on online teaching and learning. It is organized into four topics: course environment, learners' outcomes, learners' characteristics, and institutional and administrative factors. The authors found little consistency of terminology, discovered some conclusive guidelines, and identified developing lines of inquiry. The conclusions overall suggest that most of the studies reviewed were descriptive and exploratory, that most online students are nontraditional and Anglo American, and that few universities have written policies, guidelines, or technical support for faculty members or students. Asynchronous communication seemed to facilitate in-depth communication (but not more than in traditional classes), students liked to move at their own pace, learning outcomes appeared to be the same as in traditional courses, and students with prior training in computers were more satisfied with online courses. Continued research is needed to inform learner outcomes, learner characteristics, course environment, and institutional factors related to delivery system variables in order to test learning theories and teaching models inherent in course design.

Keywords: distance education, Internet courses, online teaching, web-based instruction

With the rapid development of technology, online instruction has emerged as an alternative mode of teaching and learning and a substantial supplement to traditional teaching. In the academic year 2000–2001, 90% of public 2-year and 89% of public 4-year institutions offered distance education courses. In the same year, an estimated 2,876,000 individuals were enrolled in college-level, credit-granting distance education courses, with 82% of

these at the undergraduate level. Of those institutions offering distance education, 43% offered Internet courses using synchronous computer-based instruction, which can also be called online courses (Waits & Lewis, 2003). Synchronous online classes are offered in such a way that all students are online and communicating at the same time, while asynchronous online classes are those that students can log on to and work on even if no one else is logged on at the same time.

Web-based education uses the Internet and communication technologies, ranging from the Internet as a research tool to taking online classes. In some instances the Internet is also used to supplement instruction, as in the use of a website to communicate information to students who are in a face-to-face class. *Online classes* are courses that are delivered completely on the Internet. *Hybrid* or *blended courses* are those that combine online components with traditional, face-to-face components. The term *distance education* is also used to describe any courses that are delivered to students who are not present in the same room. These might be delivered via interactive television, online courses, and courses using videotapes, television, or correspondence. *E-learning* may be used to describe any learning that is electronically mediated or facilitated by transactions software (Zemsky & Massy, 2004). The term *traditional course format* is interchangeable with *face-to-face format*.

Enrollment in online classes in the United States is increasing by 33% per year (Pethokoukis, 2002), and the market was estimated at 2.3 million students in 2002 (Katz-Stone, 2000), with almost 200 schools offering online graduate degrees (Pethokoukis). Though online instruction and learning constitute a relatively new frontier for education research, with an expected increased use of the Internet for instruction and apparent plans for even more use, an assessment of research in this area is needed to help guide effective ways to teach online (Broad, 1999). Accordingly, the purpose of this article is to review the empirical literature related to online course instruction. Since few reviews report on face-to-face courses and hybrid courses for purposes of comparison, we are limited in our ability to report on such investigations. Similarly, this review focuses on empirical research reports about online course instruction rather than on program descriptions or conceptual articles.

Sources of Data

We completed our search for literature in two stages. First, we reviewed literature that we found in electronic databases using online course descriptors. In the second stage we searched for articles cited in some of the articles that we had read and searched Internet journals and tables of contents of journals. We used ERIC, PsycINFO, ContentFirst, Education Abstracts, and WilsonSelect. Our search descriptors included *online course and instruction, cyberspace course, computer-based course/instruction/learning, distance education, e-learning, online teaching, web-based teaching, Internet/teaching/instruction, computer assisted instruction, computer software instruction, telecourses, instructional technology in education, virtual learning,* and *distributed learning.* We reviewed 91 articles and deleted 15 of these. They were discarded because they were about general distance education and not online courses in particular. The Appendix includes the authors, date of publication, method, purpose of the study, participants, and the research method for each article reviewed and, as well, the aspect (course environment, learners' outcomes, learners' characteristics, and institutional

and administrative factors) of our review for which each study was used. All of the 76 studies cited in the Appendix are included in this literature review.

Methodologies of the Literature

In this section we summarize the various research methods used in the studies we reviewed. Generally, the earlier studies that we reviewed were descriptive and somewhat exploratory, whereas the more recent quantitative studies were more experimental and causal-comparative in design.

Summary of Quantitative Research Methodology

Our literature review included 40 studies based on quantitative analysis. Among these, 10 studies collected data with survey instruments. Such studies typically reported descriptive statistics related to perceptions and attitudes toward online instruction of students, instructors, and administrators. Another category of research articles that we reviewed included 18 correlational and causal-comparative studies. Here we defined causal-comparative research as that using a nonexperimental research method with which researchers attempt to identify behavior patterns (e.g., part-time employment defined as either employed or unemployed) (Gall, Borg, & Gall, 1996) or personal characteristics (e.g., ethnic background) (Gall, Borg, & Gall; Gay & Airasian, 2003) as possible reasons for differences between existing groups of people in whom the patterns or characteristics are present or absent. However, because of the *ex post facto* nature of the method, causal-comparative research, as in correlational research, cannot provide true experimental data to identify the causal relationship between the independent variable and the dependent variable, although it can "help to identify variables worthy of experimental investigation" (Gay & Airasian, 2003, p. 339). Researchers who conducted these studies not only observed and described teaching and learning in an online environment but also compared and correlated the variables. The third category of reviewed articles followed experimental and quasi-experimental research design. In 12 studies, researchers manipulated features of the online environment as independent variables and then compared students' learning and perceptions in online courses as dependent variables.

Summary of Qualitative Research Methodology

We also reviewed 20 qualitative studies, most of which are best defined as case studies. Most of the early studies would be better defined as evaluative case studies. Some case study researchers considered multiple cases (cross-case studies or multiple course iterations), but most reviewed or evaluated one feature or one course only. A select few of these researchers applied ethnographic or grounded theory methods, but most pursued simple descriptive characteristics of the research phenomena. Given that online teaching is a new area of research, it is not surprising that a large percentage of the research was qualitative. Such research helps to define variables and processes and to generate hypotheses in new areas of research. Despite this, few quantifiable variables were identified in these studies. In addition, much of this research is lacking details defined in the historical traditions of

qualitative research designs. For example, few researchers attended to detailed measures of authenticity such as researcher biases, member checking, and triangulation.

Summary of Mixed-Method Research Methodology

Sixteen of the articles reviewed employed a mixed-method design using both quantitative and qualitative methods to collect and analyze data. Most of the data collection in these 16 studies consisted of administering a survey or questionnaire that included both Likert-type items (quantitative) and open-ended questions (qualitative). In most of these studies, descriptive statistics and content analysis processes were used to analyze the data.

Some factors complicated our analysis. We discovered little consistency or agreement on the terminology used in the literature that we reviewed. Since we defined an online course as a course offered completely online or on the Internet, our search for research related to online courses led us to multiple keywords and a review of many studies that did not fit our definition of online courses: courses offered completely online or on the Internet. The multiplicity of terms made it difficult for us to find articles related to our specific research interests and to compare results of online courses (*WWW* or *World Wide Web*, *Internet*, *computer-based*, *cyberspace courses*, and the like) across studies.

Aspects Examined

During our initial review of the literature, we began to note aspects of online courses under study. We organized this list following traditional curriculum and instructional design theories and processes (e.g., Anderson & Krathwohl, 2001; Beck, McKeown, Worthy, Sandora, & Kucan, 1996; Linn & Gronlund, 2000; Perrone, 1994; Taba, 1967; Tyler, 1950). We ultimately chose four major themes to define our literature review. These included course environment, learners' outcomes, learners' characteristics, and institutional and administrative factors.

Course Environment

Course environment is an overarching term that includes classroom culture, structural assistance, success factors, online interaction, and evaluation.

Classroom Culture

Some researchers studied the ways that online courses managed classroom interactions. Ahern and El Hindi (2000) found that asynchronous discourse mimicked the dynamics of real-time, multivoiced discussions. Their IdeaWeb format was transparent in peer-to-peer discourse, allowing self-management of discussions by students without constraints or proprietary rules. Conversely, Kanuka and Anderson (1998), in their mixed-methods research with online forums (computer-mediated conferences), found a lack of fluidity and conversational language. They raised concerns about inconsistent and unchallenged ideas, concluding that these online interactions provided little negotiated meaning or new knowledge construction. Davidson-Shivers, Tanner, and Muilenburg (2000) compared the substantive quality of synchronous and asynchronous discourse to determine whether one discussion environment produced more content-related participation than the others.

They found that chats provided a direct, immediate environment for responses, whereas listserv responses were delayed but more focused and purposeful. These researchers reasoned that in asynchronous discussions, students had more time to think about their responses and that the increased thinking time improved the depth and quality of responses.

A few researchers referred to online students as a community of learners. Winograd (2000) explored the effect of a moderator on online conferences, developing a theory that even a low degree of moderation allowed a group to form a community, as determined by the elements of camaraderie, support, and warmth. Knupfer, Gram, and Larsen (1997) surveyed faculty members from four universities to learn about graduate students' reactions to online discussions. Their results suggested that it is important to establish a community of learners. Research-based suggestions included establishing study groups early, modeling and reinforcing effective communication, identifying potential problems, and designing a plan for dealing with these potential problems. Bielman, Putney, and Strudler (2000) also reviewed the construction of an online community. They noted that learners included *emoticons*, such as smiley faces, in their online communications with one another in an effort to compensate for the missing visual and nonverbal communication cues.

Certainly, the research regarding online environment points to the importance of learner-focused course design. Knupfer, Gram, and Larsen's (1997) study of graduate students' reactions to online discussions found that instructors (although they believed that organization, collaboration, and flexibility were key components of online discussions) failed to recognize the importance of the students' feelings, reactions, and responses.

The online environment may offer a unique social advantage as compared to the traditional classroom. In Sullivan's (2002) research, 42% of the females surveyed commented on the advantage of anonymity in a networked learning environment. However, Brown and Liedholm (2002), in their comparison of face-to-face, online, and hybrid microeconomics course students, found that female students scored significantly (5.7 percentage points) lower than males in the online course though, there was no significant difference in the learning outcomes between the online and hybrid formats.

Structural Assistance

Researchers exploring this aspect of online instruction were interested in how online course designs such as scaffolds and management systems might guide or assist student learning. Christel (1994) developed an experimental comparison of multiple versions of an interactive, digital video course. Students had control at all times over the virtual rooms in which they would work. These were the auditorium, training room, library, office, or conference room. In this virtual environment, Christel found that motion-video-interface enhanced recall better than still slides, and recommended that pedagogically important course information should be presented via video. Mayer, Heiser, and Lonn (2001) found that concurrent narration and animation had a redundancy effect that caused learners to split their visual attention and lower their transfer performance. It seems that when the cognitive load is high, understanding of complex concepts is hindered.

Greene and Land (2000) explored instructional scaffolds to support cognitive functioning. They found that guiding questions (professor-developed, procedural scaffolding) helped students to focus and develop their projects. These students needed real-time, back-

and-forth discussion with their instructors that helped them to better understand their course projects and begin thoughtful consideration earlier. Student-to-student interaction, specifically over shared prior experiences, influenced student's ideas and encouraged them to expand, formalize, and refine their reasoning.

Some researchers noted that self-pacing was an important feature of online learning. Schrum (1995) completed formative research regarding the impact of pacing on developing and presenting an online course. He found that students appreciated being able to move through the course at their own pace. More successful students moved through the course more quickly than less successful students. However, Hantula's (1998) review of student evaluations from an organizational psychology course determined that asynchronous course features required a higher degree of self-management on the part of the students. Mayer and Chandler (2001) explored the benefits of computer-user interactivity to determine the pace of the presentation. Their results supported the cognitive load theory that a modest amount of interactivity promotes deeper learning from a multimedia explanation.

A few researchers tested the structural assistance of specific course features. Cooper (1999) provided online resources and course materials in folders for each week of the course. Cooper's research showed that students valued timely course announcements, lecture notes, and chapter questions and answers. Bee and Usip (1998) presented supplementary materials, tutorials, and general course information online. They found that students who used these materials achieved improved course performance and improved knowledge of cyberspace to a greater extent than those who did not use the materials.

Success Factors

Some researchers were interested in how online courses guided student success. Edwards and Fritz (1997) determined that the effectiveness of online learning is influenced by student access to material, recommending that online information may replace the traditional text format for those students who accept and learn well from the online format. Schrum & Hong (2001) completed a survey with 70 institutions and found eight dimensions that affect student success. These included access to tools, technology experience, learning preferences, study habits, goals, purposes, lifestyles, and personal traits.

Faux and Black-Hughes (2000) compared traditional, online, and hybrid sections of an undergraduate course in social work to determine the effectiveness of online learning. Their results showed the most improvement (from pretest to posttest) for students in the traditional, face-to-face section. Further, Faux and Black-Hughes found that 41.7% of the students did not feel comfortable learning from the Internet in their online course. Students wanted more instructor feedback and auditory stimulation; they wanted to listen to, rather than read about, historical material. Though this study was limited (with only 33 student participants), the results raise concern regarding (a) course design according to instructor convenience rather than student preferences, and (b) students' willingness to take responsibility for their own learning. Brown and Liedholm (2002), in a similar comparative course study (with 710 students), noted that performance differences might be attributed to differences in student effort. Students in the face-to-face class spent 3 hours in class each week, while the online and hybrid course students reported spending less than 3 hours per

week on the course. Brown and Kulikowich's (2004) results, however, comparing online and standard lecture course outcomes of graduate-level statistics students, indicated no significant differences in posttests according to group membership.

Trinidad and Pearson (2004) measured the learning preferences of the students with the Online Learning Environments Survey (OLES) as developed by Fraser, Fisher, and McRobbie to determine the effect of problem-based learning (PBL) in an online course. They found that students' actual and preferred scores on the OLES were closely matched and concluded that PBL provides a practical strategy for online learning instruction. Other research by Pearson and Trinidad (2004) suggested that the OLES might be a helpful tool for educators to enhance online learning environments and to determine which course aspects should be considered for revision.

Young (2004) examined the characteristics of outstanding online teachers in the School for All. Young's analysis defined three major categories of online pedagogical models: the single-teacher model, the co-teacher model, and the cluster-course model. These results provide evidence that online pedagogy allows alternative instructional approaches, but the results do not prove which model worked more effectively.

Interaction Systems

Researchers were also interested in the relevance of online interaction to learning tasks—that is, how much of the information that learners exchanged in the online interaction was related to learning tasks in which they were involved. Davidson-Shivers, Tanner, and Muilenburg (2000) recorded students' online discussions in two modes, synchronous (chat) and asynchronous (listserv). The comments were coded into substantive categories (related to study topics and contents) and nonsubstantive categories (not related to study topics and contents). Although the frequency of the substantive category was higher than that of the nonsubstantive category with both interaction modes, no inferential statistics were reported to substantiate differences between the categories and the modes.

This study has raised an interesting question that warrants future research. To address classroom teachers' concerns about how much class time is truly spent on students' learning, researchers developed constructs of *engaged time*, or *time on task* (Rosenshine, 1979). Of the yearly 1,000 hours of instruction in regular classrooms mandated by most states for elementary and secondary schools, only 300 to 400 hours are devoted to high-quality academic learning in which students are engaged in learning activities. The rest of the school hours are spent on nonacademic activities, such as recess, lunch, transitions, and other off-task activities (Weinstein & Mignano, 1997). Instructors in the online environment may face a similar problem but in a different format. On the one hand, online instruction eliminates the needs for recess, lunch, and transition. Instructors in online courses do not have to deal as much with discipline problems, which usually account for a big proportion of off-task time. We could expect the ratio of engaged time in the online environment to be greater than that observed in regular classrooms. On the other hand chat room, e-mail, and online discussion provide students with the convenience of social interaction in cyberspace, which is not available in the regular classroom. Students could easily be distracted from their academic learning and become involved in nonacademic interaction with their classmates. Furthermore, as indicated in other sections of this review, students as well as

instructors in online classrooms often experience technical problems with courses via the Internet, especially those who are novices in computer technology. People devote a great amount of teaching or study time to learning new skills that they must possess to be successful in the online learning environment (Davidson-Shivers et al., 2000; Richards & Ridley, 1997; Warschauer, 1998; Wells, 2000). Although the time spent on the learning curve of computer-related skills is necessary, it may not be directly related to learning of course content. The Davidson-Shivers et al. study indicated the importance of the distinction between the substantive and nonsubstantive interaction in the online environment. While some researchers use the frequency of logging on to course websites or the length of logged-on time as measures of students' engagement in online learning (Ahern & Durrington, 1995; Taraban, Maki, & Rynearson, 1999), this study indicated that the quality, rather than the quantity, of the time spent in online courses might be a more accurate index of students' engagement. In any case, this issue has not received the attention it deserves from researchers. In a promising development, a recent study (Daroszewski, 2004) showed that educators were taking advantage of the technology to encourage students to share learning experiences online. Nursing students posted online journals weekly, discussing their clinical work experiences for two quarters, and were required to read and comment on their classmates' journaling entries weekly. A postevaluation of the practice showed that students perceived that sharing clinic experiences enhanced their learning and promoted mentoring, critical thinking, and socialization.

Other researchers (Kanuka & Anderson, 1998) were interested in the depth of online interactions. Applying a model of mass communication, the researchers contended that participants in a communication process construct knowledge through a five-stage process. In Stage 1, participants share their information and opinions. In Stage 2, participants discover and explore dissonance and inconsistency in the information and opinions shared. In Stage 3, participants negotiate and co-construct knowledge. In Stage 4, participants further test and modify newly constructed knowledge. In Stage 5, the final stage, participants explicitly phrase agreements, statements, and applications of new knowledge. With data obtained from an online forum with 11 participants and coded into the stages, researchers found that students' interactions in the online environment were primarily at the lower levels of communication (sharing information and discovering dissonance) and rarely developed into a higher level of communication where negotiation, coconstruction, and agreement occurred. Although the study was done with a small sample of participants, it provided a promising model for future research on the relationship between the quality of interaction and construction of knowledge.

The findings of Kanuka and Anderson (1998) were echoed by those of Thomas' study (2002). Thomas examined undergraduate students' interactions in online discussions on two themes in an environmental studies course aligned with a five-level taxonomy of cognitive engagement: prestructural, unistructural, multistructural, relational, and extended abstract (Biggs & Collis, 1982). The researcher found that, for both themes, students' cognitive engagement peaked at the multistructural level, which was defined as "the learner picks up more and more relevant or correct features, but she does not integrate them" (Thomas, 2002, p. 255). Thomas believed that factors such as unfamiliarity with the field

and pressure to spend time on learning activities other than online discussion contributed to the learners' lack of high-level cognitive engagement.

This study revealed a problem with learning in the online environment. If learning is viewed from the Vygotskian perspective as a constructive or co-constructive process (Vygotsky, 1978), the shallow level of participation shown by this study to exist in a communication modality that shares and acknowledges only the differences in participants' views is not sufficient to make construction or coconstruction possible. Students learn only when their current view of knowledge is challenged, reformed, and synthesized through their interaction with others (Vygotsky, 1978). However, this occurs only when students intensify their participation in the online interaction upward to Stage 3, 4, or 5 in Kanuka and Anderson's (1998) model.

We do not know exactly what causes the students' shallow participation in online interaction. One possible explanation is the lack of instructors' guidance in online chatting and discussion. Once again, Vygotsky provided possible solutions to the problem. Contemporary Vygotskian theories emphasize the importance of guided participation (Radziszewska & Rogoff, 1991; Rogoff, 1991). Instructors in online courses, like their counterparts in regular classrooms, play a crucial role in students' knowledge construction by scaffolding the learning process for them. If instructors do not assume responsibility for guiding students' learning, their learning could be inefficient or ineffective. Research on discovery learning in traditional classrooms could benefit online instruction, because it shows that when discovery learning was conducted in a random and unstructured manner, students were more likely to construct misunderstandings or wander in a time-consuming process of investigation without arriving at conclusions (Hammer, 1997; Schauble, 1990). When discovery learning activities were carefully planned and structured, students were led to make correct interpretations of information and produce solutions to problems presented to them (Hickey, 1997; Minstrell & Stimpson, 1996; White & Frederiksen, 1998). Thus it is the online instructor's responsibility to organize online interactions that are sufficiently structured to benefit students' learning.

Some researchers (McIssac, Blocher, Mahes, & Vrasidas, 1999) believed that certain characteristics of the online environment would enhance the interaction between students and between students and their instructors. Believing that interaction is "the single most important activity in a well-designed distance education experience," McIssac, Blocher, Mahes, and Brasidas (1999, p. 122) qualitatively examined archived messages exchanged between doctoral students during chat time in six Web-based courses and interviewed them after the courses to learn about their experiences in the online interaction. The researchers found that students' positive experiences during the interaction online could be promoted by the instructors' providing prompt feedback, participating in the interaction, encouraging social interaction, and employing collaborative learning strategies.

Ahern and Durrington (1995) manipulated two variables, anonymity of participants (salient versus anonymous) and interface of online discourse (graphic-based versus text-based) to explore whether different online communication tools and formats influenced people's participation in online interaction. The interaction pattern was operationally defined as frequency of visits, number of messages, number of words, and time spent. The authors found that when the communication was anonymous, students were more likely

to establish "highly structured" communication patterns, that is, to spend more time and write longer messages. They also found that anonymity and the graphic-based interface enhanced students' engagement in highly structured interpersonal interactions. When students could choose to address their comments to either a group or an individual in the computer-mediated discussion, students who used pen-names with the graphic-based interface (allowing them to visually trace previous discourse) were significantly more likely to choose individuals over groups as their audience.

Most of the literature reviewed on online interaction provided descriptions of the various formats used, the instructors' experiences, and participants' reactions. Some research studies evaluated the level of interactions and determined the critical components of online interactions (Mikulecky, 1998). Though there are numerous options available for online interactions, those described most often in the literature included e-mail, listservs, and chat.

Althaus (1997) conducted a study to examine whether supplementing a face-to-face discussion with computer-mediated discussions would enhance academic performance. Through a correlational study with 142 undergraduates, he pointed out that online discussions, which do not usually occur in real time, avoid some of the undesirable characteristics of face-to-face discussions in the classroom. Face-to-face discussions must occur at the same time and place, and students bid against each other for an opportunity to speak. This can create crowding or disruption to the flow of discussion. In online discussion, students are able to log on and join the discussion when it is convenient, and they have more time to read messages, reflect on them, and compose thoughtful responses. He concluded that students who were actively involved in the computer-mediated discussions earned higher grades than other students.

Mikulecky (1998) compared class discussions in an online graduate course on adolescent literature to those of a face-to-face version of the same course. There were 22 graduate students in the online course and 18 students in the face-to-face format. The face-to-face group included 7 graduate students and a mixture of 11 postbaccalaureate and undergraduate seniors. Electronic interchanges were found to be as helpful as face-to-face classes and were characterized by the following patterns: (a) rich descriptive presentations of situations, dilemmas, and solutions; (b) detailed, thoughtful responses and counter-responses to fellow students, including suggestions for further professional development; (c) comments to link to one's own experiences as well as to spur and synthesize new thoughts; (d) sharing of troubling professional experiences and provision of support to others; and (e) occasional debate. Graduate students seemed to benefit from the online, asynchronous discussions. However, the lack of immediate feedback from the instructors allowed students to procrastinate in entering their responses or to withdraw from the discussion.

Blignaut and Trollip (2003) noted the importance of instructor "presence" in an online course and hypothesized that, in the online world, presence requires action. They also analyzed faculty discussion postings by looking at postings across three online business courses, and developed a taxonomy of instructor participation. They defined differences between administrative, affective, corrective, informative, and Socratic responses. Though they did not evaluate instructors' facilitation strategies, the research results clearly point

to broad differences in instructor participation online, which may be attributed to differences in cognitive and teaching styles.

From the results of a mixed-method study with 110 undergraduate students, Wilson and Whitelock (1998) concluded that the number of online interactions needs to be kept relatively high in discussions, and some dramatic tension should be created to motivate participation. They also suggested that involving students in the process of getting to know each other also affects collaborative engagements. On the other hand, Frey, Faul, and Yankelov (2003) found, in their assessment of Web-assisted strategies, that students perceive e-mail communication with the instructor as the most valuable strategy; these study participants did not value highly the strategies designed to facilitate communication among students (creation of home pages, accessible e-mail addresses, and discussion groups). Young (2004) and Keefe (2003) found a high degree of interactivity and student participation to be critical components of online instruction. Keefe's comparative study (2003) found that students performed better and were more satisfied in the face-to-face environment than in the online environment. Keefe suggested that the lack of interaction experience in the online section may have contributed to this difference. However, no evidence was offered to support this conclusion.

Berge (1999) pointed out that the instructional design, rather than the delivery system (e-mail, chat sessions, listserv, and the like), affects the quality of online discussions and the learning that takes place. Instructors need to choose from the systems available and select those that will best meet the instructional goals of the course. Critical to understanding online interactions is to realize that they involve a continuum from teacher-centered to student-centered participation. A study of the use of a graphic interface program for online interaction, the IdeaWeb, indicated that graduate students in a teacher certification program socially constructed their ideas about teaching and learning in a more peer-oriented discourse without direction from the instructor (Ahern & El Hindi, 2000). Christopher, Thomas, and Tallent-Runnels (2004) developed a rubric along the lines of the Bloom taxonomy (Anderson & Krathwohl, 2001) to assess the thinking levels of discussion prompts and responses. While these researchers found that unguided discussions fell into the middle level (organize, classify, apply, compare, and contrast) of the taxonomy, they suggested that more direct guidance from the course instructor might have encouraged development of higher levels of thinking in the responses (synthesize and evaluate). This guidance might take the form of instructors adding information to the discussion and asking follow-up questions.

Im and Lee (2003/2004) conducted a comparison study of synchronous and asynchronous discussion with 40 preservice students in an online university course. They found that synchronous discussions were more useful for promoting social interaction and asynchronous discussions were more useful for task-oriented communication. Based on these results, Im and Lee suggested that synchronous and asynchronous discussions should be used for different educational purposes in online courses.

Hansen and Gladfelter (1996) concluded that online pedagogy comes naturally to some instructors but may be perplexing to others. In their focus group study of online seminar participants, they concluded that online instructors could not expect to create a stimulating collaborative online learning environment while thinking merely of textbook chapters and

lectures. Rather, online instructors must create an atmosphere of respect and safety so that informed debate and collaborative problem solving can flourish.

Evaluation System

Although this review of the literature did not reveal much discussion of evaluation in online courses, it is an important issue to consider in online teaching and learning. Managing student assignments, providing feedback to students, and assessing students' learning are all key factors in any course, whether face-to-face or online. While the online format presents some challenges to instructors, it also may encourage the development of new learning and teaching techniques. Levin, Levin, and Waddoups (1999) conducted a study of a Master of Education program that is offered entirely online. Their mixed-method study included surveys sent to the online students to ask them about their perceptions of the courses. Levin et al. also developed case studies during the first three semesters of the program, following four of the online students in the program. Their findings suggest that instead of being restricted to face-to-face learning environments for evaluation, instructors could make use of the various options available for learning, teaching, and assessment through innovative online education. In their recently developed CTER (Curriculum, Technology, and Education Reform) online program, Levin et al. have employed multiple assessment techniques, including assessment by classmates and the professor, by other educators (fellow teachers, graduate students, professors from other universities), and self-assessment.

Summary of Research on Course Environment

In summary, studies related to course environment showed that current research on course environment was largely limited to descriptive research wherein small numbers of participants compromised generalization to a larger population. Several of the studies included a specific and unique group of students, a specialized program, or a specific type of software program (the IdeaWeb rather than the more widely used WebCT or Blackboard) that may not be easily applied in other contexts. In addition, some of these studies reported on course situations that were partially online. Further, no data were provided to assess the effectiveness of one particular form of evaluation or format over others for online courses. Clearly, researchers have just begun to understand and delineate the variables of online pedagogy as they ponder whether online classroom culture should be similar to or different from face-to-face classrooms, consider how the online environment can mimic traditional classroom discussions, analyze scaffolds to maximize opportunity for individualizing learning, and propose ways that online interactions can improve or enhance learning. These decisions need to be made before effective evaluation systems for online instruction can be implemented.

   Some findings were supported by multiple studies. One of these was the importance of creating a learning community in an online class by forming small groups and by allowing students to see effective communication modeled by instructors. Instructor presence through scaffolding during discussions and posting of timely feedback and announcements also was beneficial to the students. Finally, promotion of and participation in teacher-student and student-student interaction promoted learning. It was also noted that

this interaction should reflect a deep understanding of the content of the course in order to be truly helpful.

Learners' Outcomes

Researchers who are interested in understanding the teaching and learning processes in the online environment have used various research methods to explore learning outcomes in the cognitive and affective domains.

Cognitive Domain

One question that people who are involved in online teaching and learning want to answer is whether online instruction produces as much learning as traditional instruction does. To answer the question, researchers have compared learners' academic performance in online courses with academic performance in regular classrooms. This research was done primarily in causal comparative (no manipulation of instructional mode), quasi-experimental, or experimental studies. For example, Bata-Jones and Avery (2004) studied nursing students' performance on midterm and final examinations in a pharmacology course, comparing students who chose the online version with those who enrolled in a face-to-face format. No significant difference in the test scores was found between the two groups. Focus group discussion following the course with the students in the online format showed that the students were satisfied with their learning in the course and positive about meeting instructional objectives. Buckley's study (2003) compared midterm and final scores and course grade among three groups of nursing students in face-to-face, hybrid, and online sessions of the course taught by the same instructor and found no significant differences there either. Other studies (Caywood & Duckett, 2003; Christopher, Thomas, & Tallent-Runnels, 2004; Neuhauser, 2002; Peterson & Bond, 2004; Thirunarayanan & Perez-Prado, 2001/2002) using convenience samples to compare learning by online and traditional methods failed to find differences. With various student populations (nursing students, students with special needs, preservice teachers, ESL teachers, special education teachers) and a wide spectrum of measures of learning outcomes (test scores, course grades, course projects, rated performance) involved in the comparison, it seems that the majority of researchers agree that online instruction is at least as effective as traditional ways of teaching.

One study (Maki, Maki, Patterson, & Whittaker, 2000) showed that online instruction could be even more effective for students' learning than traditional instruction. The researchers collected data from undergraduate students who enrolled in either online or lecture sections of a psychology course throughout an academic year and then compared achievement in the two different instructional modes on identical course content. They found students in the online sections acquired more content knowledge and performed better on in-class examinations than those in the lecture sections. As predicted, those taking the course online accessed the Internet and used computers more frequently than their counterparts in the lecture sections. The online course experience also decreased students' computer anxiety.

Gilliver, Randall, and Pok (1998) assessed the academic performance of a cohort of university freshmen to investigate the effectiveness of online instruction as measured by students' learning. Among 24 freshman classes, 6 were chosen to take an accounting course

with supplementary reading materials and help sessions provided online; the rest took the same course in regular classrooms without the online assistance. A final examination score was used to measure students' learning. It was found that students with online assistance outperformed students without the help on the test, though no control group examined the potential impact of providing assistance in the face-to-face class. However, another study (Parker & Germino, 2001) that used student cohort performance on course examinations cumulated throughout five semesters showed more complex findings. The examination consisted of two parts, conceptual knowledge and technique knowledge in dealing with business case studies. Although online and traditional teaching were equally effective in students' learning as measured by a total test score, students in the online environment outperformed those in the traditional environment on the conceptual part of the test, and students in the traditional environment did better in the part on technique knowledge. Shiratuddin's (2001) study with students who learned multimedia design either in traditional or online classrooms in a Malaysian university showed similar results. Students in the online classroom outperformed students in the traditional classroom in course work, final examination grades, and course grades.

To better control potentially confounding variables, a few researchers have used experimental research designs. In a study by Smith, Smith, and Boone (2000), preservice teachers in a technology integration course were randomly assigned to either online or traditional classrooms by flipping a coin. A multiple-choice test was administered to measure students' learning at the completion of the instruction. The study found no differences in learning between the two groups. However, Keefe (2003) randomly assigned students in an organizational behavior course to either a face-to-face or an online session taught by the same instructor using the same textbook. Students' learning was measured by three examinations given during the semester, each composed of five to eight essay questions. The researcher found that students in the face-to-face session of the course did better than those in the online session. Other researchers (Dellana, Collins, & West, 2000; Hiltz, 1993) investigated questions by comparing learning between existing groups of students who enrolled in either online sessions or face-to-face sessions of the same courses. Neither study reported a significant difference in learning between the two modes of instruction.

Historically, some researchers in instructional technology voiced concerns about the comparison of learning outcomes between different media (Clark, 1983). They argued that learning in environments with different media could differ in many aspects, so that pinpointing the specific factor or factors that might make a difference in learning would be difficult, if not impossible. Although the argument predates computer assisted instruction, it has continued and is still debated among researchers (Clark, 1994; Kozma, 1994). Our literature review showed that concern about the validity of comparing learning outcomes between the online classes and the traditional classroom may be justified. For example, when nursing students' learning in an online pharmacology course was compared with face-to-face formats of the same course (Bata-Jones & Avery, 2004), it was discovered that the two groups of students learned the course materials differently. Students in the online session self-studied the content through online discussion. The instructor provided feedback in the group discussion, whereas students in the face-to-face session had more than 30 hours of lecture. Similarly, a study by Gilliver, Randall, and Pok (1998) argued that it

was hard to predict whether students taking the course online would still have an advantage if students taking the course in traditional classrooms had access to the same supplementary reading materials and help sessions offline.

Although comparisons of learning between different instructional modes, such as between online and traditional instruction, might be questionable, comparisons of academic performance within differently structured online environments usually have produced valid results. McManus (2000) manipulated variables of linearity of presentation and availability of advance organizers in an online course on computing tools for educators. The author used the term *linearity of presentation* to refer to different fashions of presenting course materials that either allowed students to jump freely from one topic to another or required them to follow a predetermined order or sequence. The author argued that nonlinearity is an advantage of online instruction that allowed a greater degree of learners' control over the organization of information and made it more personally relevant than regular classroom delivery. Students' self-regulation in learning was measured and categorized into three levels and used as another independent variable. Students' declarative knowledge was measured by a multiple-choice test, and procedural knowledge was measured by 20 computer applications in an authentic situation. McManus found that an advance organizer helped students when materials were presented with low or medium levels of nonlinearity but had a detrimental effect on learning when information was presented with a high level of nonlinearity. He also found an interaction effect between self-regulation and nonlinearity. That is, with low levels of nonlinearity of presentation, low and medium self-regulated learners performed better than highly self-regulated learners. With medium levels of nonlinearity of presentation, the three types of self-regulated learners performed equally well. With high linearity of presentation, low self-regulated learners did better than medium and high self-regulated learners. It seems that the attribute-treatment-interaction paradigm, such as the one used in the study by McManus, is a useful approach that allows researchers to study how individual learner differences and characteristics of the online learning environment interact with each other to influence learning.

Some researchers were interested in behavioral patterns in the online environment (Ahern & Durrington, 1995; Davidson-Shivers, Tanner, & Muilenburg, 2000; Kanuka & Anderson, 1998). Because the Internet can be used as a convenient mode of communication between students and between students and instructors in online courses, most research has been focused on learners' interaction patterns in the online environment.

Some researchers took advantage of the fact that computers can automatically record interactions between the user and the machine to study students' learning behaviors in an online environment. Taraban, Maki, and Rynearson (1999) observed how students in face-to-face and online classes spent their studying time differently for classes and for tests. They found that the distribution of study time in the two conditions was almost identical. Although students knew that an ideal student should use distributed practice to spread study time over several occasions, they exclusively studied just before examinations. It seems the convenience of taking online courses, where students can study whenever they want to, does not change students' undesirable habit of cramming before being tested.

Maki and Maki (2001) attempted to change students' undesirable last-minute cramming habit by providing reward-attached online aids to undergraduate students taking a psychology course online. In this experimental study, the researchers manipulated various learning activities that were rewarded. Some students were rewarded with an opportunity to earn points from mini-quizzes if they viewed "frequently asked questions" (FAQs) posted online, while other students were rewarded with the opportunity to earn points from the quizzes if they viewed chapter outlines posted online. As old behavioral principles show, students' behavior was contingent upon the reward (Skinner, 1938). Students in the condition where viewing FAQs might be rewarded did view the FAQs more often than did students who were not rewarded for viewing FAQs. Students in the condition where viewing chapter outlines might be rewarded viewed the outlines more often than did students not rewarded for viewing chapter outlines.

Ridley and Husband (1998) compared GPAs (grade point averages) of students who completed courses in both traditional and online formats to investigate a persistent concern about academic integrity in online learning. They argued that "remote learners connected to the faculty only through computer networks may have greater opportunity than ever to turn in work that is not their own" (p. 185). They hypothesized that cheating in the online courses should be detectable by its effects on grades: Students in the online courses should have higher GPAs than those in courses taken in traditional, face-to-face classrooms. What they found was just the opposite. Students' GPAs in courses in the traditional, face-to-face format were higher than those in online courses. They concluded that the concern about academic integrity was either exaggerated or unfounded. However, because of confounding variables uncontrolled in the comparison, the conclusion was not convincing. The GPAs could be based on different courses that students took or different tests that instructors used to measure students' learning in the two instructional environments. Higher scores could also be the result of superior quality of instruction in courses taught in regular classrooms. The conclusion that the integrity of online learning was not exceptionally vulnerable seems especially suspect as the prevalence of online cheating and plagiarism becomes a major concern for faculty and administrators engaged in online instruction (McAlister, Rivera, & Hallam, 2002; Olt, 2002).

Affective Domain

In addition to learning outcomes in the cognitive domain, researchers were also interested in learning outcomes in the affective domain, such as students' attitudes, satisfaction, and perceptions of the online environment. Some researchers used descriptive research methods to report students' experiences in online courses (Althaus, 1997; Edwards & Fritz, 1997; Hansen & Gladfelter, 1996; Richards & Ridley, 1997; Sullivan, 2002). These researchers were interested in students' perceptions of their own learning experience and perceptions of various learning activities used in online instruction. College students who were participants in the studies generally showed positive perceptions of learning outcomes and the learning environment of online courses and wished that the same or similar online materials and activities were available in other courses.

More often, researchers have conducted correlational research to investigate the relationships among characteristics of learners, features of online learning environment, and

satisfaction of the learners (Bee & Usip, 1998; Gunawardena & Duphorne, 2001; Mortensen & Young, 2000; Swan, Shea, Fredericksen, Pickett, Pelz, & Maher, 2001; Wells, 2000). Learners' prior experiences in computer-related activities such as e-mail and Internet use, their learning styles, and the quality of their social interactions in an online environment were variables commonly investigated. Not surprisingly, people with more prior experience and training in computer-related activities felt more satisfied and comfortable with their experience in the online environment.

Correlational research also yielded profiles of users and nonusers of online instruction (Althaus, 1997; Bee & Usip, 1998; Richards & Ridley, 1997; Roblyer, 1999). Richards and Ridley showed that although discrepancies in prior experiences with technology were evident between the user and nonuser groups, those differences were not a major factor in people's decision to take online courses. Most students took online courses because they were the only alternative when they had constraints on their course schedules. Bee and Usip (1998) found that both users and nonusers agreed that the Internet was a valuable supplement to class lectures and that e-mail provided a convenient way of communication, but only the experienced online course users believed that online instruction would improve their academic performance. Roblyer (1999) found that users of online instruction valued most the autonomy to determine the pace and timing of the learning process, whereas nonusers valued more the interaction between students and the instructor in traditional, face-to-face classrooms.

Summary of Research on Learning Outcomes

In summary, many learning outcome variables in both the cognitive and the affective domains of the online environment have been investigated. Unfortunately, we do not think that the findings can withstand rigorous scientific scrutiny because of the flaws in the research designs and execution methods. Our two concerns about the quality of research in this area will be described in a later section of this article, "Future Research."

Given the methodological challenges of research in this area, we did find that most studies comparing online and traditional classes concluded that both methods of delivery were adequate. In some studies, students in the online classes outperformed students in the traditional classes, and vice versa.

Learners' Characteristics

As more institutions develop and deliver online instruction, researchers have begun to ask more sophisticated and complex questions about this instructional modality. Understanding what motivates students to choose online courses, how to match learning styles with instructional design, and how to deliver this type of instruction are some of the issues researchers are beginning to investigate.

The importance of understanding the learner's goals, needs, and motivations in taking a course is a basic tenet of instructional design. Two studies, by McManus (2000) and Schrum (1995), were concerned with some basic design issues for online courses. Anecdotal research indicates that the most successful online students are highly self-regulated learners who require little in the way of formal lesson design. If they want to know something, they will learn it. McManus attempted to confirm this perception by comparing the

performance of two groups of undergraduate education majors: learners who were identified as self-regulated and learners who were identified as less self-regulated. The two groups each were placed in two environments, a linear one where students had few choices and followed steps to complete the course, and a nonlinear one where students had many choices in activities and pacing. McManus found no statistically significant evidence to support the notion that self-regulated students did better than less self-regulated students in either of the two environments. Nonetheless, McManus suggested that design issues are extremely important for both the highly self-regulated and the less self-regulated student, especially when instruction is limited to online access.

Schrum (1995) advocated coming to a better understanding of the interplay between design, delivery, and user characteristics. She conducted a case study of an online graduate seminar made up of administrators, district personnel, teachers, and other educators in order to identify significant events in the development and presentation of an online course. Schrum concluded that one cannot simply take a traditional course and turn it into an online class. Course design, which matches the needs of the learners with the content, is essential for student success. Schrum recommended that pedagogical, organizational, and institutional issues must be considered when starting to deliver courses online.

Learning Styles of Online Students

In another study, Graff (2003) investigated the interplay between cognitive learning styles and the effectiveness of online courses in delivering instructional content. Students were categorized on a range from *holistic* to *analytical.* Holistic learners view ideas as complete wholes and are unable to separate the ideas into discrete parts. In contrast, analytical learners are able to comprehend ideas in parts but have difficulty in seeing the complete picture. Along another axis, learning styles were arrayed from *verbalizers* to *imagers*. Verbalizers do well with text-based material, whereas imagers deal well with spatial data.

Fifty students (9 male, 41 female) were randomly assigned to one of two conditions. Web Structure 1 presented content in a "short-page" format, which contained 23 pages of content with little on each page. In contrast, Web Structure 2 consisted of "long-page" material and was only 11 pages long with much content on each page. In each of these conditions, half of the participants received a system overview in the form of a map and half did not. The students were tested on recall through a simple test as well as an essay question on the content of the lesson.

The results concerning the effect of Web structure on learning showed that analytics performed better in the long-page format than the holistics. Analytics, because they were able to learn the content in parts, could integrate the information. Along the other axis, imagers were superior to verbalizers on the recall test in the short-page condition. This result appears consistent in that imagers are better able to keep track of where they are in the website. According to the author, this study provides clarity for instructional designers and suggests that Web-based learning environments should be matched to the cognitive style of the user.

Social Interaction and Online Learners

More research is necessary to identify the effects of delivery environments on learning performance. Sonnenwald and Li (2003) conducted a study that specifically investigated the effect of computer-mediated delivery systems on social interaction preferences. They identified social interaction preference as cooperative, competitive, or individualistic. They then used innovation adoption and diffusion theory as a foundation for investigating students' perceptions of the usefulness of the online collaborative system.

The study consisted of 20 pairs of students working either in face-to-face groups or in online groups. Using a repeated measures design, the researchers found an effect on how well students perceived the usefulness of the collaborative system. When working remotely, those students who had a competitive learning style preference ranked the ability to learn to use a new system lower than face-to-face settings. The results show that it may be possible to deliver authentic learning environments online, but these environments are not necessarily equally effective or desirable for all types of learners. Instructional designers must carefully weigh the user characteristics necessary to create a true instructional space.

Research demonstrates that learner control is a very attractive feature of online instruction and not a simple convenience. When students can control the pace of the lesson, satisfaction and engagement improve. Numerous studies point to pacing as one of the most important incentives for students in choosing online instruction (Richards & Ridley, 1997; Roblyer, 1999; Wilson & Whitelock 1998). Students like the opportunity to choose both when and where to learn. Nonetheless, this does not negate the importance of good instructional design, as Wilson and Whitelock (1998) pointed out in their study. They indicated that instruction needs some dramatic tension from week to week in order to sustain a high level of participation. Further, they suggested that the instructor needs to facilitate student access to needed technologies, create a sense of engagement, foster the sharing of information, and promote individual gratification. Finally, pedagogical, organizational, and institutional issues must be considered. For example, the identification of student roles and a specific conceptualization of the teacher's role are essential in the redesign of course delivery systems.

Demographics of Online Learners

Another group of researchers attempted to understand the demographics of the online population (Schneider & Germann, 1999). In their study, they looked at both the online and the non-online populations of a university and a state college. For the university, the online population was 182, with a non-online population of 5,565. In contrast, the state college had an online population of 259 and a non-online population of 1,474. The results indicated that online learners were typically older, with an average age of 29. They found that gender was split equally between men and women (52% versus 53%). White students (86.2%) constituted the largest ethnic group in the study, with 5.4% African American students, 4.2% Asian students, and 7.7% Hispanic students.

In a more recent study, Bocchi (2004) confirmed these results. The majority of online students are between 30 and 35 years old. In this study, the typical online student was White and male; 33% were female, and less than 10% came from a minority group. This is

important information for Web course development. Developers need to pay close attention to the issues of diversity and access.

Richards and Ridley (1997) were interested in what factors, such as prior computer knowledge or online experience, helped students to persist in taking online courses. Their sample consisted of 155 students who had taken one or more online courses prior to 1996 and were currently enrolled in an online course. They found that most students were self-taught in terms of computer usage (61.5%). However, the students recommended better hands-on computer training, as well as more available online interventions in the form of online help or tutoring, to improve the online experience. The primary reason, according to the participants in the study, is that the current systems are not totally transparent and easy to use. Almost 30% of the students wanted additional training in how to use the new system, especially in transferring files and using e-mail and the current operating system.

A few studies also demonstrated a need for continuous training of both students and faculty members on the most effective use of online technologies. For example, computer-mediated communication (CMC), or communication with others via a computer, is one of the older online technologies. According to the research, the use of CMC needs to be carefully designed in order to match learner expectations with course performance (Davidson-Shivers et al., 2000; Warschauer, 1998; Wells, 2000).

Warschauer (1998) conducted a study at a medium-sized Christian school whose enrollment consisted primarily of minority ESL (English as a second language) students. Warschauer, who was an active participant in the study, felt that CMC provided an excellent tool for promoting critically collaborative learning. Warschauer discovered that there were important social relations between the teachers, the instructors, and the institutions. Though the institution was eager to integrate the technology into their curriculum, the conservative context of the school and the need for top-down control from the instructor essentially negated the opportunities that the technology presented. Even though CMC provided the students with communication anywhere and anytime, the teacher rigidly controlled both the interaction and access. What was interesting in this study was that even though the instructor had incorporated CMC into the curriculum, s/he did not effectively change how the course was conducted. The people and the institution shaped the implementation of technology, in this case CMC, within instructional contexts. These results point to the importance of tailoring the design of the online experiences to the cultural experiences of the intended students.

Lessons are not delivered in a vacuum but within specific technologies and within specific communities that are constantly changing and evolving. Much more research is needed to understand the nature of the current online population. It is evident that we need to know how the online population will change in the future and how we can provide access for it. Researchers are starting to investigate the complex relationships between learner characteristics, delivery technologies, and instructional design. Research is needed not only to better inform the design of instruction but also to better effect changes in the technology itself, so that both the teachers and the students are able to learn in supportive environments.

Summary of Research on Learners' Characteristics

Much of the early research on online instruction focused on the impact the delivery system had on the efficacy of student learning. Recently, researchers with concerns about the design of online learning have shifted focus from simply investigating the effect of different delivery systems to a more sophisticated investigation of the synergistic relationships among the learners, the design of instruction, and the constraints of the delivery system.

We have found that research has begun to address the subtle questions regarding who is using these systems and why. The majority of students using online services were older than the typical undergraduate student. These students were adults who had significant roles in the community and were highly motivated and focused on achieving specific learning outcomes. Even though convenience was an important factor, studies have found that the quality of the instructional design was crucial in providing a successful learning experience, even with a highly focused and motivated student. Graff (2003) discovered that a large number of different learning styles are present even in this highly motivated audience. An essential conclusion of this research is that developers must design online learning environments to match not only the expectations of the learners but their cognitive styles as well.

Researchers are beginning to investigate the relationship between learner characteristics and the type of delivery tools available to online course developers. The links among the delivery environment, specific instructional tools, the learner, and the instructor are not only complicated but subtle. Other studies found that a learner's preferred learning style affects how her or she uses specific online tools. Studies have documented that online learners and faculty members alike are complicated and diverse. This is not to say that students and faculty are not adaptable but that there is simply no one-size-fits-all format when it comes to delivery environments. Instructional designers must carefully weigh the user characteristics, the available faculty, the institutional concerns, and the delivery tool in order to create an effective instructional experience online.

Institutional and Administrative Aspects

There is little formal research on various institutional factors for online courses. Most of the research on this aspect of online courses is organized around distance education. Distance education is distinguished from online education by the fact that online education includes courses delivered completely via the Internet, whereas distance education is instruction delivered through various forms of electronic media (videotapes, interactive television, television, Internet), as well as by faculty who travel to sites away from campus (Butner, Smith, & Murray, 1999).

Of the studies we found, many were focused on distance education. Most of them also mentioned technology. It was difficult to determine where online courses fit into the study results for many of these articles. Therefore, we decided to report results only from those studies that were about online courses. We divided research on institutional aspects into three parts: institutional policies, institutional support, and enrollment effects.

Institutional Policies

In one well-planned endeavor, researchers used survey and interview data to determine which benchmarks for online courses recommended by several national organizations in higher education were actually incorporated in six schools recognized as distance education leaders (Phipps & Merisotis, 2000). One of these benchmarks was establishing institutional policies for online instruction as well as for the rest of distance education deliveries. Even though most of the leading institutions that participated did have university policies for online classes, some of them had not yet established clear policies for support, course development, and evaluation.

Institutional Support

Training was one type of support requested by faculty members (Feist 2003; Rockwell, Schauer, Fritz, & Marx, 1999). In a case study, Feist interviewed 10 instructors who had taught online courses. One finding was that the instructors wanted training but said that when it was offered many of them did not take advantage of it. They preferred that it be offered in ways that they could easily use. For example, they wanted training that could be used right away, had built-in follow-up, fit into their schedules, matched their learning styles, focused on curriculum, included leadership and direction from their department chairs, and included a support person they could all use later. Similarly, in a study of incentives and obstacles to distance education, Rockwell and her colleagues (1999) surveyed 139 faculty members and 23 administrators in two universities in colleges of agriculture (with return rates of 67% and 77%, respectively). They found that both groups cited lack of training in how to teach online as an obstacle to participation.

Several studies also showed that faculty members want technical support if they are to teach online courses (Frith & Kee, 2003; Jennings & Bayless, 2003; Lan, Tallent-Runnels, Thomas, Fryer, & Cooper, 2003). In a study of communication effects on student outcomes in a nursing course (Frith & Kee), faculty members said that they needed technical support and a reliable infrastructure. They believed they had lost students because of technical problems. Frith and Kee suggested some ways to avoid technical problem, such as piloting a course site during its development and beginning the course with a videotaped or face-to-face orientation. It seemed that students, who were asked to have certain skills to take the course, enrolled without those skills. In another study, undergraduate students were asked to evaluate their instructors, identify any technical problems they had experienced, and explain how these problems affected their learning (Lan et al., 2003). Students used a Likert scale to rate the level of technical problems they had experienced in each aspect of the course, such as in chat rooms, discussions, and online tests. They also rated the importance of each of these aspects to their learning. The combined score for the two ratings resulted in an impact score calculated by the researchers. Research results showed a negative correlation between the impact scores and instructor evaluations. The more the students experienced technical problems, the lower they rated their instructors, demonstrating a need for technical support for the courses. Finally, in a study comparing students in two sections of the same course, one online and one face-to-face, students in the face-to-face class (who had clear procedures to help them solve problems) expressed more satisfaction with the course than those who were online and had technical problems that they could

not solve (Jennings & Bayless, 2003). In the second case, we learned that it was not the presence of technology problems that caused poor student perceptions of the course but rather the lack of help to solve the technology problems.

Faculty members expressed a need for course development assistance and a system of evaluation and assessment of online education and faculty. Two studies (Gibson & Herrera, 1999; Zhang, 1998) focused on instructor experiences in course preparation, and both discussed the need for time for development of online courses. Gibson and Herrera (1999) conducted a case study of an online bachelor's degree (Gibson & Herrera, 1999), describing their program development process. The second case study (Zhang, 1998) included detailed and pertinent data collection and evaluation information. Faculty members reported that the preparation of courses was much more time-consuming than they had expected and that they needed released time (course time that a faculty member is released from to pursue other professional endeavors) for course development. Researchers in both studies concluded that faculty members need assistance both during the development of the courses and during delivery.

In a third study of online course preparation, Dahl's (2003) survey of 428 faculty members demonstrated that faculty thought they should be paid for the development of a course, and agreed that online instruction takes more time than face-to-face instruction, especially when it came to communication with their students. The survey results offered no empirical data to support this conclusion.

Another study queried students in what the author described as an instrumental case study from a single university (Vallejo, 2001). This qualitative study used multiple sources of data and was based on engagement theory. Students in this study said they wanted administrative support in online courses for grade reporting, help with scheduling courses online, online admissions for online students, appropriate fees for online courses, and tuition payments offered online for the convenience of the online students and other students (Vallejo, 2001). Clearly the research on institutional support demonstrates that both students and faculty members want technical support. Faculty members also want compensation for course development and training for course development.

Enrollment Effects

The impact of online courses on enrollments (Ridley, Bailey, Davies, Hash, & Varner, 1997) also was examined. Surveys sent to students in one university resulted in a 61% return rate, yielding responses from 129 online course students. In addition, data were gathered on patterns of course taking and the relationship between commuting distance and credits taken. The results revealed no relationship between the type of courses taken (online or face-to-face) and distance of the students' homes from campus. Many distance education students lived in the same town as the campus of the online course, but some did not. Online courses generated a net increase of 175 credits from students who had not enrolled in the university before. Ridley et al. deemed this increased credit hour generation to be a positive factor in online course enrollment. However, time flexibility seemed an important consideration. These researchers concluded not only that online courses were attractive for students who lived more than 50 miles away, but that the scheduling of the courses helped

the school to better serve students whom they had served in the past who lived within 50 miles of the school.

Summary of Research on Institutional and Administrative Aspects
A few conclusions can be drawn. First there is no research that demonstrates that universities have established comprehensive policies to guide distance education or online courses. Another finding is that both faculty members and students want and need training and technological support. This training should be more one-on-one and ongoing, as with the technical support. Support is also needed for faculty when they develop such courses, as the task is very time-consuming and perceived by faculty to require more work than development of a traditional course. Finally, it seems that online courses can increase enrollment for universities as well as meet the needs of both distance students who live more than 50 miles away and students who live closer and want more flexibility.

Conclusions and Discussion

Because of the inconsistency in terminology used in the research we reviewed, we recommend some standardization of terms. We suggest that courses taught totally online should be called *online courses*. Those with an online component added might be called *hybrid* or *blended* courses. We call both hybrid, or blended, courses and face-to-face courses *traditional courses*.

We found no comprehensive theory or model that informed studies of online instruction. We also found few conclusive guidelines from the studies that we reviewed. Though several of the reviewed studies pointed to the need for a more sophisticated approach than merely moving text-based courses to the Internet, they simply recommended use of new technologies and sound pedagogy as models. Very few areas of inquiry about online courses were supported by multiple studies.

There were, however, some conclusions we could draw from research we reviewed. Students preferred to move at their own pace even though this required a high degree of self-management. They did not want to be locked into completing assignments at the same time as others and wanted to be able to move ahead in their courses at their own pace.

The literature showed that online instruction is welcomed by students because it provides learners with convenience and autonomy. This positive attitude toward online learning is more evident among students who have prior experience with computer assisted instruction and who are proficient in computer skills. Even students who have little experience with technology in teaching and learning find that online course experience eases their computer anxiety and improves their computer proficiency.

Many researchers have attempted to investigate the cognitive aspects of online learning. Two major findings can be summarized from the research. First, many studies focused on comparing students' learning in online and traditional environments. Learning was operationally defined in various ways, including by test scores, course grades, cumulative GPAs, and authentic performance of learned content. Although some researchers raised concerns about the validity of the findings because of inadequacies in research design, measurement, and analysis, overwhelming evidence has shown that learning in an online

environment can be as effective as that in traditional classrooms. Second, students' learning in the online environment is affected by the quality of online instruction. Not surprisingly, students in well-designed and well-implemented online courses learned significantly more, and more effectively, than those in online courses where teaching and learning activities were not carefully planned and where the delivery and accessibility were impeded by technology problems. This finding challenges online instructors to design their courses in accordance with sound educational theories. An even bigger challenge to education researchers is to further investigate the features of online teaching that will most benefit students.

There were many studies of online interactions between students. The options for online interactions most often studied were e-mail, listservs, and chat. Some faculty members also used these options as extensions of face-to-face classes. The results of some of these studies demonstrated that online students usually engaged in interaction that was no more comprehensive and involved no higher level of thinking than that found in face-to-face classes. However, graphic-based interfaces (IdeaWeb) helped students to engage in highly structured interpersonal interactions. Faculty should strive to promote both teacher-student and student-student interaction to help learners construct knowledge. In addition, instructors need to participate in the discussions and provide scaffolding to help students in their discussions.

Institutional aspects of these studies showed that few universities have written guidelines or policies for online courses. They also confirmed the lack of technical support for both faculty members and students engaged in online instruction. Faculty members want training and course development assistance as well as rewards for preparing courses to be taught online. Few faculty members said that they would require additional compensation for the work if they could get help developing and delivering courses.

Future Research

Aspects of Research on Online Courses

Clearly, more well-designed research is needed on online courses. Specifically, we need more systematic research focused on the aspects defined in our study. While recent research literature defines online delivery systems, few studies actually focus on instruction and learning online. Many studies point to student preferences, faculty satisfaction, and student motivation as primary delivery system determinants. To assess delivery system models, new research is needed that measures impact on academic success and thinking skills. Additional research might focus on plausible learner outcomes related to delivery system variables to test learning theories and models of teaching in the design of online courses.

A key element in online courses is providing effective communication and interaction. A variety of formats are available for online interaction, and many have been used to supplement face-to-face courses for the past several years. However, research needs to be conducted to determine which format provides the highest level of interaction and the most effective learning experiences for various kinds of students. In addition, future studies

need to show which format best fits a particular pedagogy used by instructors. More important, future research needs to examine the kinds of instructor and student roles in online interactions that enhance class discussions and encourage critical thinking and construction of knowledge.

Because online instruction and learning still constitute a relatively new frontier in education, informative theoretical frameworks and empirical evidence addressing some research questions are scarce. We found that researchers in related areas could be helpful in designing studies about online instruction, especially in the areas of multimedia learning (sound and picture) and computer-assisted instruction (using a computer in instruction). Although multimedia learning and computer-assisted instruction are not conducted online, they share many features with online instruction, including presenting information, classroom interaction, and evaluation. Principles developed in the two related areas could be applied in research on online courses. For example, in a multimedia learning study, Mayer, Heiser, and Lonn (2000) found a redundancy effect, which resulted when redundant on-screen text was added to a narrated animation. No positive effect on learning could be attributed to the added text. They also found a coherence effect. When they added interesting but conceptually irrelevant information, transfer of information was reduced. Investigation of the two effects in an online instruction environment will have both theoretical and practical significance. With advanced technology, we tend to include more and more information in online courses and present the information in a way that seduces learners' attention. We need research to generate information that will guide online instruction design to facilitate, rather than hinder or simply describe, students' learning.

Appropriate and excellent course design and development may prove to be paramount to the success of students in online courses. The relationship between various learner characteristics and course design is closely aligned. It has been shown that the more transparent the interface the more likely it is that the student will be successful in online environments. Research should be directed into at least two strands. First, what transparent interventions need to be developed? Children are taught at a very early age how to correctly use and treat a book. They carry this knowledge into the classroom so that the book becomes a transparent intervention. Once similar transparent interventions are developed for online course access, students will not need as much training in how to use online course delivery systems.

Another strand of research that would most likely bear fruit is improved design and management of online discussions. Research demonstrates that students value meaningful interaction, but further research is needed to better understand the way in which online interactions—student-to-student or faculty-to-student—enhance thinking and learning. What online discussion formats improve and increase students' thinking? How can faculty members confidently design and manage online discussions that include critical thinking at the higher levels of Bloom's taxonomy?

We also need research on the cost effectiveness of online courses. Only one study (Ridley et al., 1997) attempted to examine whether enrollment was positively affected by online courses. If enrollment is increased by offering online courses, it would help to justify the money that institutions must spend for equipment, software, training, and support for online instruction. More information is needed on institutional factors related to each

method of distance delivery. For example, more needs to be known about the impact of university policy on development and delivery of online courses, as well as on student achievement. Studies also are needed to determine whether online courses are more time-consuming to develop and to teach. In addition, we need to know more about the impact of technical difficulties on students' evaluation of the courses. We have not yet determined if this can affect the student's opinions of a course as a whole.

More research and development are necessary to match the various competing user interests with effective instruction, because one constant in this area of research is that the delivery technology will change. However, with more basic research, faculty members and institutions will have access to a wider variety of technology appropriate for a much more diverse audience.

Design and Methodological Issues

As mentioned earlier in this review, we have two concerns about research methods. Our first concern is that many of the studies that we reviewed did not follow rigorous designs. Without a control group, differences found between pretest and posttest scores might not necessarily be attributable to online instruction. The internal validity of a study could be threatened by differences that could be the result of maturation of participants, changes caused by taking the pretest, differences in scoring and administering of the tests, statistical regression between the pretest and the posttest, and attrition of participants between the two tests (Gay, Mills, & Airasian, 2005). For example, many studies were conducted with a single treatment group and a pretest and posttest design (e.g., Lesh, Guffey, & Rampp, 2000; Mortensen & Young, 2000).

Adding a control or comparison group to the single-sample pretest and posttest design could strengthen that design considerably. However, even with a control group, researchers are still concerned about confounding variables in the comparisons. If participants are not randomly assigned to the treatment and control conditions, the validity of the findings is still questionable. For example, as some researchers indicated (Clark, 1983, 1994), differences in learning outcomes observed between face-to-face and online courses could be attributed to so many variables that interpretation of any differences becomes virtually impossible.

Second, we believe there is an imperative need for developing adequate measurements for variables of interest. One common practice that we observed in online research was the use of a single item to measure a variable, which prohibits researchers from examining psychometric characteristics (reliability and validity) of measurement. If the reliability and validity of the measurement cannot be ensured, findings based on the measurement are questionable.

Sometimes researchers used instruments developed for traditional classroom learning to study online instruction. Although some measurement instruments worked equally well in the traditional and online environments (Richardson, 2003), given the differences between the two learning environments, an instrument that is valid in the traditional learning environment may not be valid in the online environment. McManus (2000) found that students with low self-regulation learned better than students with medium and high self-

regulation. Given that his finding contradicts findings in self-regulation research, it is possible that the instrument designed to measure self-regulation of learning in traditional classrooms did not validly assess students' self-regulation in the online environment.

Significance of This Review

This literature review provides direction for future research as well as some guidelines for the nature of that research and suggested methods for further study. Some of our results suggest recommendations for best practice in online courses. We also recommend that researchers develop appropriate theoretical foundations to inform future research. Some of these might involve theories of student motivation and learning, as well as theories of communication and social interaction. The poor quality of some of the earlier research that we reviewed may be indicative of the fact that this is a relatively new field of study, one in which important variables and processes have yet to be developed. This may be the reason for the plethora of descriptive studies and the lack of more experimental studies. Future qualitative research will continue to define researchable variables, and we encourage researchers to adhere to sound methods of analysis and triangulation of data. With the influx of online courses and the prospect that these courses will increase in number, it is imperative that researchers continue to inquire into this area of study and, in doing so, use sound scientific methods. A new model for online courses should be established, one that is based on research, not just on intuition or on the standard model for traditional courses. This review should assist researchers as they study online course behavior and continue to build knowledge about how to provide more effective learning online.

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Appendix
Summary of reviewed studies

Author(s) and year	Method	Purpose of study	Sample	Research method/aspect
Ahern, T. C., & Durrington, V. (1995)	Quantitative	Examine effects of individual identity and communication interface on students' online interaction	15 college students	Experimental/course environment
Ahern, T. C., & El-Hindi, A. E. (2000)	Qualitative	Describe IdeaWeb management of collaborative discourse	23 undergraduate students	Case study/course environment
Althaus, S. L. (1997)	Quantitative	Distinguish user groups by their perceptions of listserv discussion	142 college students	Correlational study/course environment, learners' outcomes
Bata-Jones, B., & Avery (2004)	Mixed-method	Compare learning and demographics of students choosing between online and face-to-face versions of a nursing course	18 nursing students in the website session and 52 in the face-to-face session	Causal comparative and focus group discussion/learners' outcomes
Bee, R. H., & Usip, E. E. (1998)	Quantitative	Differentiate between the attitudes of users and nonusers on various issues pertaining to distance learning via the Internet	153 college students	Causal comparative/course environment, learners' outcomes
Bielman, V., Putney, L., & Strudler, N. (2000)	Qualitative	Describe ways that online students construct social culture	37 community college students in an online course	Interaction ethnography/course environment
Blignaut, A. S., & Trollip, S. R. (2003)	Quantitative	Analyze faculty participation in online discussions	3 business courses, 469 instructor postings	Descriptive with surveys/course environment
Bocchi, J. (2004)	Quantitative	Determine demographic characteristics and reasons for taking online programs	Two graduate student cohorts ($n = 35$) and ($n = 29$) in an MBA program	Survey/learners' characteristics
Brown, B. W., & Liedholm, C. E. (2002)	Quantitative	Compare learning outcomes and characteristics of students in three different modes of instruction on the principles of microeconomics	363 traditional course students, 258 hybrid course students, 89 online course students	Experimental/course environment
Brown, S. W., & Kulikowich, J. M. (2004)	Quantitative	Compare online delivery and standard lecture courses	121 participants (26.4% male, 73.6% female) enrolled in graduate-level statistics courses (2 samples)	Causal comparative/course environment
Caywood, K., & Duckett, J. (2003)	Quantitative	Compare quizzes, final exam, and rating of teaching practice between students taking a behavioral management course online or on campus	75 on-campus adult students, 76 online adult students in special education program	Causal comparative/ learners' outcomes
Christel, M. G. (1994)	Quantitative	Compare multiple versions of interactive digital video in courses	72 college students in a digital video course	Experimental/course environment

Christopher, M. M., Thomas, J., & Tallent-Runnels, M. K. (2004)	Qualitative	Analyze the level of thinking used in online discussions	10 part-time graduate students in gifted education	Rubric used to analyze interactions/course environment
Cooper, L. (1999)	Quantitative	Describe students' perception of an online computer foundations course	College students	Descriptive study/course environment
Dahl, J. (2003)	Quantitative	Describe and compare faculty's compensation for developing and teaching online courses	212 individuals from 160 universities in 1999; 216 from 152 schools in 2002	Descriptive study/ institutional and administrative factors
Daroszewski, E. B. (2004)	Mixed-method	Evaluate effectiveness and value of online, directed journaling in a clinical nursing course	6 female graduate nursing students	Content analysis, descriptive/course environment
Davidson-Shivers, G. Tanner, E., & Muilenburg, L. (2000)	Mixed-method	Describe relevance of discussions to course content of students' interactions during synchronous (chat) and asynchronous (listserv) modes in a graduate course	14 graduate students	Descriptive statistics and coding scheme/course environment, learners' outcomes, learners' characteristics
Dellana, S. A., Collins, W. H., & West, D. (2000)	Quantitative	Compare students' learning and behaviors in online and traditional classrooms	221 college students	Causal comparative/learners' outcomes
Edwards, C., & Fritz, J. H. (1997)	Quantitative	Describe students' learning experiences in online courses	34 college students	Descriptive/course environment, learners' outcomes
Faux, T. L., & Black-Hughes, C. (2000)	Mixed-method	Compare instructional methodologies used in three sections of one course (traditional, online, hybrid)	33 undergraduate social work students	Causal comparative/course environment
Feist, L. (2003)	Qualitative	Explore the types of professional development activities that meet the needs of online instructors	10 online instructors	Case study/institutional and administrative factors
Frey, A., Faul, A., & Yankelov, P. (2003)	Quantitative	Assess Web-assisted teaching strategies that students perceive as valuable	253 Master's students in social work (40% male and 84% female)	Survey research and various scales/course environment
Frith, K. H., & Kee, C. C. (2003)	Quantitative	Determine the communication effects on students in an online nursing course	174 undergraduate nursing students	Experimental/institutional and administrative factors
Gibson, J. W., & Herrera, J. M. (1999)	Qualitative	Describe the design and launch of an undergraduate online program	Undergraduates in a large private university	Case study/institutional and administrative factors
Gilliver, R. S., Randall, B., & Pok, Y. M. (1998)	Quantitative	Compare students' learning with or without online supplementary readings or help sessions	111 college students	Quasi-experimental/learners' outcomes
Graff, M. (2003)	Quantitative	Determine effects of segmentation of information and provision of website overview coupled with students' cognitive styles on recall	50 psychology students learning psychological ethics	Experimental/learners' characteristics

Greene, B. A., & Land, S. M. (2000)	Qualitative	Review ways that students used online scaffolding (instructional supports)	18 college students	Multi-case study/course environment
Gunawardena, C. N., & Duphorne, P. L. (2001)	Qualitative	Examine adults' experience of learning in an online course	50 students from five universities	Grounded theory/learners' outcomes
Hansen, N. E., & Gladfelter, J. (1996)	Mixed-method	Describe and evaluate 9 years of experimentation with online courses	47 graduate students	Descriptive statistics/content analysis/course environment, learners' outcomes
Hantula, D. A. (1998)	Qualitative	Describe development of a virtual course through three iterations	College course	Evaluative case study/course environment
Hiltz, S. R. (1993)	Quantitative	Compare students' learning in online or face-to-face classrooms and examine relationship between students' perception of online instruction and learning	315 college students	Causal comparative and correlational/learners' outcomes
Im, Y., & Lee, O. (2003/2004)	Mixed-method	Analyze and compare the content of synchronous and asynchronous online discussions	40 undergraduate preservice teachers	Content analysis and descriptive statistics/course environment
Jennings, S. E., & Bayless, M. L. (2003)	Quantitative	Determine whether there are differences in GPA, ages of students, and student success between students in a traditional class and in an online class	Upper-level undergraduates in a traditional business course (47) and an online business course (39)	Quasi-experimental/institutional and administrative factors
Jones, C. A., & Gower, D. S. (1997)	Quantitative	Survey institutions on using distance education	All Tennessee 2–4-year institutions	Survey study/institutional and administrative factors
Kanuka, H., & Anderson, T. (1998)	Mixed-method	Explore the dynamics of learning community creation and support through a text-based mediated form of interaction occurring asynchronously over a limited time span	11 college students	Grounded theory, descriptive study/course environment, learners' outcomes
Keefe, T. J. (2003)	Quantitative	Assess student performance differences between online and face-to-face courses	118 undergraduates in business	Experimental/course environment, learners' outcomes
Knupfer, N. N., Gram, T. E., & Larsen, E. Z. (1997)	Qualitative	Examine instructor and student reactions to listserv discussion	29 college graduate students in four universities	Case study/course environment
Lan, W. Y., Tallent-Runnels, M. K., Thomas, J. A., Fryer, W., Cooper, S., & Wang, K. (2003)	Quantitative	Determine whether students' technical problems affect their evaluations of instructors	202 undergraduates	Survey/institutional and administrative factors
Levin, J., Levin, S. R., & Waddoups, G. (1999)	Mixed-method	Evaluate an online Master's program	26 graduate students	Surveys and case studies/course environment

Maki, R. H., Maki, W. S., Patterson, M., & Whittaker, P. D. (2000)	Quantitative	Compare students' learning, attitude toward computers, and satisfaction between online and lecture sessions of a psychology course	75 college students	Causal comparative/learners' outcomes
Maki, W. S., & Maki, R. H. (2001)	Quantitative	Examine the relationship between online course activities and learning	311 college students	Correlational/learners' outcomes
Mayer, R. E., & Chandler, P. (2001)	Quantitative	Determine whether control over the pace of instruction resulted in better transfer and retention of material	59 college students	Experimental/course environment
Mayer, R. E., Heiser, J., & Lonn, S. (2001)	Quantitative	Investigate effects of redundancy and coherence of information on students' learning	College students	Experimental/course environment
McIssac, M. S., Blocher, J. M., Mahes, B., & Vrasidas, C. (1999)	Mixed-method	Examine the role of interaction in online courses	Undergraduates	Descriptive and interviews/course environment
McManus, T. F. (2000)	Quantitative	Examine effects of linearity and self-regulation on learning	119 college students	Experimental/learners' outcomes, learners' characteristics
Mikulecky, L. (1998)	Qualitative	Compare discussion formats in an online and a face-to-face class	29 graduate students and a mixture of 11 postbaccalaureate and undergraduate seniors	Multi-case study/course environment
Parker, D., & Gemino, A. (2001)	Quantitative	Compare teaching effectiveness measured by performance on a final comprehensive test and two subscores on conceptual knowledge (multiple-choice items) and technique application (business cases), using cumulative data throughout five consecutive semesters (two semesters online and three semesters face-to-face)	128 online and 107 face-to-face students	Causal comparative/learners' outcomes
Pearson, J., & Trinidad, S. (2004)	Mixed-method	Compare online learning environment to student preferences.	10 secondary business teachers in Hong Kong	Survey research, content analysis/course environment
Peterson, C. L., & Bond, N. (2004)	Mixed-method	Compare student learning between program online and face-to-face	38 online and 49 face-to-face students in a teacher preparation program	Mixed-method/learners' outcomes
Phipps, R., & Merisotis, J. (2000)	Qualitative	Review benchmarks for quality online courses	27 faculty, 62 administrators, 16 faculty and administrators, 42 college students	Cross-case study/course environment, institutional and administrative factors
Richards, C. N., & Ridley, D. R. (1997)	Quantitative	Survey factors influencing students' persistence in online courses	69 college students	Survey study/course environment, learners' outcomes, learners' characteristics

Richardson, J. T. E. (2003)	Quantitative	Validate two instruments designed to measure college students' perception of course/approach to studying and compare to grades	178 undergraduate students in a computer course	Correlational/learners' outcomes
Ridley, D. R., Bailey, B. L., Davies, E. S., Hash, S. G., & Varner, D. A. (1997)	Quantitative	Investigate reasons for taking online courses, impact of online courses on full-time equivalent, and relationship between online credit and commuting distance	200 college students	Correlational, factor analysis/institutional and administrative factors
Ridley, D. R., & Husband, J. E. (1998)	Quantitative	Determine whether GPA is inflated in online courses	100 college students	Correlational/learners' outcomes
Roblyer, M. D. (1999)	Mixed-method	Provide baseline data on whether attitude factors and personal characteristics exist that can predict students' choice of course delivery systems	27 high school students, 33 community college students/online	*t* test, content analysis/learners' outcomes, learners' characteristics
Rockwell, S. K., Schauer, J., Fritz, S. M., & Marx, D. B. (1999)	Quantitative	Survey faculty's incentives and obstacles for delivering online courses	237 faculties and administrators	Survey/institutional and administrative factors
Schneider, S. P., & Germann, C. G. (1999)	Qualitative	Describe the learning environments provided by interactive technology	441 college students (182 university, 259 state college)	Case study/learners' characteristics
Schrum, L. (1995)	Qualitative	Identify significant issues in the development and presentation of online courses	One graduate course over 3 years	Case study/course environment, learners' characteristics
Schrum, L., & Hong, S. (2001)	Mixed-method	Identify the dimensions that characterize successful online learners	14 faculty in 70 institutions	Document analysis, descriptive/course environment
Shiratuddin, N. (2001)	Quantitative	Examine effect of Internet on students' performance	169 college students	Causal comparative/learners' outcomes
Smith, S. B., Smith, S. J., & Boone, R. (2000)	Quantitative	Examine effects of instructional mode and instructional method on students' learning	58 college students	Experimental/learners' outcomes
Sonnenwald, D., & Li, B. (2003)	Quantitative	Explore learning style preferences and perceptions of technology	40 upperclassmen, undergraduates	Experimental/learners' characteristics
Sullivan, P. (2002)	Qualitative	Discover whether online courses offer a more female-friendly classroom	21 female students	Narrative research/course environment, learners' outcomes
Swan, K., Shea, P., et al. (2001)	Quantitative	Investigate factors in online course design related to students' learning and satisfaction	1,406 college students	Correlational/learners' outcomes
Taraban, R., Maki, W. S., & Rynearson, K. (1999)	Quantitative	Compare patterns of students' studying time in online and traditional classrooms	99 college students	Experimental/course environment, learners' outcomes

Thirunarayanan, M. O. (2002)	Quantitative	Compare preservice teachers' learning of core concepts and ideas in a Teaching English as a Second Language course between online and face-to-face instruction	29 online and 31 face-to-face ESL students	Causal comparative/ learners' outcomes
Thomas, M. J. W. (2002)	Qualitative	Determine whether online courses are beneficial for students	69 undergraduates	Evaluation/course environment
Trinidad, S., & Pearson, S. (2004)	Mixed-method	Evaluate online learning environments	14 part-time Master's students in information technology	Interpretive framework, survey, e-mail interviews, online discussions, and online reflections/course environment
Vallejo, I. N. (2001)	Qualitative	Determine explanation of student support services for distance learners	College students	Case study/institutional and administrative factors
Warschauer, M. (1998)	Qualitative	Investigate social-cultural factors that helped shape a computer-based ESL course	Online Master's degree program	Ethnography/learners' characteristics
Wells, J. G. (2000)	Quantitative	Examine the relationship between personal characteristics and concerns with Internet at different stages of concern development	13 graduate students	Correlational/course environment, learners' outcomes, learners' characteristics
Wilson, T., & Whitelock, D. (1998)	Mixed-method	Assess distance learners' perceptions of collaboration and group work in an online environment	106 undergraduates	Descriptive, content analysis/course environment, learners' characteristics
Winograd, D. (2000)	Qualitative	Explore how a trained moderator affects students in computer conferences in an online course	30 undergraduate students	Grounded theory, narrative/course environment
Young, S. S. (2004)	Mixed-method	Investigate the teacher role in School for All (free courses taught by volunteer teachers for no credit)	Those who successfully completed any of 2,300 college courses over 2-year period (2000–2002)	Questionnaires, focus group interviews/course environment
Zemsky, R., & Massy, W. F. (2004)	Qualitative	Chart how the market for e-learning was changing over time and what it would be like in the future	6 institutions of higher education and 6 corporations with 15 faculty, 15 administrators, and 15 students from each place	Interviews/institutional and administrative factors
Zhang, P. (1998)	Qualitative	Describe actual use of distance education technologies during design and delivery of a graduate distance course	1 instructor, 1 teaching assistant, 15 graduate students	Case study/institutional and administrative factors