Online Learning in Higher Education: a review of research on interactions among teachers and students

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ABSTRACT Online learning has become a widespread method for providing education at the graduate and undergraduate level. Although it is an extension of distance learning, the medium requires new modes of presentation and interaction. The purpose of this article is to provide an overview of the existing literature in communications, distance education, educational technology, and other education-related fields, to articulate what is currently known about online teaching and learning, how the field has been conceptualized in the various research communities, and what might be useful areas for future research. The review indicates that, although there has been extensive work to conceptualize and understand the social interactions and constructs entailed by online education, there has been little work that connects these concepts to subject-specific interactions and learning. That is, the literature provides insights into social aspects of online teaching and learning such as the development of community, the social roles of teachers and students, and the creation of online presence. The review recommends future research into how these social, personal, and interpersonal aspects relate to subject matter learning, the impact of differences in subject matter, and how students learn online.

Online university courses are a new phenomenon, increasing dramatically since the 1990s. According to Harasim (2000), the first entirely online course was offered in 1981. The ancestors of online courses, however, have a long history, reaching back to the nineteenth century. Since the 1890s, universities have offered courses at a distance and such education has been the subject of both research and controversy ever since 1. Since the early 1990s, colleges and universities all over the world have begun to offer
courses and even entire degrees online, a phenomenon made possible by advances in technology unimaginable as recently as 15 years ago. Rumble (2001) characterizes the recent history of distance education as an evolution ‘from a modernist form of education to a phenomenon that fits with postmodernist developments such as consumerism, the emergence of the postbureaucratic organization, and globalization’ (p. 31).

It is the purpose of this review to look at recent research in order to understand the learning and teaching issues entailed by offering online coursework in higher education. In particular, the review focuses on research about what teachers and students do in such classes, and whether and how communities are formed. ‘Distance education’ will be used here to encompass formal education in which the teacher and students are physically separated, including both online and offline formats. ‘Online education’ will be used to mean classes that are offered entirely online. The focus of this article is on research that sheds light on learning and teaching in online distance education, in which the students and the teacher are dispersed in time as well as space.

Why This Review?

The review arose from two questions pertinent to designing and teaching online courses for teacher professional development. First, what constitutes teaching in online classes? Second, what difference does the nature of subject matter make in online classes? The first question is asked from the point of view of researchers who have studied teaching extensively in face-to-face classroom settings. The perspective on teaching, stated simply, is that teaching is an essential element of education for most students. Put another way, most students need the help and mediation of a teacher to make sense of complex subject matter (Erlwanger, 1973; Leinhardt, 1994; Bransford et al., 1999) No matter how well presented or represented, many subjects are difficult to learn on one’s own without discussion, feedback, encouragement, or explanation from or with a knowledgeable other. Recent views of cognition suggest that learning is also enhanced by engagement in a community in which learners help each other to make sense of information and ideas, with the teacher acting as a mediator to focus and guide discussion (Brown et al., 1989; Brown & Campione, 1994). Prior to the availability of online environments, such interaction was difficult to achieve in distance education courses. Two common modes of distance education—correspondence courses and television broadcasts—featured at most written exchanges of comments and feedback, and often few opportunities for interaction with the teacher or with other students. With the advent of online education, it is important to ask how the interactive roles of teachers—the personal, immediate, and responsive aspects—can be realized in online classrooms, or if they cannot be realized, what the role of the teacher becomes once the materials are online and the class begins.
This is an area in which research is just beginning. As Salmon (2000) points out, 'Millions of words have been written about the technology and its potential, but not much about what the teachers and learners actually do online' (p. 11).

The second question—what difference does subject matter make?—arises in the author's work in teacher education, a field in which the representations of knowledge are complex, and in which the layers of knowledge are multiple and interwoven. For example, a mathematics teacher learning about teaching with technology needs to know not only the mathematics associated with the new technology (possibly mathematics that is new to the teacher), but also the details of using the technology, the location and use of the technology in the curriculum, and the pedagogy of using the technology to enhance student learning. For such a class, teaching online means trying to teach about subjects that are not easy to convey in text. The question is how the nature of the subject matter and its representation impacts online teaching and learning. The literature reviewed below provides a reasonable foundation for studying this question even though research directly addressing the question is sparse.

In recent years, some have argued that teaching online is best understood as facilitating or moderating a discussion. For these authors, the role of facilitator implies that the need for subject matter knowledge is low and that knowing how to facilitate in an online environment is more important than extensive subject matter knowledge (Moore & Kearsley, 1996; Palloff & Pratt, 1999; Salmon, 2000; Collison et al., 2000). Although that argument is made, it is not presented as a finding of research, but, rather, as a conclusion drawn from the experiences of these authors. These claims seem to directly contradict the findings of research on teaching, that subject matter knowledge is an important factor in effective teaching (Shulman, 1987; Brophy, 2001). These claims, and others that make prescriptions for online education, led to this investigation of what has been studied and learned about online teaching and learning, both directly from studies of online courses and, when applicable, from research on earlier modes of distance education.

Methods of the Review

The literature relevant to this review is found in many disciplines—research about online distance education is found in journals in communications, higher education, educational technology, as well as in the subject disciplines. Many recent articles in journals and professional magazines advocate in favor of online education and provide anecdotes about successful experiences of individual faculty members or programs. A rash of how-to books, describing techniques for developing and teaching online courses, can be found in bookstores. While interesting and perhaps useful to online educators as they plan new courses, most articles and books in
these categories—advocacy, success stories, and how-to books—lack a research perspective. The volume of literature in these categories is huge—even in research journals, many of the articles that have appeared in recent years about online learning are anecdotal or promotional. Such articles are excluded from this review.

Research of three sorts is included: theoretical or foundational work relevant to understanding the nature of teaching and learning in distance education, previous literature reviews, and empirical research that addresses teaching or learning in online distance education. The review will exclude demographic research describing who offers distance education courses or who takes them; anecdotal articles describing how individual faculty members or institutions went about providing distance education; articles that advocate online or distance education; and how-to books. It will also exclude research on policy, finance, and infrastructure as well as articles reporting technological details for developing online classes. Finally, the review does not include any of the ‘horse-race’ studies that compare online courses to face-to-face courses. Such studies have consistently found ‘no significant difference’ and they shed little light on the advantages or disadvantages of either mode. Comparison studies provide few details on how students and teachers interact with each other, or with subject matter, in either distance or face-to-face courses.

The primary sources of literature were journals in distance education, communications and educational technology. To conduct this review, the starting point was the main journals that directly address distance education: the Journal of Asynchronous Learning Networks, the American Journal of Distance Education, the Journal of Distance Education, the International Journal of Educational Telecommunications, and the Journal of Computer Mediated Communication. Educational technology journals were included as well: T.H.E. Journal, the Journal of Educational Computing Research, the Journal of Research on Computing in Education, the Journal of Computers in Mathematics and Science Teaching, the Journal of the Learning Sciences, Internet and Higher Education, the British Journal of Educational Technology, and the Journal of Technology and Teacher Education. Journal searches were followed by ERIC searches using keywords from the articles identified in the journal searches, and followed promising citations in bibliographies of key articles and in previous literature reviews. This review also includes research from the developing computer-supported collaborative learning (CSCL) research community. Although this research has only recently turned to online learning, past CSCL research focused on face-to-face settings in which the computer is one element of a collaborative learning environment. Some of this work includes studies that evaluate tools for supporting online discourse, with results relevant to online teaching and learning. Current CSCL research builds on the theoretical foundations of the field, seeking to understand the collaborative construction of knowledge in face-to-face and online settings.
This is not a complete review of all articles written about online teaching and learning; that goal seemed nearly impossible given the reach of articles in publications all over the world and across every discipline, and the preliminary state of much of the research. It represents, however, a comprehensive search for relevant articles in these likely sources, selecting those that seemed promising based on the title, the abstract, or a citation from another study. In the end, more than 200 articles were considered, of which over 100 are included in this review. The review provides a comprehensive perspective on some of the important concepts in research about online teaching and learning, and it includes sources that seem to be seminal work in this area. Research reviewed here will be discussed in four broad categories: student roles and interactions; teacher roles and interactions; online collaboration and community; and new tools to support online learning.

**Student Roles and Interactions**

How do students participate in online classes? The availability of transcripts and log files in online distance education has made it possible to study student behavior, and then to correlate behavior with measures derived from questionnaires and interviews. Although there have been a few studies that connect characteristics or levels of participation with outcomes, much research has been dedicated to developing and validating theoretical constructs for studying student participation. Three major constructs defined in this literature are *transactional distance, interaction*, and *social presence*, all developed in studies of distance learning prior to the advent of online courses.

**Transactional Distance**

Introduced by Moore in 1980 as a measure of student involvement in distance education courses, transactional distance was defined as a function of dialogue and structure. Moore’s idea was that a smaller transactional distance would be a sign of greater involvement by the student. More dialogue between instructor and students indicated a smaller transactional distance, while more structure provided by the instructor was taken as a proxy for a larger transactional distance. In the latter case, the idea was that more structure meant less student control of his or her own learning, and less student control implied less engagement with content. In any mode of teaching, transactional distance can vary depending on how the course is structured and delivered. Lectures with no discussion are characterized by large transactional distance (high structure, low dialogue), while synchronous online peer-group discussions have small transactional distance (low structure, high dialogue).

Moore and Kearsley (1996) hypothesized that a third factor, student
autonomy, interacted with dialogue and structure and that the three together formed a useful model for understanding the role of the learner in distance education, a model they call the theory of transactional distance. Autonomy was seen as the level of student control of the planning, execution, and evaluation of his or her own coursework.

These constructs—transactional distance, dialogue, structure, and student autonomy—have been explored as a means of understanding how students engage in and respond to distance education classes. For example, Saba, and Shearer (1994) tested the concept of transactional distance by creating a dynamic model in which transactional distance increased with increases in dialogue, and decreased with increases in structure. Variables in the model included instructor control, designated as direct or indirect, and learner control, designated as active or passive. Instructor control determined values for structure while learner control determined values for dialogue. They tested the model with 30 students, interacting one at a time with an instructor through a prototype distance learning workstation that included video, data, and voice. The resulting model produced values for transactional distance consistent with the theory that transactional distance is directly proportional to dialogue and inversely proportional to structure.

Garrison and Baynton (1987) explored the concept of learner autonomy, and suggested that it is a function of independence, power, and support. They identified elements of course structure that led to less student autonomy, including pacing, course objectives, and frequency and immediacy of communication. Historically, distance education focused on adult education and aimed at producing independent learners. Thus, literature is filled with references to independent learning and autonomy. In a review of this earlier literature, Garrison and Baynton make clear that the constructs of independence and autonomy have been ill defined and used more as symbols for the purposes of adult distance education than as well-defined outcomes. They suggest that the dimensions of autonomy (independence, power, support) and the elements of transactional distance (dialogue, structure, autonomy) are complexly interwoven, so that, for example, increases in structure may not always mean loss of autonomy.

None of these studies, and no others that were found, addresses the meaning or significance of transactional distance or the related constructs as they affect student learning, satisfaction, or motivation. Moore describes his theory of transactional distance this way:

_The theory of transactional distance has served as a tool that can be used to describe distance education courses and programs and to locate any one in relation to others in the universe of such events. At the same time it provides a framework within which researchers can locate numerous variables of structure, dialog, and learner autonomy, and then ask questions about the relationships among these variables._ (Moore & Kearsley, 1996, p. 211)
The theory of transactional distance has been a descriptive rather than a predictive theory, although it has clear potential for correlation with outcome variables. Some research identifying the underlying variables and studying their relationships has been carried out and is reviewed below.

Interaction

Moore (1989) also suggested three kinds of interactions that together constitute the sites for student engagement in distance education classes and thus sites where transactional distance and learner autonomy could be studied. These are learner-content interactions, learner-instructor interactions, and learner-learner interactions. Hillman and colleagues (1994) added a fourth type of interaction, learner-interface interaction. These four together have been suggested as the loci for studying and measuring transactional distance.

Interaction has been used to understand how students construct knowledge in distance education environments. Several studies developed coding schemes that categorize interaction according to models of knowledge construction to understand how online dialogue might lead to student understanding. Gunawardena and colleagues (1998) developed a model and coding scheme for online interaction with five phases of knowledge construction:

1. sharing/comparing of information;
2. discovery and exploration of dissonance or inconsistency among ideas, concepts, or statements;
3. negotiation of meaning/co-construction of knowledge;
4. testing and modification of proposed synthesis or co-construction; and
5. agreement statement(s)/applications of newly constructed meaning.

In a study of an online global debate, they found that participants rarely moved beyond the second stage and stayed mostly in the first stage of sharing and comparing information. Dissonance was rarely acknowledged when it existed and participants created agreement where it did not exist by not acknowledging differences.

Salmon (2000) developed a five-stage model to understand the process in which students engage in online classes:

1. access and motivation;
2. online socialization;
3. information exchange;
4. knowledge construction; and
5. development.

She used this model as the basis for analyzing and describing how the teacher (in her language, the 'e-moderator') could support student learning.

Harasim (2000) suggested a framework for analyzing online discourse,
1. Divergent thinking: democratic participation and idea generating
   - Quantitative indicators: usage reports
   - Volume of participation
   - Density of participation
   - Distribution of participation
   - Qualitative indicators: discourse analysis

2. Intellectual progress and idea linking
   - Quantitative indicators: level of interactivity
   - Qualitative/quantitative indicators: name mentioning and transcript analysis

3. Convergent thinking
   - Quantitative indicators: density of (1) and (2)
   - Qualitative indicators: conclusive supported position statements (agree or disagree)

Fig. 1. Harasim's (2000) categories for analyzing online discourse.

and is using this framework in a current study of online courses. Fig. 1 shows Harasim's categories and measures.

Kanuka and Anderson (1998, p. 66) conducted a study using Gunawardena's five phases to analyze discourse in an online conference with 16 participants. They found that students engaged in 'an acquisition of information that was compatible with existing knowledge, thereby increasing the participants' overall knowledge base. In this type of interaction, additional information was acquired, but the basic structures of the participant's views remained unchanged' (p. 66). They called this kind of interaction 'social interchange' and concluded:

The result [of social interchange] is a discussion that lacks the kind of fluidity that occurs in conversational language where knowledge construction is a process of constant evolution based on social interaction and meaning negotiation. The lack of communication by the participants to clarify and discuss inconsistencies results in a nonfluid and nonsequential discussion ... existing paradigms appear to remain unchanged. (p. 68)

Although the study did not examine reasons for these kinds of interactions, Kanuka and Anderson make the following conjectures:

First, this type of discussion is common in informal dialogue that occurs at face-to-face professional development activities. Second, there was no subject matter expert to draw out and develop new concepts nor a teacher empowered to require participants to deal with issues ... Third, the satisfaction ratings [indicate that] the forum was of value and generally met their expectations ... An alternate hypothesis explaining the absence of negotiation of meaning is that it is much easier to ignore or not respond to online messages that are incompatible with existing knowledge than it is in a face-to-face environment ... It may also be possible that the construction of knowledge is not an observable activity. (Kanuka & Anderson, 1998, pp. 71–72)
In a study of 3800 students taking 264 online courses through State University of New York's online learning network, Swan (2001) analyzed course documents and asked students to fill in questionnaires rating their perceptions of their courses across various dimensions, including learning, interaction with instructor, interaction with classmates, and their personal level of activity. In 73 courses (selected based on the size of the course and rate of return of the surveys), Swan found significant correlations among several of the variables. The more interaction students believed they had with the instructor, the more they were satisfied with their courses, and the more they thought they learned. Significant correlations were also found for beliefs about interactions with other students: the more interaction with other students, the more satisfaction with the course and the more perceived learning. Swan found a significant correlation between students' reported levels of activity in the course and reported satisfaction and learning. In analyzing course documents, Swan found significant correlations between greater structural consistency within the course and student outcomes—satisfaction and perceived learning. Fewer course modules also correlated significantly with student learning.

Perhaps as interesting are the factors for which no significant correlations were found in Swan's study: interface design, links to the Web, methods of assessment, class size, student achievement levels, and instructor voice each had no significant relationships with any of the student perception variables. Swan concludes in this study, 'three (and only three) factors ... contribute significantly to the success of online courses. These are a clear and consistent course structure, an instructor who interacts frequently and constructively with students, and a valued and dynamic discussion' (Swan, 2001, p. 13).

In a 2001 study of adult distance education students in China, Chen (2001) explored transactional distance and sites of interaction in an effort to determine factors that define the construct. Using a questionnaire administered to 80 students, Chen verified the four types of interaction suggested by Moore and Hillman as constituting separate factors in measuring transactional distance. The learner–learner factor 'related to the degree of accessibility to other learners, communication with them, agreeing with their opinions/comments, understanding their perspectives/ideas, and overall quality of interaction with them.' This factor accounted for 33% of the variance in transactional distance. Learner–content items asked about understanding of 'learning materials, discussion questions, hyper-linked keywords, assignment requirements, chapter resources ... and the degree to which these items met respondents' learning needs and matched their expectations.' The learner–content factor accounted for 13% of the variance. Learner–interface items asked about the user-friendliness of the interface, difficulty in using the interface for finding course information, engaging in discussion, and communicating with others. This factor accounted for 10% of variance. Finally, the learner-instructor factor
included items about instructor accessibility, communication, and overall quality of interaction, and it accounted for 7% of variance. All four factors were correlated, but independent.

Wang and colleagues (2001) conducted a study of students taking statistics lab sections online. The course was conducted as a live chat-room lecture and discussion, lasting about 1.5 hours per week. This study differs from most of the others reviewed because the mode of online teaching and learning was synchronous; that is, students and teacher were online together, separated by space but not in time. Wang and colleagues found that the level of student participation, and in particular, the number of times a student responded to a lecture issue or question, correlated significantly with student outcomes in the course as measured by final course grades. Their analysis indicated that student outcomes could be predicted based on their participation during the third week of the course. They further found that the frequency of social remarks, although the third most frequent type of remark in their 12-item coding scheme, did not correlate with any of the graded components of the course.

Gibson (1996) conducted a study of academic self-concept in distance learners, examining the relationship of academic self-concept to 'perceived confidence, perceived competence, commitment, barriers to and enhancers of educational progress, and breadth of resources used in pursuing their studies' (p. 23). She concluded that these students vary widely in academic self-concept, but that their success depends on having or developing a positive self-concept. Gibson suggests that instructors can support high academic self-concept by providing clear structure and expectations in online courses.

Bodzin and Park (2000) conducted a study of 32 pre-service science teachers using an online forum for a substantial part of a science methods course. Students were required to post two messages a week to the online discussion board, including the 10 weeks they were in the field working as student teacher interns. Although the purpose of the forum and the focus of the assignment was the pedagogy of science teaching, students' postings were general and did not address the complexities of science pedagogy.

Overall, the research on student participation suggests two important themes: First, students in online courses value and benefit from interaction with other students and the instructor. Second, interaction that moves into cognitively complex engagement with ideas is not common for reasons that are not clearly explained by research. This effect could be particular to conditions in the studies that have been done, or it could be related to more general structural issues of online learning.

Social Presence

Short et al. (1976) introduced this construct, defined as 'the degree of salience of another person in an interaction and the consequent salience of
an interpersonal relationship' (p. 65). They pointed to intimacy and immediacy as elements of social presence, where intimacy is determined by personal responses such as smiling and eye contact, and immediacy is determined by verbal and non-verbal interactions such as asking questions, responding to requests, or reacting to comments. Social presence, they suggested, is a factor of both the medium and the participants. Different media afford different opportunities for intimacy and immediacy, and participants take up those opportunities differently. Although the construct was defined as part of an effort to understand telecommunications in social interactions, it has proven useful in understanding how students and teachers interact through educational telecommunications.

Gunawardena and Zittle (1997) explored the concept of social presence to understand its impact on student satisfaction with online distance learning. They sought to 'measure how effective social presence is as a predictor of overall learner satisfaction in a computer conference environment' (p. 11). They also investigated the relationship between student use of emoticons, social presence, and satisfaction. Using a Likert-scale questionnaire, they surveyed 50 graduate students from five geographically dispersed universities who had participated in an online conference. They assessed a range of responses to and beliefs about the online conference, including items about social presence, active participation, attitudes toward online learning, barriers to participation, confidence with respect to online learning, training and preparation, technical skills, previous experience, and overall satisfaction with the course. They found that social presence accounted for 60% of the variance in satisfaction with the course. The only other significant factors were equal opportunity to participate and technical skills, which together accounted for another 8% of variance in satisfaction.

Rourke et al. (1999) define social presence as 'the ability of learners to project themselves socially and affectively into a community of inquiry' (p. 50). They developed a coding scheme consisting of 12 items in three categories to measure social presence, shown in Fig. 2.

In two graduate-level conferences in workplace learning, they sought to test the efficacy of their coding scheme for analyzing social presence. Each conference was 13 weeks long, with 14 and 17 participants respectively. The difference in the number of conversational units between the two
conferences was so great (24,000 vs. 6,000) that they developed what they called 'social presence density' to compare the two. This function was defined as the number of instances in a given category (from the 12 listed in Fig. 2) divided by the total number of words, then multiplied by 1000, yielding incidents per 1000 words. They found this measure to be useful in understanding and comparing the transcripts from the two conferences.

Although the study was primarily conducted to test their methodology, Rourke and colleagues offer some substantive comments about social presence suggested by these data. First, the level of social presence decreased over time, confirming results from Angeli and colleagues (1998). Second, they suggest that although 'fairly high levels of social presence are necessary to support the development of deep and meaningful learning, we expect that there is an optimal level above which too much social presence may be detrimental to learning' (Rourke et al., 1999, p. 67). Finally, they suggest that some of the 12 indicators in their coding scheme are more important factors in social presence than others, but they were unable to verify this in the current study.

Rourke and Anderson (2002) conducted a study of a graduate course in communications. Seventeen adult students were enrolled in the class in which groups of four students were formed to discuss course content. Within these peer teams, students rotated the job of leading the discussion. Students reported that the peer teams were more satisfactory than instructor-led discussions, finding them 'more responsive, more interesting, and more structured' (p. 19). Students reported 'they were not looking to the online discussions for an authoritative presentation of content, but rather for an exchange of opinions and a sharing of experiences' (p. 20). Students reported that they enjoyed leading the discussion and learned content better when they were discussion leader. Although students took on the functions of the teacher in these small groups, the teacher participated in the groups, sometimes assuming a teaching role: 'Any of the teaching presence responsibilities that peer teams might have overlooked or struggled with, such as diagnosing misconceptions or making macro-level comments about the course content were still assumed by the instructor' (p. 24).

Garrison et al. (2001) extend the concept of social presence to what they call cognitive presence. They define this as a measure of student engagement in inquiry. To study cognitive presence, they use a four-phase model of inquiry by which they code triggering events, exploration, integration, and resolution. In a test of their coding scheme in three graduate-level online courses, they found that students interacted mostly in the exploration phase (42% of coded interactions). Triggering events were rare (8%)—in part because the instructors set the problems. Integration (13%) and resolution (4%) were also infrequent. Garrison and colleagues suggest that because integration is both time-consuming and risky—solutions or hypotheses might be rejected by others—it is less likely to
occur. They further hypothesize that the medium may not support resolution as readily as it supports sharing and comparing ideas.

Based on this research on social presence, it seems likely that social presence is an important factor in students' learning and satisfaction in online courses. It is not clear, however, in what ways social presence impacts learning. It is possible, for example, that optimal levels of social presence exist that might depend on the size or purpose of the class, the nature of the subject matter, or other factors yet to be determined. The construct of cognitive presence is an interesting extension of the earlier construct, with intriguing possibilities for insights into how students learn in online classes.

**Student Participation Summary**

In summary, the literature on student participation makes several important points. First, students participate actively in online classes in which discussion is valued. They create social presence by the nature and content of their participation, and social presence seems to be an important element of both satisfaction and learning. Establishing social presence is especially important at the start of courses, with evidence of efforts to establish social presence decreasing over time. Students in online courses value discussion with both the teacher and fellow students, and course structure seems to be an important factor in enabling discussion. There is some evidence that how much a student contributes to online discussion is correlated with his or her performance in the course, although the study in which this correlation was found was conducted in a *synchronous* online lecture course (Wang et al., 2001) and thus may not apply to courses in which all interactions are asynchronous.

The construct of transactional distance, although interesting, has not been used adequately in empirical study to know how it affects, or correlates with, student satisfaction or outcomes. Swan's work may call into question Moore's use of structure in his definition of transactional distance. Her studies indicate that a consistent and well-defined structure was an important element in student satisfaction and perceived learning outcomes (2001; Swan et al., 2000). Although Swan does not do so, one could theorize that more structure in an online environment facilitates more discussion and greater autonomy, taking some of the burden of figuring out what to do away from students so that they can focus on the important subject matter of the course. Structure might increase the opportunities for cognitive presence in ways that decrease transactional distance. Moore (1993) proposes the opposite, that structure distances students from the content and the instructor. Garrison and Baynton (1987) suggest that these concepts are not as clearly related as Moore's definition of transactional distance implies.

One problem with the literature on student participation is that much
of the evaluation of outcomes is based on student self-reports. Perceived learning and satisfaction are two commonly used outcome measures. Other research indicates that these are not necessarily good measures of learning. For example, in a study of student learning from television, Salomon (1984) compared student self-efficacy and learning outcomes when students learned via television or print. He investigated the 'amount of invested mental' effort in 124 students who either watched a television show or read a similar story. He hypothesized that when 'easy' material (television) is shown, subjects with high self-efficacy will invest less effort and achieve less. The results of the study bore out his hypothesis: Students reported greater self-efficacy in the television mode, but learned more from print. Students worked harder in the print medium, but liked it less.

Hara and Kling (2000) argue that more research about online courses from the students' perspective is needed. In a case study of graduate students enrolled in an online course, they found that many aspects of the course frustrated students, and that the instructor remained unaware of the continuing level of frustration. They suggest that many researchers bring an optimistic, romantic view of technology that may dampen their ability to look at hard questions and apply rigorous research methods. Much of the research, they maintain, has been advocacy and theorizing about future possibilities.

Another problem with this literature is that it does not reveal much about what students are likely to learn from their participation in online discussion. In the few studies that looked for engagement in inquiry or knowledge building, the evidence suggests that students do not readily move beyond sharing information. None of these studies has investigated what it would take in terms of course structure or teacher mediation to reliably engage students in discussion that led to a deeper understanding of subject matter. In fact, none of these studies considered subject matter knowledge as a variable in its own right, looking instead at constructs that might be correlated with subject matter learning (e.g. social or cognitive presence) but not directly at subject matter.

In the end, we know that, in online courses, students value discussion and structure; that they create social presence by the nature of their discussions; that they value being socially present in these online classes; and that instructor participation in discussions is important to students. Students report that they have learned more when these conditions and opportunities are present in online environments.

**Teacher Roles and Interactions**

A big question for faculty members designing new online courses concerns their role as a teacher: what do I do when I teach online? Designing the course materials, interacting with students and giving them feedback, and assessing student work are obvious tasks for the online teacher. What is not
1. Instructional design and organization
   Setting curriculum
   Designing methods
   Establishing time parameters
   Utilizing medium effectively
   Establishing netiquette

2. Facilitating discourse
   Identifying areas of agreement/disagreement
   Seeking to reach consensus/understanding
   Encouraging, acknowledging, or reinforcing student contributions
   Setting climate for learning
   Drawing in participants, prompting discussion
   Assess the efficacy of the process

3. Direct instruction
   Present content/questions
   Focus the discussion on specific issues
   Summarize the discussion
   Confirm understanding through assessment and explanatory feedback
   Diagnose misconceptions

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**FIG. 3. Anderson et al.'s (2001) categories for teaching presence.**

obvious, however, is how those tasks are carried out. Particularly problematic is the role of the teacher once the class begins, which certainly affects both how the course is designed, and how student work is assessed. Class discussions, small group activities, lectures, and all the other tools in the repertoire of face-to-face teaching are radically changed online. In addition, many of the guides for teaching online suggest that the amount of time it takes can be overwhelming; instructors are cautioned to use their time wisely lest they spend many multiples of a normal teaching load responding to students. Next, we look at two important constructs for understanding the role of the teacher, teacher presence and immediacy. Then we review several descriptive models of teachers' roles in online courses.

**Teacher Presence and Immediacy**

Anderson and colleagues (2001) define teaching presence as consisting of three parts: design and coordination, facilitating discourse, and direct instruction. They use 'teaching presence' rather than 'teacher presence' to allow for the possibility that people other than the course instructor will assume parts of the teaching role. They developed these categories based on a review of literature about functions of teaching in online environments, and then created a coding scheme for teaching presence, shown in Fig. 3.

They used these categories to code transcripts from two 13-week online classes, one in health, and one in education. Although they found
considerable difference between the classes, in both classes the majority of
teacher interactions were coded as direct instruction, the category that
involves interaction about subject matter. In the health class, 77% of the
coded units were in direct instruction, and in the education class, 87%.
(Note that message units could be coded in more than one category.)
Anderson et al. argue that direct instruction, which requires subject matter
expertise, is an essential element of learning in an online class:

A widely documented problem in computer conferencing is the
difficulty of focusing and refining discussions so that conversation
progresses beyond information sharing to knowledge construction and
especially application and integration. We believe that this stalling of
the discussion at the lower levels of the critical inquiry process occurs
when there is not adequate teaching presence in the computer confer-
ence. The teacher’s summary is also normally not merely a neutral
‘weaving’ of the previous postings. It often serves to develop and
explicitly delineate the context in which knowledge growth has taken
place. (p. 9)

Closely related to teacher presence is teacher immediacy, a theoretical
construct developed in studies of teacher communication in face-to-face
settings (e.g. Mehrabian, 1969; Richmond et al., 1987; Frymier, 1994).
Rourke and colleagues (1999) give a short history of the construct.

LaRose and Whitten (2000) apply the concept of teacher immediacy
to web-based classes within the framework of social cognitive theory. They
suggest that teacher immediacy, defined as ‘teaching behaviors that en-
hance closeness to and nonverbal interaction with another’ (p. 321), is a
mediating factor in motivation, which in turn mediates both social and
cognitive learning. They compare immediacy behaviors in three web-based
classes, one providing only a text-based environment, one audio, and one
video. Their goal in this study was to identify ‘potential indicators of
immediacy’ and to that end, they developed a coding scheme and applied
it to documents and transcripts from the three classes. The coding scheme
identified four kinds of teacher immediacy behaviors, explained in Fig. 4.

Some of these behaviors clearly cannot be seen in online text-based
environments, but LaRose and Whitten found that, in all three conditions
(text, audio, and video), teachers manifested a variety of immediacy
behaviors appropriate to the medium. They argue, based on the literature on
immediacy and motivation and on their observations from these three
classes:
closer integration of immediacy features with lesson content is also
called for. The separation of lesson material from immediacy cues in
time and (cyber)space is likely to reduce their motivational impact on
affective learning. Theoretically, it is essential that the social and
Social Approval: Praised students, provided feedback, smiled

Status Recognition: Used personal examples, addressed instructor by first name

Social Interest: Addressed student by name, looked at the class, touched students, asked questions of students, solicited student opinions

Status Enhancements: Used humor, initiated out of class contact, used second person plural, relaxed posture, moved around classroom, permitted digressions, used gestures, varied vocal expression

Fig. 4. LaRose and Whitten's (2000) teacher immediacy behaviors.

*status incentives provided by immediacy behaviors be closely associated with the content of the lesson.* (p. 333)

Schweizer et al. (2001) conducted a study in which they systematically varied the immediacy behaviors of the teacher in a web-based class and studied student responses in their written discourse. They set up four conditions: text communication only; text and context-appropriate pictures of the teacher; text, and audio; and text, audio, and context-appropriate pictures. Twenty-four pictures were taken of the teacher before the class began, representing six different expressions: explaining, showing empathy, being interested, gaining attention, and providing feedback (positive or negative). They studied responses of 101 students in a nine-week course who were randomly assigned to the different conditions. Their classification scheme comprised the attributes 'task orientation vs. personal orientation,' 'formal vs. informal communication style,' 'tension and extremely emotional evaluations of the communication partner or the communicational setting.' In the end, they confirmed their hypothesis that 'experiencing the tutor with less social presence leads to extremely emotional evaluations as well as more task oriented, informal, and tense reactions, compared to conditions in which the tutor can be experienced with greater social presence' (web print-out). They report that this confirms theories developed by Walther and Tidwell (1995), which they describe as follows:

In CMC the exchange of information is slower than in face-to-face interaction. Therefore, in comparison to face-to-face communication the construction of interpersonal knowledge is slower. In the beginning, CMC is more task-oriented than person-oriented and less powerful. In this phase, the communication style in computer-mediated situations is regarded as more informal but one is also likely to find cues for tension and extremely emotional evaluations of the
communication partner or the communicational setting. (Web print-out)

Schweizer and colleagues also found significant differences in the use of emoticons, with the students in the conditions of lower teacher presence using them more frequently than those in conditions of higher teacher presence. They describe this as an adaptation on the part of the students in the first condition to the demands of lower teacher presence. This is consistent with theories of adaptation and affiliation proposed by Walther & Tidwell (1995).

Models for Teacher Roles

Offir and Lev (2000) developed a model for understanding both student and teacher participation in online discourse. They built their model from Henri’s (1992) analysis, which produced a system for analyzing online discourse. The Henri framework included five dimensions: participative, social, interactive, cognitive and metacognitive. He used this system to study student learning. In a later study of courses offered by a university to advanced high school students, Offir and colleagues (2003) expanded their instrument to include six categories:

1. Social: teacher statements that create a positive atmosphere and support motivational affective aspects of learning.
2. Procedural: teacher statements containing information regarding administrative and technical issues related to the lesson or course.
3. Expository: statements presenting knowledge content.
4. Explanatory: the teacher uses a question or comment initiated by the learner in order to explain content.
5. Cognitive task engagement: the teacher presents a question or learning task that requires learners to actively engage in processing the given information.
6. Learning assistance interactions: the teacher attempts to gain and maintain students’ attention as well as repetition and organization of content to facilitate retention. (p. 71)

The courses were hybrids with video, two-way audio and online elements. In this study, they found a correlation, increasing over time, between teachers’ social interactions and learning assistance interactions. Both of these types of interaction were significantly correlated to students’ self-assessment of their understanding of the course content. They report a ‘significant increase in the number of students who confirmed that they understood content when the teacher’s learning assistance interactions correlated with teacher’s social interactions’ (p. 72). As reported in this article, Offir and colleagues used these findings to improve outcomes for students by changing teacher behaviors. They emphasize the importance of
the teacher's role in supporting the affective and social aspects of the course, elements that can easily be missed in distance learning environments.

A comprehensive model of the roles of the teacher in online courses is reported by Goodyear and colleagues (2001). Developed at a workshop held in the UK in June 2000, this identification and description of roles included key competencies associated with each item. The six primary roles are:

- The Process Facilitator is concerned with facilitating the range of online activities that are supportive of student learning (contrast with content facilitator).
- The Adviser-Counselor works with learners on an individual or private basis, offering advice or counseling to help them get the most out of their engagement in a course, (contrast with process facilitation, which is mainly, if not exclusively, done in the group or public setting.).
- The Assessor is concerned with providing grades, feedback, and validation of learners' work.
- The Researcher is concerned with engagement in production of new knowledge of relevance to the content areas being taught.
- The Content Facilitator is concerned directly with facilitating the learners' growing understanding of course content.
- The Technologist is concerned with making or helping make technological choices that improve the environment available to learners.
- The Designer is concerned with designing worthwhile online learning tasks. (Cf. process facilitation, which is predominantly an 'in course' activity; design work is predominantly a 'precourse' activity.) (Quoted from an unnumbered web print-out)

Bonk and colleagues (2000) developed a typology of learning assistance, categorizing the types of support online teachers provide:

1. Social and cognitive acknowledgement
2. Questioning
3. Direct instruction
4. Modeling/examples
5. Feedback/praise
6. Cognitive task structuring
7. Cognitive elaborations/explanations
8. Push to explore
9. Fostering reflection/self awareness
10. Encouraging articulation/dialogue prompting
11. General advice/scaffolding/suggestions
12. Management (in private email or discussions, not for the whole class).

Although the models from both Bonk et al. and Goodyear et al. are
interesting and promising for future research, they are at present descriptive.

In a similar vein, Salmon (2000) offers a five-step model for teaching and learning online: access and motivation, online socialization, information exchange, knowledge construction, and, finally, development. For example, in the final stage, the role of the teacher, whom she describes as an e-moderator, is that of ‘weaving’:

_They pull together the participants’ contributions by, for example, collecting up statements and relating them to concepts and theories from the course. They enable development of ideas through discussion and collaboration. They summarize from time to time, span wide-ranging views and provide new topics when discussions go off track. They stimulate fresh strands of thought, introduce new themes, and suggest alternative approaches._ (pp. 32–33)

Salmon suggests that e-moderating moves away from many of the conventional roles of teaching as instruction or telling, focusing on helping students make meaning rather than on transmission of content.

In an interview study of faculty members who have taught online, Coppola and colleagues (2002) suggest a similar shift in the role of the online teachers: ‘Overall, faculty reported a change in their teaching persona, toward more precision in their presentation of materials and instructions, combined with a shift to a more Socratic pedagogy, emphasizing multilogues with students’ (p. 169).

**Summary of Teacher Roles**

Research on the role of the teacher in online learning environments is at an early stage. Much of the earliest research about distance education assumed that ‘learners take care of the cognitive aspects of learning situations on their own’ (Sammons, 1990), leaving little role for the teacher except to respond to students when they need help. Recently, there has been increasing interest in understanding the interactive role of the online teacher in courses in which communication and interaction among students and teacher is encouraged. The studies available indicate that teachers can create presence in online discussions through a number of techniques, including facilitating discussions, providing direct instruction, and giving feedback to students. No studies were found that evaluate the impact of teacher presence and immediacy or other possible aspects of teaching, on learning outcomes, or on the nature of student dialog. In particular, fruitful areas for future research are the relationship of teacher presence and immediacy to students’ engagement in knowledge construction and to student learning; developing and analyzing other constructs that might better characterize the teacher’s role in online classes; and considering
the interplay of the teacher's role with the particular demands of the subject matter being taught.

**Online Collaboration and Community**

Collaboration and community are issues that come up repeatedly in research about online teaching and learning. Researchers and practitioners have emphasized the importance of community in online learning environments, and the need for collaboration to foster community (Berge & Collins, 1995; Harasim *et al.*, 1995; Palloff & Pratt, 1999; Collison *et al.*, 2000; Salmon, 2000). This emphasis on community arises in the intersection of three current trends in educational research: theories of learning that emphasize social interaction and collaboration (Brown & Campione, 1994; Bransford *et al.*, 1999; Riel, 2000); conceptualizations of technology that highlight its role as a tool for communication and collaboration (Pea, 1994; Bruce & Levin, 1997; Owston, 1997); and the widespread participation in online course development of educational researchers steeped in these theories of learning and technology (Riel, 1996; Bonk & King, 1998; Koschmann, 2002). Researchers and practitioners who see learning as a social, situated, and collaborative activity, and who view technology as a resource for collaboration, will demand that online education be more than mere presentation of material, as in the old correspondence courses, no matter how 'high tech' or multimedia that material may be. In this view, without interaction that entails collaboration and at least potentially leads to creation of a community of learners, the opportunities that the medium affords are wasted.

Studies of collaboration and community in online environments began early in the history of online environments, with a substantial body of writing focusing on online groups outside of the formal educational establishment, including Internet-based special interest groups and support groups and work-related collaborative groups (Harasim, 1990; Sproull & Kiesler, 1991; Kaye, 1992; Olson *et al.*, 1993; Ruopp *et al.*, 1993; Schmidt & Bannon, 1993; Finholt & Olson, 1997). Groups in formal learning environments—in courses offered for credit—have substantially different characteristics from voluntary or work-related groups. In particular, participants in courses have different motivation and different purposes from people in other types of online groups. In addition, online courses last for a limited and pre-determined period of time. The very definition of community in a formal educational setting is consequently different from the ideas of community described in literature on 'communities of practice' (Wenger, 1998), 'knowledge-building communities' (Hoadley & Pea, 2002), or special interest communities that have formed on the Internet (Baym, 1998).

Community and collaboration in formal online teaching and learning are constructs that are conflated, in part because of the short-lived and
somewhat involuntary nature of relationships in online courses. In online courses, collaboration is sometimes a token for community, and community is defined as some form of collaboration, with perhaps an added element of social interaction or evidence of personal concern. The argument can go both ways: successful collaboration depends on the existence of community; community is evidenced by collaboration. Definitions of learning communities emphasize the nature and importance of discourse aimed at learning, as well as social discourse that promotes trust and belonging (Palloff & Pratt, 1999). Both community and collaboration are products of and constituted in discourse.

For example, Harasim (2000) writes, ‘The principle of collaborative learning may be the single most important concept for online networked learning, since this principle addresses the strong socio-affective and cognitive power of learning on the Web. The Web’s asynchronous nature both enables and requires collaborative learning: collaboration provides the social glue of a community that engages learners and motivates them to participate’ (p. 53). There are, however, a number of different definitions of community in online courses, as well as different ways of linking community with collaboration. The following sections review conceptions of collaboration and community and then look at research on how communities are created.

**Definitions of Collaboration and Community in Online Courses**

Research outside of education has clearly demonstrated that online communities form around special interests and needs (Baym, 1995, 1998; Lombard & Ditton, 1997). Several authors have reported that communities also form in online classes (McGinnis, 1996; Hermann, 1998; McDonald & Gibson, 1998; Palloff & Pratt, 1999; Collison et al., 2000; Salmon, 2000; Campos et al., 2001). The definition of community varies widely in these studies, but all agree that in educational settings, community is evidenced in a class in which students participate actively, sharing personal as well as academic ideas. Most often, community is constituted through a discussion board or some other shared network forum, to which students have access anytime. In some cases, the community functions through synchronous ‘chat’ environments, e-mail, or a combination of communication methods.

Some researchers define community directly, while others are more interested in collaboration or discourse, with community as an indirect outcome. Woodruff (2001) suggests that community ‘is held together by four cohesion factors: (1) function, (2) identity, (3) discursive participation, and (4) shared values’ (p. 158). In reviewing conceptions of community, Rovai (2002a) quotes early definitions not directed at online learning that identify the essential elements of community as ‘spirit, trust, mutual interdependence among members, interactivity, shared values and beliefs,
and common expectations' (p. 198). Rovai (2002b) later defines community in online environments as:

consisting of two components: feelings of connectedness among community members and commonality of learning expectations and goals ... Classroom community is strong when learners (a) feel connected to each other and to the instructor, (b) manifest the immediate communication behaviors that reduce social and psychological distance between people, (c) share common interests and values, (d) trust and help each other, (e) actively engage in two-way communications, and (f) pursue common learning objectives. (p. 322)

Riel (2000) defines a learning community as:

a group of people who have a shared interest in a topic, task, or problem; respect for the diversity of perspectives; a range of skills and abilities; the opportunity and commitment to work as a team; tools for sharing multiple perspectives; and knowledge production as a shared goal or outcome. (p. 8)

She applies the definition to both online and face-to-face learning communities, and reflects both new conceptions of learning and new opportunities for the development of learning communities through technological resources. In another study, Riel and Fulton (2001) describe students’ participation in a learning community:

Students learn to work in teams and learn how to make teams work ... each member of the team contributes in some way to the outcome. This makes students in a learning community interdependent ... Distributed knowledge is a building block for such learning communities. (Web print-out)

Palloff and Pratt (1999) suggest that a successful online community includes:

active interaction involving both course content and personal communication, collaborative learning evidenced by comments directed primarily student to student rather than student to instructor; and social constructed meaning evidenced by agreement or questioning, with the intent to achieve agreement on issues of meaning. (p. 32)

They suggest that students need ‘community’ space that includes social and emotional as well as intellectual and academic contact. They identify six keys to the creation of a learning community: honesty, responsiveness, relevance, respect, openness, and empowerment. They argue that development of community is mandatory to the success of online courses because of its essential role in active learning online. As evidence of community, they look for expressions of support and encouragement exchanged
1) **Situatedness**: fostered by contextualized activities, e.g. tasks and projects based on demand and needs.

2) **Commonality**: fostered by shared interests, e.g. in books; and shared problems.

3) **Interdependency**: fostered by varying expertise levels; varying perspectives or opinions; varying needs, mutual benefits; and complementary motives.

4) **Infrastructure**: fostered by rules; accountability mechanisms; and facilitating structures.

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**Fig. 5. Hung and Chen’s (2001) dimensions of principles of learning (p. 10).**

between students, as well as willingness to critically evaluate the work of others.

In a study aimed at developing ‘community-oriented Web-based design principles,’ Hung and Chen (2001) weave together ideas from situated cognition, Vygotskian thought and communities of practice to categorize principles of design for electronic learning environments. They develop four dimensions, shown in Fig. 5. These four, they argue, are needed to create a ‘vibrant and sustaining community’ (p. 7). Hung and Chen illustrate the importance of these four dimensions with two examples of spontaneous web-based communities, and then argue that these dimensions are important for any web-based learning environments.

In a study of students taking a library science class that combined face-to-face and online elements, Haythornthwaite (Haythornthwaite et al., 2000) defines community as a group of people with the following characteristics: ‘recognition of members and non-members, a shared history, a common meeting place, commitment to a common purpose, adoption of normative standards of behavior, and emergence of hierarchy and roles’ (web print-out). She concludes that although a community was formed in this class, maintaining the community was harder in the online segments of the class than in the face-to-face portions.

Several authors address collaboration, and, in its definition, include elements that others point to as evidence of community. For example, in a study with the purpose of operationally defining collaboration, Hathorn and Ingram (2002) identify three key elements: interdependence, synthesis of information, and independence from the instructor. Interdependence is seen when students support each other’s learning rather than competing and thus obstructing or ignoring the learning of others. Synthesis of information means generating a joint product that is different from the contribution of any individual. Independence means looking to each other for confirmation and support rather than to the instructor. In their analysis of these constructs, Hathorn and Ingram developed a coding scheme based on the three elements and used it to analyze discourse in four online groups in two mixed-mode (online and face-to-face) classes. They conclude that their
definition of collaboration and the accompanying coding scheme does distinguish important differences between collaborative and non-collaborative activities.

Harasim (1999) defines online collaborative learning as ‘an interactive, group knowledge-building process’ in which students participate actively and the instructor monitors, facilitates interaction, and assesses progress (p. 44). Building on concepts developed by Scardamalia and colleagues (1994), Harasim writes, ‘Knowledge building is the process of progressive problem solving, which encourages students to be innovative, create intellectual property, and develop and acquire expertise’ (p. 44). In a study of over 300 courses and 250 instructors at the Virtual-U (http://virtual-u.cs.sfu.ca), Harasim reports that, with tools that adequately support collaborative interactions, students engage in these knowledge-building practices and instructors are able to facilitate collaborative learning.

What can we conclude from these definitions and studies of online community and collaboration? First, it is clear that these are constructs of considerable importance to current research about online teaching and learning. For researchers and practitioners who adopt current theories of learning, online classes without collaboration or community are undesirable transmission models, which focus on moving information rather than on building knowledge. Second, researchers include a component of interaction among students as a fundamental ingredient of community in online classes. This must include interaction about the content of the course that goes beyond making each individual’s ideas available to others. Researchers who focus on community also look for social and personal interaction among students. Finally, although there is a certain level of agreement across definitions of community and collaboration, these are constructs that are neither uniformly nor clearly defined. For example, there are no clear boundaries in any of the studies cited above between collaboration and community. Is collaboration in an online class synonymous with community? Or, must community include more than collaboration? Community may be a significantly different construct in an online class than in other online or in face-to-face settings. Is collaboration in online classes also distinct from collaboration elsewhere?

Creation of Community

We now turn to a second question: how is community created in online classes? Early theorists hypothesized that connections would be weak online because of the lack of social and contextual cues, making it difficult for people to develop relationships that might encourage collaboration or foster community (Short et al., 1976). Instead, research now suggests that the pace and anonymity of online environments mean that a wide range of people can participate and they do it at their own pace and with a range of interpersonal relationships (Baym, 1995). In some classes, relationships are
formed that constitute community (Palloff & Pratt, 1999). Of interest here is understanding the conditions in which collaborative relationships develop or community builds.

Researchers have defined online community and developed schema for identifying and studying community as it develops (or does not) in online classes. For example, Riel (1996) identified design issues for creating networked communities, including balancing focus with diversity, size with function, and structure with creativity. Riel and Fulton (2001) describe electronic tools that make learning communities feasible, including electronic field trips, online mentoring, and ‘Learning Circles.’ Harasim and colleagues (1995) suggest a number of differences between networked classes (both face-to-face and online) and classes that have no network access. They argue that these differences are necessary changes in classes that take advantage of the affordances of the network.

• The role of the teacher changes to that of facilitator and mentor.
• Students become active participants; discussions become more detailed and deeper.
• Access to resources is expanded significantly.
• Learners become more independent.
• Access to teachers becomes equal and direct.
• Interactions among teachers are increased significantly.
• Education becomes learner centered; learning becomes self-paced.
• Learning opportunities for all students are more equal; learner-learner group interactions are significantly increased.
• Personal communication among participants is increased.
• Teaching and learning is collaborative.
• There is more time to reflect on ideas; students can explore on the networks; exchange of ideas and thoughts is expanded; the classroom becomes global.
• The teacher-learner hierarchy is broken down. Teachers become learners and learners become teachers. (pp 14–15)

This idealized description of what happens when networks enter classrooms, or when classrooms go onto the network, can be seen as precursors to the development of community, and ingredients of collaboration. It might be reasonable to hypothesize that teachers who effect the changes Harasim suggests will foster collaboration and the creation of community.

It is not, however, an automatic process. Other research suggests that neither collaboration nor community is an automatic result of online discussions. Thomas (2002) argues that the usual asynchronous threaded structure of online discussion forums does not support knowledge-building interactions. In a study of undergraduate students using a discussion forum to supplement an environmental studies course, he found that students did not so much participate in a discussion as insert comments. He suggests
that the typical discussion forum presents a conflict between form and function that inhibits collaboration:

*Face-to-face discourse is fundamentally interactional in nature, while written discourse is generally transactional in nature. Accordingly, the text-based medium of the online discussion forum does not simply present a technology-mediated alternative to face-to-face dialogue. Rather, it attempts to serve the function of face-to-face interaction through the sole use of the written form.* (p. 363)

Thomas further suggests the need for better interfaces and tools to support knowledge-building activities, and new approaches to curriculum designed for collaborative activities. New tools and new approaches could resolve the conflict between form and function in online discussions.

Another possibility is that the mixed-mode nature of the course Thomas studied may have been a bigger factor than the medium itself. There is some evidence that collaboration is fostered and community builds more readily when interactions among students are primarily online, with at most infrequent face-to-face meetings (Althaus, 1997; Collison et al., 2000). If this is right, then it is not at all clear whether the absence of collaboration in Thomas's study is the result of structural incompatibilities between the online discussion tools and the purposes of the discourse, or of social, psychological, or pedagogical constraints that make it difficult to develop a parallel online community when face-to-face interaction is readily available.

The picture is far from clear. In a somewhat ambiguous result with respect to the issues of collaboration and community, Angeli and colleagues (1998) report that graduate students in a psychology class made only the mandatory number of postings to an online discussion, but that their postings were thoughtful and responsive. Other researchers report similar results in online discussions that supplement face-to-face classes (e.g. Rodrigues, 1999; Bonk et al., 2000). Questions for future research include, under what conditions and for what purposes are online discussions compatible with face-to-face classes, and how can they be used to foster and support learning communities? To what extent, and under what conditions is it beneficial to supplement online classes with face-to-face meetings?

Mäkitalo and colleagues (2002) explore the idea of common ground which people 'build and maintain ... by sharing mutual understanding, knowledge, beliefs, assumptions, and presuppositions' (p. 248). They suggest that an important aspect of building common ground is that students 'show evidence of understandings through written feedback [and] provide support to their peers in their replies.' They derived characteristics of successful online discussions—those that achieved deeper levels of discussion—by analyzing discourse from 68 subjects in an eight-week web-based conference. They point to agreement as a sticking point for
developing common ground: when participants agree, the discussion may end. From this study, Mäkitalo and colleagues conclude:

*In collaborative learning situations, misunderstanding and corrections could offer the space for negotiation, which is a common mechanism of grounding ... It is important that the participants provide evidence of their understanding, even when there is no place for misunderstandings.* (p. 262)

That is, students should be asked to continue their discussion and provide feedback even when they believe agreement has been reached. They suggest that participants could be instructed to provide feedback to each other in the form of both social and cognitive cues.

Poole (2000) conducted a case study of a course in educational technology with the purpose of understanding how student participation contributed to the class as a community of learners. The class consisted of 14 graduate students who were K–12 teachers in a Master’s program. Although students were required to post at least 27 comments in an asynchronous discussion as part of their coursework, they posted considerably more than required, an average of 73 per student, and most of the postings (85%) were related to course content. Poole found that the teacher of this class made about 30% of the postings—she describes it as a ‘student-centered’ class. Students were required to take turns acting as discussion moderators in the asynchronous discussion, and it was in this role that they were most active, posting an average of 14.5 messages compared to 4.8 for students who were not moderating. Even though a synchronous chat room was available, and students were encouraged to use it to complete a group project, only two chat room conversations took place during the class.

As evidence of community, Poole looked at students’ use of class members’ names, their use of emoticons, how they responded to emotions and conflict that emerged, and whether they provided personal information. Poole described evidence that students in the class had formed a cohesive group and concluded that, although she did not develop measures for community, the nature of the discussions online provide evidence that these class members felt a sense of community in this online class.

Rovai (2002a) suggests several factors that impact the ‘sense of community’ in online classes: student–instructor ratio, transactional distance, social presence and instructor immediacy, lurking, social equality, collaborative learning, group facilitation, and self-directed learning. In this study, Rovai reports on the design and testing of a ‘Classroom Community scale’ to measure the sense of community in online classes. He concludes that the scale is a valid and reliable measure of community with two subscales, connectedness and learning.

Collison and colleagues (2000) suggest that three types of dialog are evident in online discussions: social, argumentative, pragmatic. They argue
that the online teacher should be a facilitator who aims to support pragmatic dialog, which has goals of (a) building community, (b) supporting a culture of respect, (c) cultivating reasoned discourse. With such facilitation, a community can be built that successfully engages students in subject matter learning.

**Summary of Characteristics and Development of Community**

The consensus in studies of online community is that community can be developed in online learning environments, and that it plays an important role in student success. These claims overlap with literature on student participation reviewed above. However, the literature specifically about online community is more anecdotal and case-based, more likely to illustrate the existence of community than to probe its origins or outcomes. Several important research questions are outstanding, including whether online community is fostered or impeded by including face-to-face sessions; whether and how community and collaboration differ; whether the existence or strength of community is related to student learning outcomes.

**Tools to Support Online Teaching and Learning**

The computer-supported collaborative learning (CSCL) research community 'focuses on the use of technology as a mediational tool within collaborative methods of instruction' (Koschmann, 1996, p. 2). A large part of the research associated with this field has considered how students learn in face-to-face collaborative environments, and how technology can be used to provide representational artifacts or communication platforms for enhancing this collaborative learning. The biggest contribution of the CSCL literature to date is in developing theory and technological tools that support theory (Koschmann, 1996, 2002). Researchers have offered frameworks for understanding collaboration; for identifying knowledge-building in collaborative communities; and for analyzing discourse in ways that foreground important constructs in CSCL research. However, much of the CSCL work has been done in face-to-face settings, where computer tools support collaborative aspects of learning. There have been few empirical studies of CSCL environments that function entirely online.

Nonetheless, the CSCL literature provides important insights into some of the tools available for supporting online discourse. CSILE, for example, has been used primarily in classrooms, providing an online forum for knowledge building that is used as part of a face-to-face environment (Scardamalia et al., 1994). The successor to CSILE, the Knowledge Forum, is being used in online settings, but there has been little empirical research about its use and impact. Other tools described in the CSCL literature include SenseMaker (Bell, 2001), the Collaboratory Notebook (Edelson et al., 1996), CoWeb (Rick et al., 2002), SpeakEasy (Hoadley & Linn, 2000).
WebAnn (Brush et al., 2002), and CaMILE (Guzdial, 1998). Each was developed for use in conjunction with face-to-face classrooms, providing technological support for learning by scaffolding student thinking in some way. Most of these tools provide forums or platforms where students can discuss ideas, make arguments, and reach conclusions.

What has been learned from research on these tools that might be applicable to online classes? CSILE introduced the idea of structured or scaffolded discourse, providing tags to identify the type of posting. The tags succeeded in requiring a level of metacognitive thinking by students, engaging them in a learning process that they might not have constructed for themselves (Scardamalia et al., 1994). Other researchers have followed up on this idea, creating tools that allow flexible setting of discourse structure by the teacher or course developer. For example, Jonassen and Remidez (2002) suggest three major categories—problem, proposal, and warrant—with several subcategories for student postings that could be used in their scaffolded discourse environment.

Other tools have experimented with organization of online discourse. WebAnn lets students annotate and comment on documents viewed online (Brush et al., 2002). In their research, Brush and colleagues found that students made more comments, were more specific, and were more thoughtful and involved using WebAnn than using a typical threaded discussion. Students expressed a preference for the threaded discussion, although many acknowledged that the discussion was better in WebAnn.

CoWeb provides a ‘virtual whiteboard’ on which every student, and the instructor, can annotate, edit, or even add new pages (Rick et al., 2002). Rick and colleagues used CoWeb in English composition classes to foster ‘close reading’ of texts. In a study comparing a class with access to the tool to a class with no access, they conclude that CoWeb was an effective learning tool, with CoWeb students outperforming the control group in learning to write essays.

Guzdial and Carroll (2002) investigated possible reasons for the repeated finding that students in face-to-face classes post infrequently to online discussion boards. This research is interesting for online classes because it suggests that students learn in different ways from participation in online discussion than in face-to-face collaboration. For example, Guzdial and Carroll offer the hypothesis that students in online discussions learn both from reading the comments of others and from considering their own response even when they do not post a response. They suggest that the mechanisms that lead to learning in online discussion may be quite different than in face-to-face collaborative learning environments.

Discussion and Conclusions

This review began seeking evidence about teaching and learning in online classes in higher education. In part, the review was motivated by the
author's efforts to design and teach an online class, which led to seeking assistance from the research literature. The review found many useful results, but also significant gaps in the literature, areas where future research could be particularly useful.

**A Summary of Findings from Research**

1. Researchers have developed useful frameworks for analyzing online teaching and learning by looking at records of online discussions. These frameworks, developed over more than 10 years of work, take into account a range of social, cognitive, and metacognitive variables. Some are aimed at identifying student progression into higher levels of thinking in their discussions of course content. Others aim at distinguishing modes of interaction that define or explain constructs such as community.

2. Using these frameworks, researchers have found that moving student discourse from sharing and explaining to knowledge building is an elusive process in online classes. Students are willing to share ideas but not to challenge each other's thinking or press for deeper understanding. It is not clear whether the nature of the subject matter or assignments, the practices of the teacher, or other factors are significant in moving students toward knowledge building.

3. Teachers in online courses take on multiple roles. They facilitate or moderate discussions, they respond to individual students and to the class as a whole, and they manage the flow of content through assignments and responses. Their presence and immediacy seem to impact student satisfaction and learning.

4. Substantial evidence exists to support the importance of social presence, student interaction, and teacher presence in online learning environments. Settings in which students and teacher establish social presence, in which teachers interact with students and support them in a variety of ways, and in which student participation is high, are likely sites for student learning and student satisfaction.

5. Online community is another important variable in online classes. When a platform for online discourse is available and used, community can develop even in courses with only a few weeks' duration. Although community seems to play an important role in development of meaningful dialogue, the mechanism by which community contributes to learning in these environments is not well theorized or researched. Community is taken as a desirable goal at least in part because without it, online courses become mere transmission of information. Collaboration and community are somewhat conflated in this research, which lacks clear definitions of when and how the two differ.

6. Several interesting tools for supporting online discourse have been developed. However, few have been used or researched in classes offered exclusively online. The most interesting tools were developed for online
discussion forums in support of face-to-face learning. Research in face-to-face classes suggests that they could be useful in online courses, and could lead to very different modes of interaction and different results for students and teachers. In particular, many of these tools have been developed to address knowledge building by scaffolding interactions in ways that make student thinking visible or focus students on metacognitive awareness.

**Areas for Future Research**

Research about online teaching and learning is in its infancy. There are numerous questions and issues that have not been researched, and many areas of current research with important outstanding questions. Although the technology will certainly change in ways that cannot be predicted, the fundamental idea of teaching and learning through a medium that separates participants in time and space is perhaps independent of the exact nature of the technology. The literature reviewed above suggests several areas ripe for research.

1. **Interaction of student and teacher variables with outcome variables.** Several analytical frameworks are described in the literature reviewed here. One fruitful area of research is to use those frameworks in extensive studies of online classes to understand the interaction of variables such as student presence, teacher presence, and teacher immediacy with dependent variables such as student learning, student satisfaction, or outcomes for teachers. Although the literature suggests that presence and immediacy are important elements of online learning, they are only loosely connected to student outcomes and not related to differences in subject matter or other important variables such as course objectives, number of students participating, course level, or teacher outcomes.

   Because of conflicting claims about the impact of structure, transactional distance is another construct that bears further scrutiny. How should transactional distance in online courses be defined, and how does it correlate with other constructs or with important outcomes for students and teachers? Is transactional distance a uniform construct across media and setting, or does it change based on the nature of the medium? One could hypothesize that in distance learning, structure decreases transactional distance, while in face-to-face settings, structure increases transactional distance.

2. **The nature of online teaching.** In the current literature, online teaching consists of preparing a course and then facilitating a discussion by being ‘present’ and ‘immediate’ in the online discourse. The work of online teaching, especially as it relates to interacting about subject matter, is not well described or researched. Except for student learning and satisfaction, outcomes for online teaching have not been considered. For example, time required to teach is an important outcome since there is evidence that
online teaching can be prohibitively time-consuming. Another outcome of significance for the future of online education is teacher satisfaction.

One way of thinking about teaching, in addition to selecting and preparing materials that convey the desired content, is as a process of helping students move toward canonical interpretation, understanding, and problem-solving. The essence of teaching in face-to-face settings is the interaction about subject matter that reveals student thinking and provides the teacher with opportunities to bridge the gap between student understanding and canonical accounts of the subject matter. The teacher in action is trying to understand where the students are and where they can go next. Most often in formal educational settings, this is done with a group of students, not individual by individual, and the teacher is always balancing the needs of the group against the needs of the individual.

Even in a lecture, this kind of interaction occurs. The great lecturer takes account of the response of the audience, gauging facial expressions, body language, or taking questions. Members of the audience who are engaged respond to the speaker through their modes of attention. However, only by expressing their understanding, or hearing it expressed by others, and getting a response from the teacher, can they be sure they have grasped the teacher’s ideas as she intended. Sometimes, they have the opportunity to ask questions or to hear others ask questions. In other lecture classes, students get feedback about their ideas only at test time or when an assignment is returned with corrections and comments. A conscientious teacher might use the common errors displayed on a test or assignment to revisit topics that were commonly misunderstood. Again, the teacher makes a trade-off between the needs of the class as a whole and the needs of the individual. If most of the class got something wrong, the teacher revisits it.

In this melange of negotiations—between the canonical account of the subject matter and students’ understanding, and between the common ground of understanding of the class as a whole and individual instances of students’ knowing much more or much less than the current common ground—the teacher teaches by moving the class along toward better understanding and greater knowledge. How a teacher does this in an online course remains something of a mystery, at least as it is portrayed in the research literature. The focus on teacher as facilitator and on teacher presence and immediacy ignores the details of how the teacher goes about mediating between students and subject matter and entering into the complex work of teaching the group and the individual while paying attention to the requirements of the subject matter discipline.

3. Learning from online discourse. One important area for research is developing a better understanding of the mechanisms through which students learn in online environments. For example, Guzdial’s research (Guzdial & Carroll, 2002) suggests interesting ideas about the ways in which learning from online discourse may differ from learning in face-to-
face discussion. These ideas, and others, should be pursued to reach a better understanding of how students learn online and of how it differs from face-to-face learning.

4. Class configuration and structure. Another useful area for future research is studying the effects of grouping, class size, and organization of discourse in online courses, including how various organizational structures impact creation of community, student learning, and teacher effort.

5. Tools for structuring discourse. The CSCL literature suggests that various tools for structuring discourse could have a significant impact on how students engage in online discussions, and, perhaps, on both what they learn and how they learn. Controlled studies of various tools and techniques, like the work being done by Paechter and colleagues in Germany, could be extremely useful in improving our understanding of how to provide online course work.

6. Impact of subject matter. Educational research suggests that subject matter is an important dimension of curriculum design, of textbook use, and of pedagogy (Stodolsky, 1988). Different subjects make widely varying demands on students and teachers. These differences are apparent in teachers’ pedagogical content knowledge (Shulman, 1986), and in the structure and use of textbooks across different subjects. It seems logical to assume that subject matter might be an important variable in how students learn online, in how online courses should be structured, and in how teachers teach online. Studies of subject matter would need to consider variables such as social presence and teacher immediacy in light of their role in subject matter learning. There is precedence for such research in face-to-face classrooms, where ‘classroom culture’ for learning—the modes and structures of discourse, warrants for claims, and use of representations, as well as the kind of knowledge teachers need to teach effectively—differs across subject matter (Shulman, 1986; Stodolsky, 1988; Ball & Bass, 2000; Lampert, 2001).

7. Tools and strategies for studying outcomes. To date, much of the research has used student self-reports as outcome measures for online courses. Comparison studies (not reviewed here) typically use grades and test scores. None of these measures captures other important aspects of online learning that have projected it into universities and colleges all over the world: issues of equity both in who takes courses and in how they participate; changes in the nature of the university itself and in the work of faculty; changes in what students learn and how they learn it. Another area ripe for research is developing tools and strategies that can be applied within online courses—at the level of interaction illustrated in many of the studies cited here—and that measure important and possibly unconventional outcomes of online teaching and learning.
Conclusions

In many ways, research about online distance education is in its infancy. Like the image of the ‘horseless carriage’ that haunted the automobile, or the ‘digital library’ that has influenced and in many ways constrained uses of the Internet, conceptions of distance education are only slowly moving away from a metaphor of ‘delivering education’ toward a richer and more nuanced understanding of what online environments offer for teaching and learning. There is much research to be done to better understand, and invent, what can be done to take advantage of the any time, any place, and, perhaps most important, everybody opportunities that online teaching and learning provide.

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NOTES

1. For complete histories, see McIsaac and Gunawardena (1996); Moore and Kearsley (1996); Noble (2001).
2. For a discussion of the ‘no significant difference’ findings, see Joy and Garcia (2000). For a complete review of comparison studies, see Russell (1999).
3. In a 1995 study, Gunawardena reviewed the literature on social presence in computer conferences. Rourke et al. (1999) provide a short history of the development of the construct in communications research. CyberPsychology & Behavior published a special issue on social presence in volume 4, number 2, April 2001.

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