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**Using Asynchronous  
Conferencing to Promote  
Critical Thinking:**

**Two Implementations in Higher  
Education**

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# Using Asynchronous Conferencing to Promote Critical Thinking: Two Implementations in Higher Education

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## Abstract

*Asynchronous conferencing is emerging as a tool that can create opportunities for collaboration and support the inquiry process. This paper describes one such tool (ACT) designed within a specific pedagogical framework. The overall goal of ACT is to make cognitive processes visible and encourage reflection in students as they engage in critical thinking activities. This study examines the use of ACT within a graduate-level seminar and an upper-level undergraduate sociology course. We report on the tasks assigned to the students, levels of participation, and ways in which special features of ACT helped support specific pedagogical goals in the two courses. Using ACT helped the instructors meet their goals; in both cases, they reported that students displayed better critical thinking skills than in past semesters. Most interesting was the use of labels; textual, color-coded tags associated with each message. Sets of labels defined by the instructors successfully facilitated specific student activities and promoted reflection.*

There is a growing emphasis in education today on learner-centered environments, where the learning activities involve students engaged in inquiry and problem solving, typically in a collaborative framework. The strength and breadth of this shift in the pedagogical landscape has been quite dramatic if we are to judge by the policy recommendations arising from national education organizations [1, 4, 13] or by an examination of the shifting focus of educational research.

We are confident that a highly interactive, learner-centered environment is a worthy goal in undergraduate education (or in any education or training environment) in terms of the quality of the learning experience [2, 12], but is absent partially because of the reality of classroom instruction. It is only in an academic setting that we even consider trying to carry on a meaningful discussion with a group larger than ten or fifteen people, in a mere 2.5 hours per week, and in addition to presentations which are necessary to help students understand the complex issues in a field.

Despite prevailing sentiments about the importance of learner-centered education, a recent study by Nunn [16] provides what we consider rather depressing data indicating the predominance of non-interactive, lecture based instruction. Nunn examined 20 faculty teaching upper division courses in a public university under fairly ideal conditions: enrollment ranged from 15–44, faculty were all highly-rated by students, and 73% of the students were majors. Even in this environment, student discussion averaged only about 2% of class time, and contributions by the students tended to be in response to the teacher questions, consistent with the normative findings of Braxton et al. [3].

Of course, faculty can assign collaborative inquiry tasks to be completed outside of class time (or even during class time). However, it is difficult in the classroom, and impossible outside of the classroom, to monitor (and hence mentor) collaborative discussion and critical thinking when it occurs in small group meetings. Without this ability, only the final product of inquiry can be reviewed.

It is in this context that we see the potential power of asynchronous conferencing systems. Over the last 6 years there have been numerous asynchronous conferencing systems designed to support interaction among people outside of the face-to-face context (AltaVista Forum™, Lotus Notes™, First Class™, etc.) These tools provide a forum in which discussion can occur outside the classroom while allowing the instructor to:

- observe students' contributions to the discussion,
- include transcripts of the discussions in a portfolio for feedback or assessment of critical thinking and conceptual understanding
- participate in the discussion as a way to model critical thinking skills,
- interject questions and comments in order to coach critical thinking,
- provide expertise in a topic area when such input is required.

While these tools have tremendous potential, their effectiveness has been mixed [10, 17]. In part, the problem rests in understanding the pedagogy for incorporating asynchronous work into the educational environment [17].

However, we would also argue that the design of the conferencing tools themselves is an important factor in determining the effectiveness of conferencing tasks in educational settings.

We have a long history in understanding the impact of the design of tools on how or even if a job can be completed. This has been true not only in the design of computing tools [22], but in the design of tools and artifacts in general [14]. More recently we have come to recognize the importance of tools in distributed cognition — the tools we use impact how we even conceptualize the task [18]. Yet, with rare exception, asynchronous conferencing systems have been designed without any specific consideration as to the nature or goals of the interaction.

Often, the same conferencing system is intended for use without regard to the number of people involved: there is no consideration of how the design might be changed to better support groups of five versus groups of ten or fifty. Similarly, the system designs make no assumptions about — include no design consideration to accommodate — differences in the goals of discussions. Hence the same design is seen as appropriate for small group problem solving and general “newsgroup”-like discussion. Finally, the designs make no distinction between the use of the tools in an efficient business mode or a mentoring educational context. The design goals underlying asynchronous conferencing systems seems to be limited simply to supporting people who want to communicate but cannot meet at the same time and who want a shared record of their communications.

In contrast, the design of decision support tools has been very sensitive to the task context. A wide variety of tools have been designed to support the various types of activities leading to a decision [15]. Not only have these tools been found to be important, but so too have the importance of guidance and facilitation in the use of them. As the decision support tools begin to be used in new environments and for new purposes, it is clear that the design of the tools must change. Originally, decision support systems were used for special-issue decision making in a business context. As these systems become ubiquitous in day-to-day decision making, modifications in both the facilitation procedures and the tools themselves will be necessary [15]. Similarly, Nunamaker found that the use of his decision support system needed to be modified when he moved from business applications to the educational setting [15]. In essence, both the task and the task context drive the design of the support tool. With rare exceptions [7, 20; 23], the designers of asynchronous conferencing systems have failed to follow a similar course in matching the design to the use.

## 1. The Design of ACT

Our goal is to begin work on the design of an asynchronous conferencing tool for use in settings having the following characteristics: small group collaboration where students are distributed, an inquiry or problem solving task, in an educational setting.

The web based conferencing tool we are designing, the Asynchronous Collaboration Tool (ACT), is only partially developed — the tools for exploration and analysis are present but not linked — and there is still considerable development to be done. However, the analysis tool has been used in 22 courses by more than 300 students over the past year.

We hasten to note that virtually all of the features in ACT are present in one or another of the existing conferencing systems. However, the particular assembly of these features and the rationale for the design in terms of the goals of interaction is new. It is the discussion of the linkage of design to particular collaborative contexts that we find important. Each of the constraints listed above has significant impact on the design strategy. In the next section we discuss some of these key design issues as they impact the tool design, the underlying architecture, and the administrative system. We then turn to formative evaluation data that is helping to inform the ongoing design of ACT.

### 1.1. Inquiry and problem solving tasks.

A variety of terms (problem-based learning, goal-based scenarios, collaborative inquiry, informal reasoning, etc.) have been used to describe the focus of our interest. We believe the key component of learner-centered environments is inquiry [19]: a questioning that derives from puzzlement, a difference between what the individual expected and what he or she observed. To confront this puzzlement, learners must generate hypotheses, gather evidence, consider alternatives, and come to a reasoned position on the issue. In short, they must engage in inquiry-driven critical thinking. Our goal, then, is to support critical thinking in a collaborative inquiry environment as students confront issues and build an argument to justify their positions.

We feel it is important to embed support for different types of interaction in the tool itself, adhering to a coherent and consistent pedagogical stance. In particular, we disagree with what is a common design strategy in conferencing systems, the strategy of allowing users to rearrange the conference structure (e.g., sorting) at their discretion. The structure of information influences the understanding of that information — what relations are noticed, what inferences are drawn, and what the next logical activity should be [5]. If the task is brainstorming, the tool should support brainstorming; if it is systematic analysis, a different

set of characteristics are necessary. Driven by previous work looking at small teams of students in problem-solving activities [11, 12, 15] as well as our own experience dealing with small-groups and problem-based learning, we find it useful to talk about three fairly distinct types of interaction: exploration, analysis, and decision making.

*Exploration.* Group members need a forum in which they can efficiently explore a variety of options without getting too focused on the details of any one topic. There are two exploratory goals. First, small groups must develop a sense of community; building trust in each other, establishing mores of conduct, and helping each individual find a place within the emerging team where his or her talents and expertise can best be brought to bear. It involves communication which is unstructured and conversational, and which generally has much more value for its affective component than any content it may carry. Indeed, recent research points to this as a critical factor in the success of collaborative work over the web [24].

Second, the group must begin by exploring the issues, seeking to identify the expertise of the members and gathering perspectives on key issues. The discussion may quickly move from problem constraints, to possible solutions, to relevant evidence, to issues of administration as the team members explore the dimensions of their task. These exploratory interactions tend to resemble normal face-to-face conversation: the topic meanders, the focus is on the last one or two things said, and the goal is to move forward. In essence collaborative problem solving begins with divergent thinking and the development of group cohesion — both unfocused and exploratory activities.

Exploration requires an environment that is undemanding and unstructured. ACT provides *linear conversation spaces* to support exploratory activities (see Figure 1). Linear spaces are organized by date, so older messages eventually “scroll off the top of the screen”, as people move past them and focus on new posts. This provides a safe environment, where users can be sure that risky or controversial posts will soon be out of the public eye.

*Analysis.* As the exploration proceeds, issues (hypotheses, strategies, etc) will arise that require detailed, focused analysis. These issues need to be moved from an exploration space to a space that will support analysis. Analysis refers to those activities most often associated with structured inquiry: proposing hypotheses, gathering and organizing evidence to evaluate the hypotheses, developing arguments or counterproposals, and giving feedback to peers. The goal is to coordinate all of these and create a coherent structure. The evolving structure (organized by topic) should be plainly visible to users so they can easily see gaps or areas that need more attention.

ACT provides access to this topical organization through the use of *hierarchical analysis spaces* (see Figure 2). New messages are indented under those to which they are replying, creating an outline of the message subjects which can be quickly scanned to get an overview of the discussion. In this organization, messages are labeled to indicate their content, and never “scroll off the top” as they do in the conversational spaces. These characteristics combine to make the posting process less safe but more organized and rigorous.

While both the exploration and analysis spaces are developed and in use, we are still designing the interface to facilitate moving issues from exploration to analysis. Students now must copy focal issues from the exploration space and paste them into the analysis space.

*Decision making.* Exploration and analysis call for opportunities to reflect on other posts, gather evidence, and carefully evaluate alternatives. These activities call for an asynchronous environment that permits time to develop ideas and evidence. However, when it comes to making a final, collaborative decision, we would argue that the asynchronous environment is counterproductive. Decision making requires a coming together, a synthesis of views, and compromises. In an asynchronous environment it is too easy to remain wedded to individual perspectives — there is too much time to think about alternatives and become righteous in the importance of one’s particular issues. While this is an excellent context for analysis, it can easily lead to a stalemate in decision making. Hence what is required is a synchronous environment in which the team members can come together and negotiate, building off of each other’s perspectives. The synergy that can develop in a synchronous environment is essential to final decision making (of course, it is critical that the systematic analysis precede this synergistic coming together.)

Thus the third tool in the ACT system is a synchronous environment to which decision options can be moved and decided upon. The development of this synchronous environment is still underway.

## 1.2. Educational context

The educational context has a broad impact on the design of ACT, affecting both the pedagogical features and the administrative features.

**Pedagogy.** In terms of students, our goal is to make the inquiry process as visible as possible. Here the focus is primarily on the analysis tool, i.e., those activities in which the students engage in critical thinking about issues. Of utmost importance in this context are opportunities for *reflection* as described by Schon [21], both *reflection-in-action* (during the process of analysis) and *reflection-on-*

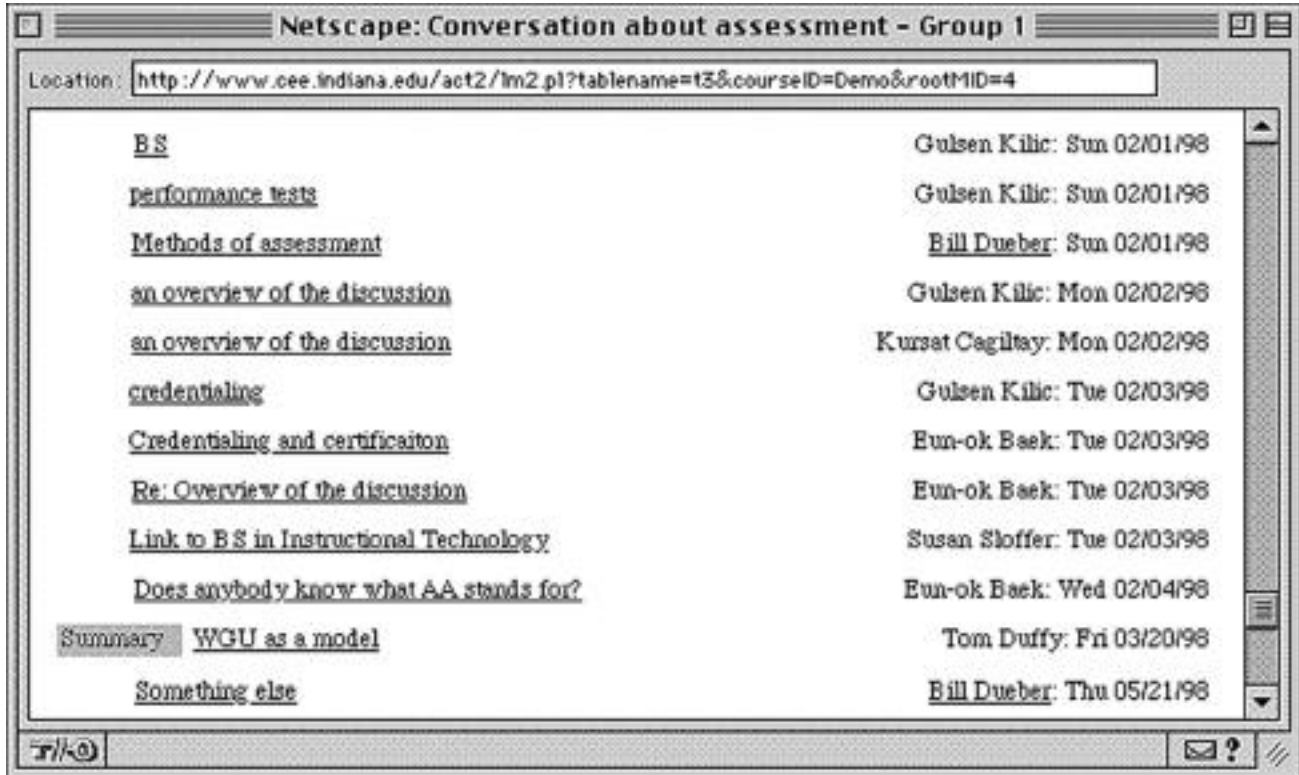


Figure 1. A linear discussion space. New messages are added to the bottom of the listing.

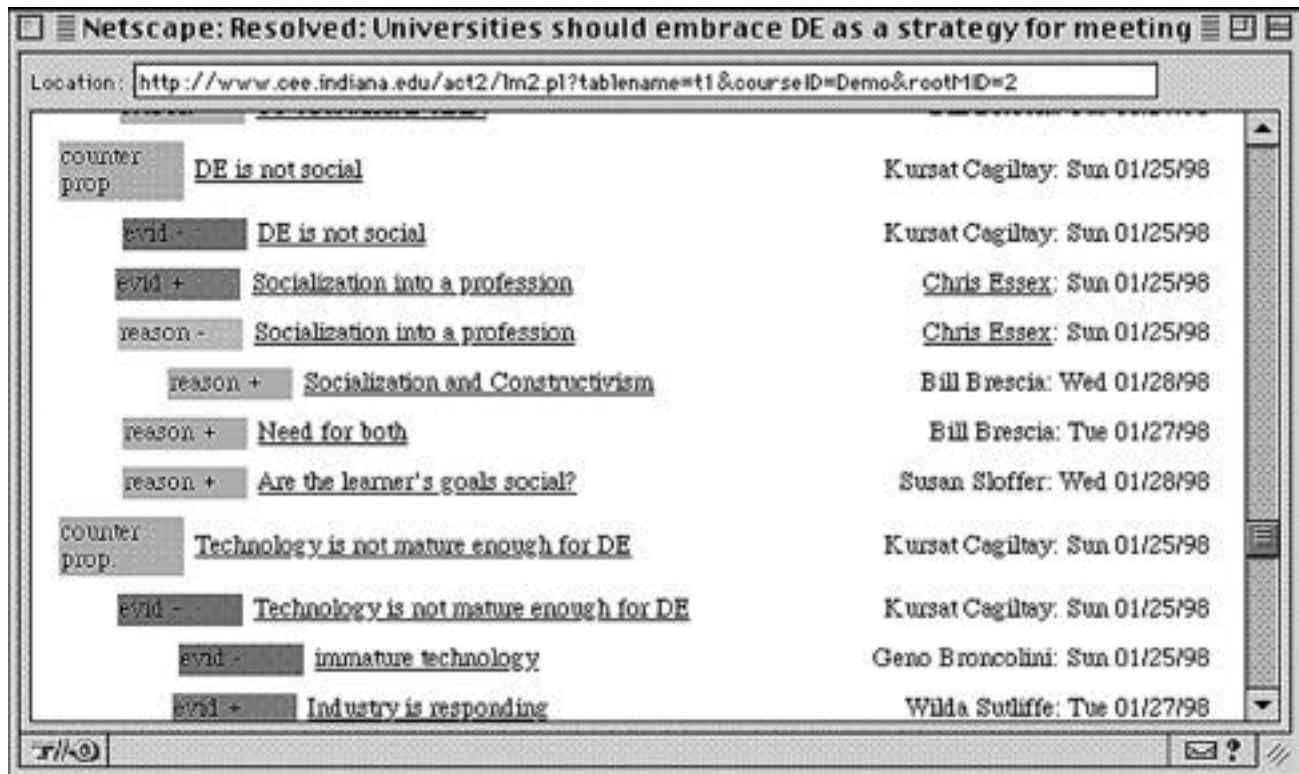


Figure 2. A hierarchical analysis space. Messages are grouped by topic, and colored labels are used to classify each post.

*action* (post-hoc reflective activities). The focus of the reflection is the inquiry process and the student’s own contribution to the inquiry.

It is important to recognize that our focus is on the critical thinking process, not just the outcome of that process. Our goal is to support and mentor that process. This contrasts, for example, with the work of Suthers [23] and his use of Belvedere. Belvedere is a concept mapping tool which small groups (pairs) of students use to summarize their analysis. That is, students engage in face to face problem solving or analysis and as they come to understand concepts and relations between concepts they represent them graphically in Belvedere. Suthers has quite rightly discussed tools like Belvedere as well as asynchronous conferencing tools like ACT as visualization tools. Indeed, as will be clear in our discussion of the ACT analysis tool, this is a significant part of our goal. However, we want to assist students in visualizing and reflecting on the analysis process while Belvedere focuses on the *output* of the analysis. With this in mind, we briefly describe four of the metacognitive and reflective activities supported in ACT.

*Structure.* The nature of the analysis outline structure itself immediately demands that users step back and ask themselves where this new message will best fit into the existing structure. Our design focuses on the discussion outline. The student cannot open all messages at once since that would eliminate any sense of the structure of the discussion that is evident from the pattern of threading, the subject headings, and the labels which are discussed in the next section. We also present all threaded message headers — we do not treat the top level message as a folder to be opened to see what is under it. We want students to see the argument developing.

*Analysis Labels.* Students are required to “label” their post in the analysis space. Each post must be given a colored textual *label* (see Figure 2) indicating how it is contributing to the analysis. The labels serve two educational purposes. First, they require users to pause and think about the nature of their post and how it will add to the ongoing analysis, resulting in reflection-in-action. The constraints imposed by the labels should force the student to reflect on the components of critical thinking and critical analysis relevant to that discussion. Second, the labels which are both text and color-coded, allow users to quickly get an overview of the general state of a discussion, simply by recognizing a predominance or lack of one or more colors. For example, they might see that there is a lot of evidence around one hypothesis but another hypothesis is dominated by conjecture. This “view” of the conference also aids the instructor in at least partially assessing the quality of the discussion and determining where coaching is required.

For example, the instructor may notice the lack of evidence and can easily comment on that without having to explain what he or she means by evidence.

There are other systems that use labels, Hypernews<sup>1</sup> being the oldest and most established. However, our focus is on tailoring the labels to the pedagogical and critical thinking goals of the instructor. Hence, the instructor can easily create new labels, resulting in a set of labels specifically tuned to his or her goals for the discussion. If, as the discussion proceeds, a new critical thinking label is needed, it can be authored and added to the label set. Again, the goal of the labels is to promote reflection-in and -on action. Indeed, a major issue in our formative evaluation work, some of which is described in the next section, is to identify the kinds of labels faculty see as important to their problem solving tasks. As this evidence accumulates we hope to develop a matrix of task types by label sets to help guide faculty.

*Exploration Label.* The exploration space is meant for free-wheeling, divergent thinking and hence labels are used quite differently here. We argue that in divergent thinking and exploration what is most important is for someone to occasionally pause and summarize the discussion, helping to focus attention on emerging key issues. Summarization has been found to be an important pedagogical tool [19] and it is from this summarization process that we would expect the key issues for analysis to be identified. Thus in the exploration space we only provide one label, “Summary” for students to apply. The instructor or the facilitator can encourage the summarization process. We always recommend providing students with the important *Summary* label to afford more opportunities for reflection-on-action.

*Post-before-read.* ACT allows instructors to set up a conference so users cannot read their peers’ posts until after they have submitted their own. This option provides two educational benefits. First, it is often the case that a discussion begins with individuals stating their perspective or their analysis of the readings assigned. Post before read prevents students from simply using or even being influenced by their peers who have already posted. Second, post before read eliminates situations where the first few posts totally dictate the mood and content of the discussion.

**Administration.** In an educational setting it is essential that software be easily configured to meet the needs of individual faculty and contexts. There are two important aspects of this. First, the system must provide the instructor the information needed about student performance. In meeting this need, we provide the instructor with access to data on not only what the students have posted, but also

1. Information about Hypernews is available at <http://www.hypernews.org>

what they have read. That is, the goal is to help the instructor to assess not only if the student is meeting requirements but if he or she is collaborating by attending to what the others are saying. A time stamp also provides data on when students were active.

Instructors also need a means to easily configure and manage conferences. In this regard we have turned much control over to the instructor with an easy-to-use interface. The instructor can:

- Create and manipulate groups of students/conferences.
- Determine conference structure (exploration or analysis).
- Set and change permissions (read, write, edit own, edit all, and post before read) for individuals and groups.
- Create a hierarchy of conferences based on student teams or projects.
- Create identical sets of conferences, e.g., for successive topics, to support working with large classes broken into small groups.
- Add and remove students.
- Change labels on the fly.

Of benefit to both students and instructors is the “unread” indicator, which is specific to each individual. The ability to easily locate new or unread messages is especially important in the analysis space where new messages are embedded in the discussion.

**Program Architecture.** Finally, the educational environment calls for a system architecture that does not depend on expensive technology or extensive administrative support. ACT has been designed to run on inexpensive hardware, using freely available software on both the server and client side: a www interface, cgi scripts written in PERL, the freeware Apache httpd server with a built in perl interpreter (mod\_perl) for speed, and the mysql database to manage data.

## 2. Formative Evaluation of ACT

We examined two courses, one undergraduate and one graduate, that used ACT during the Spring of 1998, a graduate seminar on distance education and an undergraduate course in Sociology. The courses were offered at a large Midwestern public university and used ACT in addition to normal classroom meeting times.

Our goal was not a formal evaluation study but rather to gather information about how students and faculty used ACT that would inform our design strategy. Since these were classes that had a face-to-face component, our focus was on the ACT analysis space and the overall ACT administration and management system.

We were particularly interested in the use of labels. From a faculty perspective we were interested in what labels they chose, how successful they were (retrospectively) in choosing labels, and how helpful they judged to labels to be. From a student perspective we were concerned that the labels might constrain the student too much. For example, it might force the student to chunk a larger comment into smaller disconnected pieces. We were also concerned whether the faculty member’s selection of labels was judged to be appropriate by the students. We have intentionally made the conferencing process more thoughtful and as consequence more difficult. We were interested in the students’ overall reaction to the imposed structure.

In addition to the labels, we were also interested in the types of tasks faculty used with ACT. In the longer term we want to understand how ACT enables new task design and we want to begin to understand the range of tasks which ACT needs to be designed to support. As we noted at the outset, our goal is to design the conferencing system to support small group collaborative problem solving and inquiry. If we are to meet our design goal, it is essential that we begin to catalogue and analyze the various types of inquiry tasks.

Finally, we sought more general information on the design of ACT: ease of use by faculty and students, which features were found most useful (and for what purposes), and what features should be added or modified.

In addition to the electronic record available via the ACT system (logfiles and transcripts), faculty were interviewed and students were either interviewed or wrote reflection papers.

### 2.1. Graduate Education Seminar: A debate.

We first looked at a graduate seminar in Instructional Systems Technology (IST). This topic was the design of Distance/Distributed Education with a focus on Web-based interaction and collaborative strategies. We were particularly interested in looking at this course because the debate conducted by the class exemplifies the sort of activity for which ACT was explicitly designed: rigorous application of reasoning and evidence to address an ill-structured problem while working in small groups.

**Description and goals of the course.** There were eight students in the seminar, of whom four speak English as a second language. All the students in the class had extensive experience using e-mail and most had some experience using computer conferencing, making this an excellent opportunity for us to obtain expert reflection. The instructor, a professor in the IST department, had previously incorporated asynchronous conferencing into several of his classes and is a member of the ACT design team.

The course was divided into one- to two-week seminar topics. For each topic area the students had an online collaborative task that extended throughout the unit. The tasks were designed to engage them in the readings for that unit. In-class time, one 2.5 hour meeting each week, was used to explain the task for the next topic and reflect on the previous week's experience. This reflection included both the issues in the reading and the effectiveness of the collaborative task. The focus of this formative evaluation is a debate that was conducted during the first week of the course. The debate is notable partially because it mirrors so well the use we had in mind when designing ACT: a small group engaged in systematic inquiry, with a focus on logical reasoning and the application of evidence to complex issues.

**Description and goals of the debate task.** The instructor set the process as a formal debate with the resolution to be debated, "Universities should embrace Distance/Distributed Education as a strategy for meeting educational needs in the information age." The debate lasted six days with the class divided into an affirmative ("pro") and a negative ("con") group. A set of readings for the debate was assigned for the week as a starting point, and students were encouraged to use whatever resources they could find.

In discussing the goals for the debate task the instructor emphasized that his primary goal was to support systematic, in-depth analysis of complex issues. He stated:

I have seen people debating issues both online and in face-to-face classroom environments and it is just a very sloppy process. Arguments go in too many directions, important points are lost, people forget about the need for counter-arguments and too often don't consider the strength of their evidence. I saw ACT as the natural tool for coaching students into taking a more systematic approach in arguing.

**How ACT was used for the task.** The debate task illustrates the use of three features of ACT: the organization of the conference, the use of labels, and the permission system.

**Organization.** (see Figure 2). The hierarchical organization of the conference assisted the students and the instructor on two levels. First, each proposal and counter-proposal was a top-level message. All the supporting and detracting arguments were indented below the top messages. The top level overview enabled the user to see at a glance the whole structure of the debate in outline form and by label. The label colors were also effective in this view, enabling the user to get an immediate impression of the prevalence of any given category, e.g. positive evidence for a proposal.

**Labels.** The six labels used (see Table 1) show a clear attempt to embody the process of inquiry in the structure of the system. The instructor picked labels designed to "focus the students on formal analysis," and saw the process of choosing and using the labels as a critical component.

Both the hierarchical structure and the labels are important. The ability to create labels that really fit the debate goals was critical for me — there was no need to force fit pre-existing structures. My concern, and one of the things I wanted to better understand, was the extent to which the labels might get in the way of thinking. If I had the wrong label or was missing a needed label then the labeling would get in the way. Even if I had a good set of labels, I was concerned that there might be too much focus on structure, e.g., students might present evidence, without adequately worrying about the quality of the content. Creating the label set also forced me to think about what kind of comments the students needed to make ... and what I wanted them to focus on. It required a much more thoughtful anticipation of student contributions and helped guide my thinking in even how to phrase the debate topic.

**Table 1. Labels used in the debate**

Proposal	Counter-Proposal
Supporting Evidence	Detracting Evidence
Supporting Reasoning	Detracting Reasoning

**Administration.** Over the six-day debate, the affirmative and negative groups "took turns", a practice enforced by the instructor using the permissions in ACT. While all students could always read the evolving debate, only the team whose turn it was could actually add to the ongoing discussion. The affirmative group had two days to present their argument, the negative group had the next two days to rebut. Then affirmatives then had 36 hours to respond and the negatives had the final 36 hours to finish the debate.

**Instructor's role.** The instructor did not participate in the debate itself. However, he did provide mentoring and encouragement via e-mail. These messages consisted of alerts to the students, offering motivation and reminding them when write privileges were about to shift, e.g., "Affirmatives, you only have another 8 hours to make your points." Once the time was up, and the write privilege shifted, the affirmative group would only be able to read the postings in the debate.

The instructor also sent e-mail designed to promote a competitive debate spirit, e.g., "The negatives have been very active and seem to have offered some strong counter-proposals with strong evidence." This not only motivated

students, but helped focus them on the structure of argumentation — proposals, counter-proposals and evidence. In using this strategy, the instructor noted,

The labels really helped since, when I referred to a component of critical thinking, e.g., there being a lot of evidence or not much evidence, I did not have to explain how I determined that — the labels identified the evidence statements I was referring to so I only needed to focus attention.

**Table 2. Summary statistics for the debate (8 students)**

	Median	Mean	Standard Deviation
# of Posts / person	15	14.1	8.1
# of Words / post	104	104	32
Peers' posts read	107 (95%)	104 (92%)	34 (30%)

**Outcome and assessment.** The eight participating students produced a total of 113 messages over the six day debating period. In general, students read nearly every message posted (see Table 2), reflecting a high level of investment in the task.

**Table 3. Breakdown of labels used in the debate (113 messages)**

Label	Percentage of posts using this label
Supporting evidence	28%
Detracting evidence	12%
Supporting reasoning	30%
Detracting reasoning	18%
Proposal	4%
Counter-proposal	8%

Student use of the labels followed roughly the distribution the instructor desired; a focus on evidence and reasoning, with relatively few proposals and counter-proposals which were examined in-depth (see Table 3). The relative lack of detracting evidence and reasoning is partially due to confusion about the labels: is evidence which supports a counter-proposal “supporting” the counter-proposal or “detracting from” the original proposal? Student incentive

to participate in this activity was high, since the record of the debate in ACT was the product they were to produce for the assignment. There were, however, no explicit instructions to the students for participation or explicit criteria for grading.

After some initial misgivings, students found that they appreciated the structure and discipline enforced by the system.

I really start to like the labels. Now that I have adjusted my thinking to having them, they help me structure my thoughts.

While reflecting on another class activity another student wrote,

Now that I have worked with both conference styles, I think I like the hierarchical one better because it is more structured and it helped me to focus on the discussion topic ...the labels given have a big impact on the style of the discussion.

One of her peers agreed after using another conferencing system.

Although Alta Vista Forums also allows hierarchical conferences, it does not display an overview like in the ACT conferencing system, making it difficult for the reader to understand the string of argumentation.

The instructor was very pleased with the results of the debate task, both pedagogically and in terms of how ACT functioned. He found that switching privileges for the groups was a useful way to preserve turn-taking and enforce the time-limitation characteristics of a debate. He also discovered that his fear that labels might “get in the way of thinking” was unfounded, stating three measures by which he assessed the success of the debate structure created in ACT.

Their enthusiasm in the debate was one measure. Another was how clear the structure of the arguments was when I looked at the postings. Third there was more attention to reasons, evidence, and counter-proposals than I would ever see in normal informal debates.

**2.2. Upper-level Sociology Class: Peer Critiques.**

ACT was used as a forum for students to analyze cases and problems and to facilitate peer-critiquing in a 300-level course about the sociology of the workplace.

**Description and goals of the course.** The primary instructor, a professor in the Sociology department, is a veteran user of asynchronous conferencing, having used various systems over the last seven years with mixed results. He was aided by a graduate assistant throughout the semester. The 60 students in this class were nearly all

juniors and seniors, with a few sophomores. Fifty-four percent of the students were business majors; 3% — only 2 students — were sociology majors.

The course is designed as a simulated work organization with the instructor in the role of the CEO and the students performing as interns. The students work in teams and use electronic conferences — two features of the present and near-future workplace that the instructor wanted to emphasize. Content areas include topics such as bureaucratic organization and workplace culture, structures of workplace control and their limits, and types of changes coming to the workplace of the near future.

**Using ACT for peer-critiquing.** We focused our formative evaluation on four modules the spanned most of the semester. In these modules, the instructor posed a problem that the students were to analyze. The problems were complex and often involved taking on a role, e.g.,

*You are to take the role of one of a branch middle managers. With Smith's help, you are trying to make sense of all that you've heard in the training seminar and decide how to approach the new situation as manager. Before defining your course of action, you and some other like-minded managers begin to meet on Saturdays over pizza and beer, as you analyze the situation. Your analysis should take at least two of the following into account. A more complete analysis will tackle three of these major aspects of the situation. Show your comprehension of... A. the structural changes going on at the bank and the reasons they are necessary; B. the methods that top management expects you to use, and their drawbacks; C. the problem of maintaining the consent of the workers under you, given the expectation that you can no longer use the bureaucratic rules of old (e.g., the SPM).*

Class time was spent in small groups working through various issues and engaging in some traditional lecture and discussion. Concurrent with these in-class activities, students were assigned a specific scenario and problem to pursue in the conferencing system outside of class. Students had to develop an individual position on the problem, provide their rationale, and post a document explaining these in ACT. At least two other students then offered two critiques of each position; the instructors also offered a critique. Finally the students revised their position and defense based on the critiques and submitted a final position paper.

ACT contributed to the goals of the peer critiquing in several ways. The threaded format allows clear distinctions to be made between initial positions and critiques. This is a

simple factor, common to many (though not all) conferencing systems, but important in helping students manage information.

Second, post-before-read was used so that students had to post their own position on the problem before they could see the position other members of their group took. From an educational perspective, this ability to require a student to state her position based on her own work is very important.

Finally, and most central to the instructor's selection of ACT as a conferencing tool, was the use of labels. The instructor has always insisted that the students be clear in the initial position they are taking and in the criteria they are using for their critiques. Indeed, when teaching this course he generates criteria for critiquing, many of which are specific to the particular problem under analysis. Table 4 lists the labels used for one of the problems. The initial post labels reflect the two management styles students could advocate when responding to the problem. The peer review labels denote the criteria on which the students had to critique their peers. Each student had to post two critiques and each critique had to use a different criterion.

**Table 4. Labels used for initial posts and peer reviews in one problem in the Sociology course.**

Initial Post Labels	Peer Review Labels
Only Up Up & Out	Aspects Not a clear position Rethink this Grammar/syntax Balanced Justification Understand aspects New Criterion

The instructor was very clear in the definition of the criteria. For example, “Balanced Justification” is defined as:

*Develop a justification of your decision that weighs both pros and cons of the decision you will carry out and links your analysis of the aspects of the situation to your decision. (Don't confine your answer only to evidence that supports your decision.)*

These criteria and definitions were used in years past, but students have previously met face-to-face in small groups to discuss and apply the criteria. The instructor found they simply could not use the criteria effectively:

In the previous semester, they couldn't critique each other's answers in the small groups—they just didn't have a handle on it. Some couldn't work in groups. So I went to the categories

One innovative use of the labels was the use of a “New Criterion” label. Students who felt they were unable to fit a necessary idea into the existing categories could select “New Criterion” and then petition the instructor to make an appropriate label available. This led to an adjustment of the labels over the course of the semester to better reflect the material being covered and the types of comments the instructor wanted to encourage.

**Instructor’s role** . The instructor and/or his assistant commented on every draft posted in two of the four modules, using the same criteria and labels as the students thus modeling critiquing. In the other two modules, the staff provided general feedback comments. Hence, each student received feedback both from “official” channels and from one of her peers.

This dedication to offering constructive feedback on every draft was very time-consuming compared to past semesters when the instructor had only graded group projects.

The most time consuming: print out, read, comments, no grades—usually a week turnaround. The commentary side took a lot—much more than in the fall when I was doing the group stuff—I read everything but I only had to grade the one group answer. [In the past] I would post a general comment. I wanted to see what a difference it would make if you really focused on individuals as opposed to groups.

**Outcome and assessment.** We have summarized ACT participation data from Modules 2 and 3 which roughly covered the middle 40% of the semester. In Module 3, the students did peer reviews of two other students and the instructors did not do expert review, except for general comments. Each peer review consisted of a minimum of two postings using two different labels. Counting their own initial drafts, each student had to post eight times over the course of the two modules. Of the 57 students who participated in the conferences, 75% met the minimum number of posts. As can be seen in Table 5, the average number of posts for the class as a whole slightly exceeded the minimum number required. But, as shown in Table 5, the students did not tend to read each other’s posts, reading only 14% of the posts in their conference

**Table 5. Summary data for all students, assessment modules 2 and 3 (57 students)**

	# of Post/ person	# of words/ post	% of peers posts read
Mean	8.5	183	14%
Std. Dev.	(3.3)	(101)	(7%)

We looked at label use in the peer reviews in Module 2. The students had to write at least two separate comments per paper and had 6 labels to choose from (see Table 4). Grammar/syntax, which may be the easiest category for the students to assess and also the least threatening for them to apply, was the most frequent choice by the students (32%). “Rethink This”, which we considered the most globally critical category, was used for only 8% of the posts. This seems to confirm the instructor’s belief that students do not like to give each other substantive criticism. In fact, for the last module, the instructor did not allow the students to use the Grammar/syntax label in the peer reviews, both because he felt the students should be applying this to their own work and because he wanted them to engage in more thoughtful criticism.

The instructor instituted an elaborate assessment strategy with weights for both quantity and quality of the peer review posts. This became increasingly cumbersome and time consuming to implement as the semester progressed. Based on those detailed reviews and scoring, the instructor indicated that he was impressed with the peer review process in ACT, not only in general but as it improved over time. He reported that in the first assessment module, the students just “tagged on the revisions”, but in later modules he saw complete rewrites that were significantly different than the initial drafts.

The instructor also found administration of ACT easy. He was able to form and reform groups without difficulty. He was also able to add new labels, both as the problem changed and as students requested/defended a new criterion. The success of the use of labels in this context rested in large part on the instructor’s ability to modify labels easily.

### 3. Discussion

Both instructors indicated that they were pleased with the level and quality of participation. We are encouraged by the fact that both reported that ACT successfully helped them meet their instructional goals; in both cases, the instructors reported that students displayed better critical thinking skills than in past semesters.

We believe that successful use of asynchronous conferencing tools such as ACT depends on an interaction between the nature of the task assigned, how the features of the system are used, and the maturity and motivation of the users.

#### 3.1. The students’ task

The most influential characteristic of each class was the nature of the students’ task. The debate in the graduate education seminar was an ill-structured, open-ended problem.

The professor provided the graduate students almost nothing in terms of detailed instructions or requirements, although he did provide limited mentoring via e-mail. ACT performed the function of structuring the assignment and encouraging reflection-in-action through the use of labels.

Students in the upper-level Sociology class were given much more explicit modeling and feedback. The students were also expected to produce products: a document in ACT and graded peer-reviews. The instructor, who has used conferencing for several years, commented on the need for the task to have both a specific goal and a product: the activity has to have a high enough perceived value to the student to engage them in the task. The post-before-read feature of ACT was used to ensure diversity in the initial posts and prevent what the instructor referred to as "free writing" — writing without having done the reading.

Both of these tasks, while very different, worked in the asynchronous environment. Both contrast sharply with the more typically found task of "discussing the readings" where students do not substantively discuss issues, justify their positions or offer constructive criticism to their peers.

### 3.2. ACT's support of metacognition

As indicated in our introduction, ACT was designed to support metacognitive activities primarily through four characteristics: the appropriate use of structure, reflection-provoking labels, occasional summarization by students, and the use of the post-before-read feature to discourage "group-think". Summarization was not used by either the instructors or the students in these instances, so we can deduce little about its effectiveness. The other features, however, were used in quite different ways by the two instructors, both to good effect.

**The Hierarchical Structure in ACT.** Only the debate which took place in the Graduate Education Seminar made extensive use of the hierarchical structure created by ACT. Students in that course were able to compare ACT to other asynchronous conferencing systems, and many commented on the advantages inherent in the outline-form overview for focusing their efforts and highlighting the structure of the string of arguments. One remarked:

Although Alta Vista Forums also allows hierarchical conferences, it does not display an overview like in the ACT conferencing system, making it difficult for the reader to understand the string of argumentation.

The Sociology course took advantage of the outline structure in only a very limited way, using it to differentiate between an initial post and a response. The instructor was, however, able to use even this simple structure effectively to group student responses and ease the logistics of the grading procedure.

**Use of labels in ACT.** Labels in the Graduate Education Seminar were used exclusively to illuminate the structure of the emerging debate. The label set used was content-independent, reflecting an organizational strategy, and was designed to help students think about the structure of their argument. After using both ACT and another system without labels, several students commented on the utility of the labels. One remarked,

...now that I did not have the labels provided in ACT available, I came to fully appreciate their usefulness...they structure my own argument, but also they allow a quick overview of what has been said (claimed) and if and how the arguments were supported.

The labels also provided a reference point for the instructor. When he scanned the debate as it progressed, he could see where there was a lack of evidence and coach the students accordingly.

In contrast, the label sets used for initial posts in the Sociology course were content-specific. Instead of using labels designed to encourage thinking about the structure of the discourse, the instructor of the Sociology course chose labels that focused the students' attention on specific issues in the Sociology of the workplace and that gave the students specific criteria for critiquing each other's work.

Our focus has been on the use of labels to foster reflection-in-action. However, the ability to change the label set at any time opens a number of possibilities, including dynamic generation of labels and group exercises whose goal is to create a set of labels which capture the essence of the ideas under discussion.

**Post-before-read.** The instructor of the Sociology course saw positive effects due to the post-before-read option. He reported higher-quality initial posts and was happy to eliminate the possibility of "free writing".

## 4. Future research

This study has helped us to identify several areas for future research as we continue to pursue the design and development of ACT, particularly the integration of the exploratory and analysis spaces.

The use of textual labels offers a unique and powerful means to organize discussion, foster reflection and categorize content. We will continue to develop and test sets of labels, both content-independent and content-specific. More advanced use of the labels, such as evolving label sets over time and developing student exercises whose product is a set of labels, are pedagogical strategies which deserve further study.

It is apparent that having access to such a large volume of interaction data is a two-edged sword for faculty and researchers alike. Sampling strategies and criteria for analysis and assessment need to be developed and tested. We are only beginning to see research in content analysis of conference transcripts. Faculty support and workload is another enormous issue. We are currently conducting a series of faculty interviews with instructors who use asynchronous electronic communication in both on-campus and distance education contexts. We hope to use their experiences to develop instructional strategies, management techniques and efficient assessment procedures.

An ongoing concern is the necessity of matching tools and task. We need to better understand not only small group inquiry, but also the specific ways it can be supported by these tools if they are going to have a significant impact on critical thinking and opportunities for interaction.

Perhaps most importantly, we need to develop assessment strategies that address the unique characteristics of online asynchronous conferencing. Developing methods that are effective, give necessary feedback to students in a timely manner, and can be performed without totally overwhelming the instructor is crucial if asynchronous conferencing is going to become a viable instructional tool.

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