The purpose of this study was to determine the efficacy of traditionally spoken linguistic analysis approaches for understanding the nature and outcomes of online interaction. The study took place with twenty-eight elementary school teachers in ten suburban Chicago schools involved in a technology-supported, problem-based learning curriculum development effort. The asynchronous and face-to-face communications of participants were monitored to test the utility of linguistic discourse variables for understanding interaction. The evidence showed that similar sense-making and interaction strategies are used in both face-to-face and online dialogue but that the strategies were significantly more prevalent in the face-to-face than online dialogue. When critical reflection was studied as an outcome of both forms of dialogue, asynchronous electronic communication was significantly more reflective than face-to-face discourse.

Distance learning researchers and instructors continue to have a fascination with online interaction. This interest evolves from a desire among online instructors to have learners take part in high quality, online interactions (Slagter van Tryon and Bishop 2005). Because the literature on online learning shows that the quality of dialogue and the development of the learner depend heavily on facilitation, instructors work tirelessly to promote worthwhile exchanges between online learning participants (Keeley 2004; Slocum, Towns, and Zielinski 2004; Taylor 2005). Ultimately, the extent to which learners find value in their online learning experience and are satisfied with the results rests on the quality of those interactions (Dooley, Kelsey, and Lindner 2003).
The most obvious of course interactions take place between the instructor and learner in the form of motivational messages (Visser et al. 2002) and exchanges on instructional content (Carswell et al. 2000). Interaction between learners focuses on the content or protocol of the course (Lee and Gibson 2003) or on social exchange (Sonnenwald and Li 2003; Bernard et al. 2004; Roblyer and Weincke 2003). Learner interaction with the instructional content itself involves the nature of the coursework, modalities of content engagement, and learner preferences for engagement strategies (Harris, Dwyer, and Leeming 2003; Weller 2000).

The construct of online or distance learning “interaction” as first defined by Moore (1989) is one that continues to evolve and expand. A number of additional refined definitions of interaction have emerged from the primary categories provided here. Within the distance learning field, there is acceptance of these differing conceptions of interaction. There is criticism, however, for the ways in which interaction is analyzed and measured.

Although the analysis of online dialogue is necessary to determine the nature and occurrence of interaction, much of that analysis is limited to frequency counts of postings and messages. Jonassen (1996, 263) suggested that when evaluating the quality of students’ contributions to asynchronous conferences that quantifiable criteria both in the number and the length of posted messages be used. Researchers who have followed this advice have used message frequency counts as the basis for interaction (Cunningham-Atkins et al. 2004; Orrill 2002). Student interaction also has been measured as a ratio of student reactions to an initial document posting (Ronteltap and Eurelings 2002).

In other cases, quantifiable interaction outcomes were based on message structure, such as Edelstein and Edwards’s (2002) criteria of message coherence and relevance to previously posted messages. Others have proposed even more procedurally focused criteria, such as Bauer and Anderson (2000), who advocated assessment that focuses on the degree to which a student uses complex, grammatically correct sentences on a regular basis. Morrison and Ross (1998) recommended that points be deducted for off-topic comments students make to the collaborative discourse. Swan (2001) based interaction on student responses to multiple choice questions on whether learners had “a great deal,” “sufficient,” “insufficient,” or “no” interaction with the instructor.

The frequency of postings in online learning or criteria for quality university-level work, such as writing clarity and organizational skills, can be useful gauges of online interaction. However, they do not help us understand how online discourse participants engage in a way that results in
some shared understanding or new knowledge relevant to the instruction. Nor do the traditionally practiced approaches to assessing online interaction suitably explain how the social dimensions of interaction support group structure and dynamics that are necessary for building learning communities (Kreijns, Kirschner, and Jochems 2003). The purpose of this study was to determine the efficacy of linguistic analysis tools for understanding the nature of online interaction.

**Conversational Dynamics of Online Dialogue**

Although asynchronous online dialogue is constructed almost exclusively from linguistic signs, linguists have thoughtfully considered online communication in their studies on human conversation. Studying online communication helps determine what contributions are made to the conversation by the medium—in this case a computer network—and the human users (Herring 1996, 4). Applying the accumulated expertise of the discipline of linguistics on spoken and written work lends additional insight into the structure, purpose, and composition of online interaction.

Human involvement in conversation is said to take a combination of three forms: self-involvement of the speaker, interpersonal involvement between the speaker and the hearer, and involvement of the speaker with what is being discussed (Chafe 1985, 116). In an analysis of conversation, Tannen (1989, 17) identified a number of linguistic features she suggested are “involvement strategies” between speaker, hearer, and content. Tannen indicated these involvement strategies are a basic force in both conversational and literary discourse.

One of the strategies that Tannen (1989, 23) identified was “participation in sense-making.” Tannen suggested that discourse is made effective because the more work readers or hearers do to supply meaning, the deeper their understanding is and the greater their sense of involvement is with both the text and the author. Yet in the context of computer-mediated communication (CMC), the nonverbal cues conveying social or affective information transmitted through vision (facial expressions, posture, gaze), olfaction (cologne/perfume, body odor), or audition (voice volume, inflection, tone) are absent. This is why online interaction has sometimes been characterized as impersonal, unfriendly, and task oriented and sometimes described as leading to disinhibited behavior (Sproull and Kiesler 1986). It is suggested that such qualities could make group problem solving in the online environment ineffective (Hiltz, Johnson, and Turoff 1986).
In the absence of paralinguistic communication cues, one might consider the online environment a poor facilitator of sense-making strategies. However, compensatory linguistic strategies, such as structuring turn taking and providing equal access to the conversational floor, ease the task of posing clarifying questions about what a participant may have said. The online environment may also augment the process of sense making by minimizing overlapping speech that is often a characteristic of face-to-face group dialogue.

Repetition and fixity are additional involvement strategies that Tannen (1989) discussed. Of repetition, Tannen noted that a persistent feature of conversation is the recollection and reshaping of previous bits of dialogue to apply to new contexts (Tannen 1989, 37). This type of involvement strategy bonds individual participants in both conversation and relationships. Fixity is described as the adaptation of a word or phrase and the repeated use of that word or phrase through an episode of discourse by participants (Tannen 1989, 45). Another conversational involvement strategy is spontaneity. Tannen suggested that speakers repeat, rephrase, and echo words in conversation without stopping to think and as an automatic and spontaneous way of participating in conversation (Tannen 1989, 96). The way spontaneity occurs, Tannen instructed, is through the use of first- and second-person pronouns.

Using linguistic discourse analytical approaches to measure the interactive content of online dialogue presents a new opportunity for the field of distance education to determine the extent to which true interaction in online learning environments takes place. However, interaction is only an intermediate effect and should be gauged as a medium leading to a more valuable outcome (Anderson, du Plessis, and Nickel 2001). To make the evaluation of asynchronous interaction consistent with the nature of the discourse itself, the focus must be on the outcomes of the dialogue rather than the structure. In this study, the terminal outcome desired of the interaction was collaborative and critical reflection.

Collaborative and Critical Reflection

Research describes social learning as an act undertaken by multiple group members in which learning involves sharing and examining teaching experiences with peers (Vygotsky 1978). Comparing and contrasting individual beliefs against those of a group constitutes a process by which meaning—and subsequently knowledge—is formed. The process of collaborative reflective activities are social-professional wherein assumptions and be-
liefs are examined, challenged, rejected, or adopted through discourse and critical inquiry among a group of people who share similar interests.

Cooperative dialogue strongly influences what students learn and how they learn it. Reflection is noted to be an element of collaboration, an affiliate of dialogue, and a critical step in the process of social learning (Darling-Hammond 1996; Putnam and Borko 1996). Reflection is a continual process that engages learners in framing and reframing problems while designing and evaluating solutions. In the context of asynchronous interaction, reflective properties are what, our experience suggests, has interdisciplinary application to learners, courses, and content.

In this study, we attempted to understand online collaborative interaction by analyzing communication from a knowledge creation standpoint. We explored the use of linguistic strategies by participants in electronic communications as a means to overcome the loss of more traditional communication channels used to make cognitive, situational, and social sense. In contrast to content learning outcomes, shared knowledge creation focuses on the processes of interaction and outlines learning as an interpretation of the meaning that is made in communication with others (Stahl 2003). We propose that linguistic analysis tools have the potential to help make learning visible by examining artifacts of online dialogue using spoken discourse variables.

Methods

This research involved twenty-eight fifth- and sixth-grade teachers who volunteered to participate in problem-based curriculum development in a large Chicago suburb elementary school district (see Table 1). The distinguishing feature of the problem-based learning (PBL) model used here is the emphasis on co-development. For teachers, the objective was to establish a rich knowledge-building community of practice around PBL. Participating teachers worked with colleagues from other schools to create and deliver two interdisciplinary instructional units in ways that would uniquely and appropriately engage their students. Persistent contact with co-participants outside of their school was encouraged to engage teachers around highly authentic tasks—curricular and instructional—that applied directly to their classrooms and schools.

To support the yearlong initiative to build teacher capacity for developing PBL curricula, teacher teams of three to four members met on select days after school. Because union policy and district activities limited the face-to-face contact between teachers participating in the project from various schools, network communication channels were used to host some of
the ongoing curriculum co-development and communication among teachers. The primary asynchronous communication mode was e-mail. The communication generated through intranet e-mail constituted the primary data by which discourse interaction and the resulting reflective outcomes were examined.

To determine the nature of interaction when teachers communicate under normal circumstances, a baseline of teacher discourse was gathered by audio recording six face-to-face meetings of teacher work groups ranging from the start to the end of the program. Teachers were informed that their meetings were being audio taped as a part of the data collection for project evaluation. Teachers were not aware that their interaction and reflective discourse were the variables of interest in this study.

The recording of the face-to-face meetings ran concurrently with the collection of ongoing group asynchronous communication. Teachers were free to use the communication tools in any way they chose. The interaction was neither moderated nor facilitated, presenting an opportunity to see how and for what purposes network use naturally evolved. Although participation via electronic means was not required of teachers, it was assumed that given their geographic distance from other team members, teachers might use the communication mode to address the task of developing content for integrated PBL curricular units.

The e-mail interactions between PBL project participants produced 179 usable messages posted over a four-month period. This total does not in-

Table 1. Characteristics of Study Participants

<table>
<thead>
<tr>
<th>Participant Characteristics</th>
<th>Study Sample</th>
<th>Districtwide</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Number of teachers</td>
<td>28</td>
<td>100</td>
</tr>
<tr>
<td>Number of schools</td>
<td>10</td>
<td>39</td>
</tr>
<tr>
<td>Average school size</td>
<td>623</td>
<td>—</td>
</tr>
<tr>
<td>Teacher gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>25</td>
<td>89</td>
</tr>
<tr>
<td>Male</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Teaching tenure (average)</td>
<td>18</td>
<td>—</td>
</tr>
<tr>
<td>Teacher ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Black</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>White</td>
<td>28</td>
<td>100</td>
</tr>
</tbody>
</table>
clude messages posted by administrative staff, misposted messages (resent, misdirected), cross-posted messages from other forums, or messages authored by nonproject personnel. The audio-recorded face-to-face discourse—which served as a comparative frame of analysis to the e-mail—was “chunked” to equalize in size and number the discourse units produced through the two forms of communication. The chunking of face-to-face discourse was guided by principles of distributional accountability (Schiffrin 1987). Groups of exchanges were said to be distributionally accountable when they perform the same function. The chunking process of the face-to-face discourse resulted in 222 distributionally accountable chunks ranging in size from one to twelve utterances (see Table 2).

After all identifying information (school and individual) was removed from e-mail messages and face-to-face transcripts, and the communication was comparably framed, discourse analysis began. To understand the levels of participant interaction from the perspective of spoken discourse strategies on the two modes of discourse, three common linguistic discourse variables were selected: involvement strategies, conversational cooperation, and sequential accountability. These variables are defined as follows:

**Involvement strategies** were defined by Tannen (1989) as the use of selected words that increase the involvement of the hearer. Specific strategies include the use of “wh” clauses (what, where, why, when, who), indefinite pronouns (anybody, everyone, everything), and amplifiers (absolutely, intensely, totally).

**Conversational cooperation** identifies questions as basic conversational components and asserts that participants cooperate in taking a conversation in a common direction through a series of questioning and answering. When participants fail to answer questions raised in dialogue, conversational cooperation is violated, and interactivity is reduced (Grice 1975).

<table>
<thead>
<tr>
<th>Communication Mode</th>
<th>Number of Words</th>
<th>Utterances/Messages</th>
<th>Chunks/Messages</th>
<th>Words per Chunk/Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face discourse</td>
<td>19,000</td>
<td>846</td>
<td>222</td>
<td>86</td>
</tr>
<tr>
<td>Computer-mediated discourse</td>
<td>19,303</td>
<td>179</td>
<td>179</td>
<td>108</td>
</tr>
</tbody>
</table>

Table 2. Face-to-Face and Computer-Mediated Dialogue Content Comparison
Sequential accountability refers to the meaning a message or utterance has when it is paired with another utterance. Because the order and co-occurrence of an utterance is generally made meaningful through its relationship with a previous utterance, an unrelated utterance is considered sequentially unaccountable and interactively weak (Schiffrin 1987).

Both the face-to-face and computer-mediated conferencing discourse were evaluated on the basis of each discourse variable. In the cases of “wh” clauses, indefinite pronouns, amplifiers, and sequentially unaccountable utterances, each occurrence in both the face-to-face and the computer-mediated discourse was tallied. Conversational cooperation was determined by measuring the ratio of answered to unanswered questions in the discourse. A chi-square test of association illustrated the relationship between the observed proportions of each interaction variable.

To compare the reflectiveness of the interaction, a team of three raters, independent of the school district, was trained to rate each of the face-to-face and electronically produced messages. The training used the Simmons et al. (1989) taxonomy for assessing reflective thinking. This taxonomy of reflective levels for group discourse ranges from a point at which responses merely describe events and appear disconnected from the observer to a point at which responses richly describe events and attempt to explain them in light of theory or principle. Raters judged each of the chunked exchanges in the face-to-face dialogue \((n = 222)\) and the computer-mediated distance discourse using the seven-level rubric described here.

**Results**

**Assessing Participant Interaction**

Specific discourse strategies used to heighten the interaction of participants in the dialogue were examined. Table 3 presents a comparison of the face-to-face and electronic discourse using the chi-square test of association between the observed proportions in each interaction variable.

In all five cases, the ratio of the selected interaction variables in face-to-face communication exceeded those found in the e-mail messages between discourse participants. In three of those five variables, “wh” clauses, amplifiers, and conversational cooperation results were significant at the \(p < .01\) level. The results show that face-to-face discourse is generally more interactive than the e-mail discourse.
Assessing Reflective Content

Reflection was examined as an indicator of the medium’s ability to promote interactivity between discourse participants. Talking, sharing, exploring, and analyzing are important interactions in sense making and, by themselves, constitute key components in the critical reflection process. To determine the levels of reflection in the dialogue, ratings were assigned to the e-mail messages and the face-to-face discourse chunks by three independent raters. When the raters were tested for their consistency, interrater reliability analyses on the face-to-face discourse achieved an item alpha level of .80 whereas the e-mail discourse achieved an item alpha level of .87. When the two communication media were compared on their overall level of reflectiveness, an independent t test for equality of means between groups shows that the e-mail communication had significantly higher ratings on the reflective scale than face-to-face communication (see Table 4).

A breakdown of the ratings of reflectiveness in Figure 1 shows the percentages of ratings assigned to each of the seven reflective levels. The majority of messages (70% for the face-to-face, 63% for e-mail) were rated at the first and second levels of reflection and generally showed that neither e-mail nor the face-to-face discourse is abundantly reflective. The fact that two very different distributions appeared for each discourse mode with positive skews of very different strengths (stronger at the higher end for e-mail than

Table 3. Chi-Square Values on Discourse Interaction Variables

<table>
<thead>
<tr>
<th>Discourse Variables</th>
<th>Parameter</th>
<th>CMC (n)</th>
<th>Face-to-Face (n)</th>
<th>$\chi^2$</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involvement strategies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Wh” clauses</td>
<td>Words</td>
<td>220</td>
<td>326</td>
<td>22.99</td>
<td>.001</td>
</tr>
<tr>
<td>Indefinite pronouns</td>
<td>Words</td>
<td>435</td>
<td>474</td>
<td>2.404</td>
<td>.065</td>
</tr>
<tr>
<td>Amplifiers</td>
<td>Words</td>
<td>220</td>
<td>288</td>
<td>10.348</td>
<td>.001</td>
</tr>
<tr>
<td>Conversational cooperation</td>
<td>Questions</td>
<td>25</td>
<td>95</td>
<td>10.007</td>
<td>.002</td>
</tr>
<tr>
<td>Sequential accountability</td>
<td>Utterances</td>
<td>15</td>
<td>43</td>
<td>3.009</td>
<td>.064</td>
</tr>
</tbody>
</table>

Table 4. Comparison of Communication Media on Levels of Reflectiveness

<table>
<thead>
<tr>
<th>Communication Mode</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face discourse</td>
<td>222</td>
<td>2.34</td>
<td>.962</td>
<td>4.14</td>
<td>.001</td>
</tr>
<tr>
<td>Computer-mediated discourse</td>
<td>179</td>
<td>2.73</td>
<td>1.049</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
face-to-face discourse) suggests that the two media might serve very different purposes, where reflection may have an intended or unintended role.

**Discussion**

The results showed discourse strategies that generally appear in face-to-face dialogue also appear with frequency in electronic communication, which suggests that these linguistic strategies are a reliable basis for comparing and understanding interaction. When these two modes of interaction were compared on their ability to unite listeners and elicit their participation, three of the five variables of the face-to-face dialogue analyzed appeared significantly more interactive than the e-mail discourse. A variation between the electronic and face-to-face interaction was the latency with which sense-making cues were received. Because of the time independent nature of electronic communication, content as well as contextual information relays at a slower pace. This finding is consistent with previous research suggesting that the transmission of socioemotional cues and other patterns of communication occur at a significantly lower rate in electronic communication than face-to-face communication (Walther 1992; 1993).

Because interaction is only an intermediate step toward a more significant outcome, participant reflection was identified as a variable of interest. In the end, a direct comparison between the two media showed that e-mail communication exhibited more reflective qualities than the face-to-face dialogue.
The media are different in that e-mail-facilitated reflection appeared to be more sustained while involving a greater number of contributors. In addition, e-mail-facilitated reflection is less context focused than that of face-to-face contact. More so than face-to-face discourse, computer-mediated reflection is generated by the inclusion of ideas and theories outside of the teachers’ immediate curriculum development experiences.

A process for assessing interaction that accounts for what Zhang and Fulford (1994) suggested are social and instructional aspects of interaction would account for the nature of the conversation and the collaboratively reflective content it produces. Northrup’s (2001) ideas of interaction attributes consisting of strategies and attributes to facilitate interaction (interaction with content, collaboration, conversation, intrapersonal interaction, performance support) could also serve as a suitable framework for assessing overall participant interactivity resulting in situationally relevant outcomes.

In confirming reflection as a desirable and measurable outcome of asynchronous online interaction over face-to-face dialogue, we discovered that reflection is situational—embedded in the tasks, processes, and events of practice. The asynchronous online modality appears to be a way to satisfy knowledge-based approaches to real-time needs and problems. Because e-mail and other asynchronous communications can be used anytime and anywhere system components can be found, they remain a reliable conduit to knowledge-based resources.

Several possible issues combine to constrain the findings of this study. Although the teachers who were a part of this project worked at some distance from each other, their familiarity and experience in working with each other before their e-mail communication may explain the difference in interaction between e-mail and face-to-face discourse. Teacher participants’ level of comfort with the technology also could significantly influence the level of reflection the participant demonstrates via e-mail. Despite these limitations, the study establishes the use of spoken discourse variables as a basis for understanding the nature of online interaction and critical reflection as an outgrowth of electronically supported interaction. This is significant as the context of online interaction grows increasingly wider, and new approaches to facilitating participant interaction in distance environments proliferate.

References


