Software Issues for Applying Conversation Theory For Effective Collaboration Via the Internet

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Abstract-- **Conversation is central to human interaction. The usual way to conduct asynchronous "conversations" over the Internet is to post e-mail messages on an electronic bulletin board, with messages organized by topic. However, such environments do not allow us to exploit the richness of conversation theory for effective collaboration. This presentation will review key elements of conversation theory and describe our collaboration experiences with *Forum MATRIX*, a software application that runs in a Web browser and allows users to share and edit multi-media documents, plus make in-context links and notes.**

Index terms— **Web conferencing, collaboration, collaborative learning, conversation theory, shared-document conferencing**

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I. LIMITS OF WEB INTERACTION

The World Wide Web is said to be interactive. But typically, this means that we interact with Web pages by "pointing and clicking" on hyperlinks. That is not people-to-people interaction. How do people interact *with each other* over the Web? How do they carry on conversations; that is, exchange information, reach decisions, make plans, and conduct projects?

Amazingly little analysis and application of conversation theory has occurred in the context of Web-based conversation. This is especially irksome in the case of distance education, where the on-line "discussion board" is widely accepted as an essential part of a distance learning experience. Discussion boards are also used in the business world, as exemplified by the popularity of Lotus Notes. But before we get into conversation theory as it applies to Web conversation, we need first to remind ourselves about why Internet conversation is important.

II. WHY WEB CONVERSATION MATTERS

Conversation is central to exchanging information, making our positions known, and persuading and motivating others. In education, the communication between instructor and student and student-to-student communication contribute to learning in many ways: rehearsal of facts to expedite memorization, exposure to a broad range of information and perspective, deeper understanding, a stimulus for insight and creative thought, and a basis for assessment of learning. In the workplace, conversation provides the mechanism by which workers generate ideas, reach decisions, make plans for

service or product development and marketing, and evaluate services or products.

Written forms of conversation have special value, because writing engages the author and readers with content more rigorously than does speaking. Written conversation verifies who said what and when. Written conversation can be archived and filed in searchable databases. Whether in the workforce or in school, writing provides an opportunity for richer conversation, because everyone has time to reflect on the conversation of others and to plan and edit responses. John Chaffee, in his book *The Thinker's Way* [1] puts it this way:

> "We show the most respect for people by holding them to intellectual standards of rigor and honesty, informed by knowledge and reflection. And in doing so, we encourage them to make the effort to elevate their understanding, instead of being satisfied with superficial and misguided ways of thinking."

High intellectual standards benefit everyone, whether we want better-trained students or higher quality work from employees.

III. WHAT'S WRONG WITH DISCUSSION BOARDS

The traditional way that people interact on the Web is to use electronic discussion boards that store E-mail messages. Typically, such boards organize mail by topic, but otherwise mail is displayed in chronological (not logical) order. E-mail creates a disjointed and limited kind of interaction among people. When asynchronous mail is posted on a discussion board, all one sees on the computer screen is an outline of the topics of each message. There is no way to create links outside of the hierarchical outline. You have to open each piece of mail to see what is there. There is no way to annotate any given note in context; you must create a new note and place it in the appropriate place in the outline. In order to provide context for a response to a note, you often have to cut and paste key portions of the note to which you are referring. With many systems, you can not see what is in one note while simultaneously viewing the note to which it refers. It is hard, if not impossible, to hold in working memory the key ideas in existing notes that are relevant to a note that you are preparing. Many software systems impose severe constraints on the use of graphics and multi-media materials.

E-mail does not support good "conversation." How can we hold in our working memory the context and content of prior messages when the several days may elapse between messages? Clearly, we are talking about asynchronous conversation, which I do not wish to demean, because asynchronicity provides the crucial opportunity to reflect, to gather and organize information, and to craft clear and coherent messages. Electronic real-time "chat" has its own limitations, especially regarding time-zone differentials, schedule conflicts, and the absence of opportunity for research and reflection.

The threaded-topic discussion-board environment commonly encourages people to express mere opinions. This trivializes the conversation. Opinions do not promote critical or creative thinking if they are not accompanied by data, rigorous intellectual defense, and provocative questions. We teachers like to say that we want our students to be creative and critical thinkers, but when given the opportunity to teach those skills, we often fail to put our pedagogy where our mouth is. I have seen numerous discussion-board situations where the teacher neither invites nor provides critical

feedback on what is said. In many cases, most students do not even participate, acting as "lurkers" who may or may not even be reading the postings. A common teacher response to lurking is to require a specified number of postings, which of course can easily degenerate into a game where students just go through the motions of conversing.

In the workplace, I have seen little use of discussion boards. That is probably because executives are not as interested in people's opinions as they are in getting things done. Lotus Notes, the grand daddy of workplace collaboration software, uses a discussion board, but its popularity derived from other features of the software that enhanced productivity.

Commonly, the purpose of on-line discussions is unclear and the expectations are vague. Further, many participants may be "lurkers," merely scanning what others have posted. A few people can dominate the discussion. Comments are often weak, irrelevant or off task. No compelling need motivates people to read all the postings, and therefore much of the discussion is wasted. I remember a conference presentation where a professor showed the Contents page of his discussion board, boasting about all the student postings in his course. He failed to point out all the little yellow "new" tags that indicated that he had not read the contents of those messages.

E-mail and threaded-topic discussion boards are used in the workplace and the classroom to compensate for lack of personal interactions where time and distance barriers exist. Such substitution is often inadequate. In general, people tend to use the Web in an information "delivery" mode, as opposed to a "participatory" mode. In a participatory mode, people interact with each other to develop understanding, to construct a communal base of information, to increase productivity, and to solve problems. Usually, this means that there

must be a tangible result, a deliverable of some sort that the work or learning teams produce. Generating a product from a discussion board is a problem.

In education, these forms of on-line conversation waste the opportunity for rich learning experience. The problems of engaging students in on-line discussion prompted me to specify devices that teachers can use to get students more involved in on-line discussion [2]. The principles underlying these recommendations formed the basis for developing this present overview of conversation theory and its application to on-line learning.

IV. CATEGORIES OF CONVERSATION

1. **Monolog -** exchange of opinion and supposition. Positions are taken, sometimes rigidly.

2. **Dialogue** - a community-building form of shared viewpoints. Individual advocacy tends to be minimized to achieve consensus.

3. **Dialectic** - conversation aimed at distilling truth or correctness from bgical argument. Focus is on analytical thought and factual information.

4. **Construction ("Design")** – here the idea is to use conversation to create something new, often in the form producing some kind of deliverable. The other three forms of conversation are used as tools to achieve a specified purpose.

Patrick Jenlink and Alison Carr at Penn State University have summarized the essence of contemporary conversation theory in the

context of education [3]. They consider four types of conversation:

Dialectic and construction forms should be considered the "higher" and most educationally valuable [4].

Monolog is relatively degenerate conversation. It is self-conversation. The point is not to exchange of information and views among people, but for one person to make proclamations.

Dialog is often used in the workplace as a vehicle for consensus building. Different views and alternatives are presented, sometimes in formal brainstorming sessions, and then the remaining conversation aims at evaluating pros and cons of each alternative. The group finally reduces the set of alternatives to one or a few most viable alternatives. Many commercial software products for business are group-decision support products that can formalize this process of discussion by including automated voting.

On-line dialectic has not been widely used. It is most relevant in education or in workforce training, but less so in daily on-the-job activities. One model could use electronic chat to emulate the Socratic method. However, real-time chat creates scheduling problems and does not afford time for reflection and research (which no doubt was also a problem for Socrates and his students). Possible asynchronous solutions might begin with a teacher or trainer question, to which learners independently post answers. To incorporate the conversational element, learners could then debate and jointly edit all commentary to produce a group answer. The trainer then posts a follow-up question and the process repeats. The trainer can also "write in the margin" of the posts with in-context sticky notes or links to Web resources that learners need to inspect.

A direct approach for using the construction type of conversation on line is to assign a group task, directing that all on-line commentary be geared toward producing the desired deliverable. Examples include problem-based learning, case studies, insight exercises, portfolios, and projects of various sorts. I have recently published on the use of on-line case studies [5] and insight exercises [6].

V. ACTION VERBS THAT MAKE GOOD CONVERSATION HAPPEN

Another way to think about constructivist conversation is to specify certain action verbs that require the active construction of understanding, knowledge, and insight. Especially in a teaching environment, words that are particularly useful for on-line conversation include:

- $ Identify
- $ Compare and contrast
- $ Explain
- $ Argue
- $ Decide
- $ Design

Identify. Workers can pool their skills on-line to solve problems. Examples: 1) Physicians consulting each other in a telemedicine environment who are presented with a set of symptoms and clinical tests face the issue of identifying which is the most likely diagnosis, 2) Factory managers at several plants could confront the question of identifying best practices in each plant that contribute to productivity. Students can develop their ability to observe and discern when they are required to identify relevant facts or issues. Examples for learners: 1) Identify the root causes of the U.S. Civil War, 2) Identify the criteria by which we decide whether or not a given brain chemical is a neurotransmitter.

Compare and Contrast. This approach requires people to recognize similarities and dissimilarities. It extends the "identify" requirement through further analysis. Workers can compare and contrast alternative ways of doing things. Examples: 1) A legal defense team can compare their strategy with the anticipated strategy of the prosecution, 2) A marketing task force can compare their campaign with that of

competitors. In education, compare and contrast is a classical device to stimulate reflection. Examples for learners: 1) Compare and contrast the way computers work and the way brains work. 2) Compare and contrast Netwon's view of gravity with that of Einstein.

Explain. Explaining corporate philosophy and culture can be a great challenge for a team of executives. To get buy-in from middle management, the managers have to become engaged in formulating or changing corporate culture. Examples: 1) Explain why we choose to be vertically integrated; 2) Explain the purpose for our multiple subsidiaries. Teachers have always known that the best way to understand something is to explain it to their students. Learners likewise gain understanding from explaining complex ideas to fellow students. Examples for learners: 1) Explain what a mathematical derivative is. 2) Explain why the Soviet Union collapsed.

Debate. John Chaffee [1] contends that the central reasoning tool required to analyze complex issues is to construct and evaluate arguments. He does not mean to argue in the sense of quarreling. Rather, the central value of constructing arguments is the need for mustering evidence and logic that can stand the scrutiny of debate. In the workplace, such arguments may take multiple forms involving multiple sectors of the business (finance, marketing, production, planning, R&D, etc.). Examples: 1) Make the case for investing research dollars into a certain product development; 2) Present the evidence that TV advertising will work better than radio for our product. Examples for learners: 1) Why should we consider nitric oxide to be a neurotransmitter, even though it is a gas? 2) Why should the United States not embrace European socialism?

Decide. What could be more important than the ability to make wise decisions? Making decisions often is the culmination of earlier steps of identify, compare and contrast, explain, and argue. Examples in business: 1) Why should we buy back stock as opposed to awarding dividends? 2) Should we acquire our competitor? Examples in academic curricula might include: 1) Determine the requirements for a cost-effective light rail system; 2) Decide which line of research in molecular genetics shows the greatest promise for immediate benefit. Do we have any systematic way to teach decision making to young people in most academic curricula? Group-based decision making is common practice in the business world, and the processes are taught systematically in Business colleges. Why isn't group-based decision making an important skill to learn in other curricula? It IS important in the real world outside of school.

Design. Both creativity and critical thinking are stimulated when people are asked to design something. In industry, workers are continually asked to design plans, prototypes, proposals, better procedures, and the like. Examples: 1) Design a better ketchup bottle; 2) Develop a plan that will reduce our long-term debt by 30% within three years. In education, the design tactic is standard fare in Engineering curricula. But the learning benefits could also be available in other disciplines. Examples include: 1) Develop a plan to test the hypothesis that .....; 2) Design a Table of Contents for a book on ....

Action phrases that could be especially useful in a business environment include:

- List the pros and cons of …
- Examine the barriers to success for …
- Recommend a plan (or solution) for ….
- Review our strategy for …

Responding positively to such action verbs takes conversation to a new level far beyond the mere expression of opinion. This is especially true when the activities are conducted by groups of workers or learners operating under true team conditions. Team operations are central to the success of great corporations, according to the famous analysis by Peters and Waterman [7] Team learning in on-line computer conferences is widely practiced, and I am convinced that it is very effective [8,9] Individual achievement in the real world typically depends on how well a person can work with other people. Some students are more effective group learners than others, and my experience has been that all students need improvement in this area. This is most conspicuous with students in competitive educational tracks, such as pre-professional (law, medicine) or graduate school. Such students became competitive for admission to selective professional or graduate schools because they compete (not cooperate) well. But in the real world of their professions, they will suddenly find a need to work collaboratively. Most young lawyers work for large law firms with a large stable of diverse

clients. Physicians depend on a staff of bookkeepers, receptionists, technicians, nurses, and often other physicians in group practices. The "mad" scientist working alone in an ivory tower is a myth. Scientists typically work in teams, and they must always network with peers in their field to cultivate a reputation, get published in the best journals, secure prestigious positions and awards, and obtain grant funding. Complex communication skills are often more important for success in life than expertise or the traditional idea of intelligence [10].

Teachers regard the teaching of critical thinking skills as among their highest calling. Yet, we seldom understand the role that conversational style plays in critical thinking. Nor do we usually structure on-line discussions in ways that stimulate critical thinking. Chaffee points out that critical thinking in group settings occurs when each participant does all of the following:

- $ Expresses views clearly and provides supporting evidence and logic
- $ Listens carefully to others, weighing their evidence and logic
- $ Stays focused on the issues raised by others rather than on your own position
- $ Asks relevant questions and then try to answer the questions
- $ Strives for increased understanding

Sadly, these conditions are seldom met where instructors try to use on-line discussions, because the typical requirement is for the learner to make a minimum number of postings in response to topic statements made by the instructor. Such discussions are conducted without an explicitly meaningful mission and group deliverable. Without a group mission and graded group deliverable, each member is tempted to tout personal views and biases.

VI. COLLABORATION FORMALISMS

All team effort, whether in the work place or in an on-line learner group has certain basic requirements: a mission, defined roles for each team member, a process for gathering information and decision making. In education, collaboration is not generally practiced in on-line environments. Perhaps the deficiencies of threaded-topic discussion boards only support a trivial form of collaboration, because it is

difficult for a group to DO anything on bulletin boards. Teachers have not found a way to use bulletin boards to help student learning teams make a decision, develop a plan, conduct a project, write a report, conduct a case study, construct a portfolio, or most of the other kinds of constructivist activities that rigorous "conversation" can enable.

Some of the things that I have asynchronous student groups do on-line include solving statistics problems and reaching a consensus on bioethics problems (see classes.cvm.tamu.edu/bims470). The work is made much easier because they are helping each other to understand the problems and the approaches to solutions. Another thing I do is have students participate in Ainsight exercises@ in which each student in a learning team asks a creative question about the subject matter (neuroscience) and then provides a rationale and strategy for answering it [6]. Each student in the group then makes in-context critique comments in a shared document, building up a basis for the group to select the Abest@ question and answer, which they then refine and submit as a group for a group grade   Each group has a group Leader (who assures that things get done on time and that everybody is pulling their share of the load), a Best Q&A Editor (who coordinates the debate and writes the revisions), and two or more Librarians, who do the library work to provide information. They develop a team spirit, actually wanting to compete with other groups for the best grade. See classes.cvm.tamu.edu/vaph451. I have not been the only one to notice that given the proper on-line environment, students can develop camaraderie that enhances group productivity [11].

VII. SOFTWARE CONSIDERATIONS

A major reason that most on-line discussion trivializes conversation is poor software. By poor software, I do not mean poor performance. Some discussion-board software is quite sophisticated and works with amazing

effectiveness. No, the problem is software design. As mentioned, the message-board mentality of posting notes gets in the way of optimal conversation. What is needed is software that gets beyond little notes to multi-media documents. The documents should be in highly transportable format, such as the html used by Web browsers. Moreover, students need software that allows them to work on the *same* documents. They need software that allows them to insert text, data tables, graphics, and sound or video clips into appropriate places in the documents. Software should allow creation of multiple, in-context links to Web sites and for creating hyperlinked pop-up notes.

The kind of document sharing that I am talking about is found with several commercial software systems. Most of these have been designed for corporations and government. They are called by different names: enterprise solutions, Web conferencing, meetingware, project ware, or peer-to-peer netware. Examples of systems that are potentially applicable to teaching include E-room, Hummingbird, NextPage, and WebEx. However, these systems are expensive. WebEx, for example, costs $6,000 to set up and $100 per user per month. And some of these systems require extensive support infrastructure.

My colleagues and I at Texas A&M first attempted a simple, lower-cost way to create a shared-document conferencing system, which we wanted to use in our teaching. Our original software (FORUM) allowed students to create community documents, provided all the in-context linking capability of Web pages, and did several things that Web pages cannot easily do: 1) accommodate independent teams of learners, 2) create workspaces for private individuals or groups, 3) provide variable levels of shared access permissions to any given document, and 4) support pop-up in-context sticky notes (writing in the margins). FORUM was limited in that it was based on MS

Windows, it required client software installation that was cumbersome, and the documents were formatted in a non-standard word processor and not coded in html.

However, we have now incorporated the key group-support features of FORUM into a cross-platform JAVA-applet system called *Forum MATRIX (www.foruminc.com).* This is an intranet environment that is designed to run on any server that can support a MYSQL database. Students not only can view the scrollable documents in their Web browser, but most importantly, they can check a document out for inserting text and graphics, editing, or for making links (to Web sites, MATRIX documents, or to pop-up notes). Documents are saved in html format. Students can have their own login IDs and passwords. Documents can have a range of access permissions (no access, read only, full edit). Permissions can be set by individual or by group, and permissions can be changed "on the fly," as for example when the teacher is ready for each group to see the work of other groups.

The students can create new Web pages (all Forum documents are Web pages), and they can do so with the visual editor chosen by the teacher for a given course or Activity. The teacher can choose between MS Word or use the default visual html editor that comes with MATRIX. The Word editors have built-in macros that automatically perform a conversion to html in response to the "Save" command.

Multiple items from different students can be put into the same document. The documents are not only archived on the Web server, but when a student checks out a document, all three visual editors allow the "Save As" function so that a document copy can be sent to the hard drive or any portable media. Students and teacher can scroll quickly through documents, recognizing quickly which inserts and pop-ups have special importance because of the context in which they occur. Unlike e-mail messages on

discussion boards, the inserts can be seen **in context** - without any opening and closing of files. Pop-up notes, also in-context, open and close quicker than e-mail because they are stored as an integral part of the document, which has already been opened.

VIII. SEVEN YEARS OF FIELD TESTING

Several kinds of activities have been field-tested with students for seven years. We believe that modified versions of these activities are applicable to business.

Discussion Threads in Shared Documents. The idea of coalescing threaded discussions into common documents has been tested most often in my Biomedical Research course, taught entirely over the Internet. In this course, students are asked to post an insight on assigned reading material, which they submit in a shared document. Then they create hyperlinked annotations. This way all of the commentary associated with a given document or topic is embedded in the document itself, and the context for each note is readily apparent. Most importantly, participants in the conversation have the convenience of having everything in one scrollable place. Students in a learning team put their initials at the end of their text or use different font colors.

This way, all the conversation about a given topic appears in a single compact document. A typical topic contains the postings from six students and six pop-up notes for four readings. That is a total of 144 items. Imagine what that would look like on a bulletin board! It would take several screen displays just to list the topic titles for each of the 144 items (and each would have to be independently opened and closed to see the contents). But in our case, all of the actual commentary in an integrated single document of topic conversation often is no longer than several word-processor pages long. Can there be any doubt as to which approach is more convenient?

This exercise was not formal teaming learning and therefore lacked its camaraderie and pedagogical power, but I have never had problems with sabotage. These are serious college students, and they seem to want to benefit from the ideas and input of fellow students. Where team-learning formalisms are involved, the built-in interdependence, bonding, and group grading makes sabotage even less likely (see below). Also, in the small groups of 5 or 6 that I use, it should not be too hard to catch and punish any anti-social culprits who undermine the process. Note that each group is able to read (not edit) the works of other groups, which is easily done, because the commentary is organized within one scrollable document.

Biographies. In the Biomedical Research course, I require each student to write a short biography on the discovery process used by a famous scientist (but not the ones that books have been written about). These biographies have pictures, and links to Web pages and even some of the publications of the scientists. The best part of this exercise is that everybody can see all the biographies. I could, if I wanted, set permissions so that students could insert in-context questions and commentary on the biographies. Students not only learn more about the discovery process, but most of the time they realize why some people received a better grade than others.

Web Quests. I have students conduct searches of Web pages covering certain topics. They put the hyperlink to the pages, along with a summary of what can be found at that Web site, all into one community document. Each topic can be covered in a separate document, or related topics may be combined into the same document. Because everything is html-formatted, it is easy to build a hyperlinked Table of Contents.

Insight Exercises That Produce a Group-Graded Product. A common approach that I

take in my Neuroscience course is to stimulate creative thinking. Each week I require each student to post into a shared document a creative idea on that week's academic content. The insight is to take the form of a question, accompanied by an answer. Really good questions often do not have an answer, and in those cases, the task is to outline how to do experiments that could get to an answer. The students then annotate and rank the various questions in the group to identify the "Best Q&A," which they will refine and submit as a separate document for a group grade. Sometimes, students get exceptionally creative and create their Best Q&A by combining two or more Q&As. I find that a great advantage of this approach to group learning is the requirement of both an individual and a group product.

Case Studies. In my neuroscience course, I want students to become comfortable and reasonably competent in reading primary research literature. Toward this end, I assign papers for the group to read and analyze in the Forum. However, I supply specific guidance by telling them what I want them to do in terms of understanding, assessing, and creating new ideas and perspectives. I supply the instructions in standard black font, and students insert their information and analysis under each question. Students usually approach this problem by assigning each team member to write certain responses, and then they interact to correct any misunderstandings or add multiple insights. See reference [5] for more detail.

In all of these teaching strategies, teacher feedback is easy and effective, because the teacher can "write in the margins" just as in the good old days of paper and pen. Extensive feedback can be supplied in-context as an insert (using a different font or color for emphasis), and short notes can be made in-context as pop-ups. By responding to a group rather than to each individual student, the teacher has less work and is more likely to be fully engaged in what the students are doing. When the same thing needs to be said to all groups, the teacher only inserts it once and then can refer other groups to that document.

IX. CONCLUSIONS

As more and more of us work and study via the Web, the need grows for understanding and improving the art of written asynchronous conversation. For workers, good on-line conversation supports effective decision making and productivity. For learners, good on-line conversation promotes understanding and memory.

On-line conversation is optimized when the following conditions are met:

- the conversation has a clear objective that requires some kind of group-written deliverable
- the conversational requirement extends beyond mere expression of opinion to require people to identify, compare and contrast, explain, debate, decide, and design.
- people work in teams to help each other produce the deliverable.

Talk is cheap.
Value comes from cooperative conversation in the service of creative enterprise.

X. ACKNOWLEDGMENT

XI. REFERENCES

[1] John Chaffee, *The Thinker's Way*. New York: Little, Brown & Co. 1998.

[2] W. R. Klemm, "Eight ways to get students more engaged in online conferences," *The Higher Education Journal,* vol. 26 (1), pp.

62-64.   pp. 105-143, 2001.

[3] P. Jenlink and A. A. Carr, "Conversation as a medium for change in education, " *Educational Technology," pp. 31-38, 1996.*

[4] L. Sherry, S. H. Billig, and F. Tavalin, "Good online conversation: building on research to inform practice." *J. Interactive Learning Res.*, vol. 11 (1), pp. 85-127, 2000.

[5] W. R. Klemm, "Analytical model for teaching students to analyze research reports in an asynchronous computer conference environment," *J. College Science Teaching*, vol.31 (5), pp. 298-302, 2002

[6] W. R. Klemm, "New ways to teach neuroscience: integrating two teaching styles with two instructional technologies," *Medical Teacher,* vol. *20*, pp. 364-370, 1998.

[7] Thomas J. Peters and Robert H. Waterman, Jr., *In Search of Excellence,* New York: Harper and Row, 1982.

[8] W. R. Klemm, "Using computer conferencing in teaching." *Community College Journal Research & Practice*, vol. *22*, pp. 507-518, 1998.

[9] W. R. Klemm, "Computer conferencing as a cooperative learning environment," *Cooperative Learning and College Teaching*. vol. 5 (3), pp. 11-13, 1995.

[10] Daniel Goleman, *Emotional Intelligence: Why It Can Matter More Than IQ,* New York: Bantam Books, 1995

[11] S. A. Barab, M. K. Thomas, and H. Merrill, H. "Online learning: from information dissemination to fostering collaboration," *J. Interactive Learning Research*, vol. 12 (1),