FACILITATING LEARNING THROUGH THE FEEDBACK OF CONCEPTUAL CLUSTERS IN FREE-FORMED STUDENT DATABASES

by

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A thesis submitted in conformity with the requirements for the degree of Doctor of Philosophy
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Facilitating learning through the feedback of conceptual clusters in free-formed student databases

Doctor of Philosophy, 1997
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Abstract

Computer conferencing provides student learning through group interaction under the guidance of a knowledgeable facilitator. But because of the sequential organization of entries, related information can become scattered across the database.

Current information linking and retrieval methods, including keywords, text string matching, or hypertextual links, presuppose that users are able to specify appropriate links. But users moving from relative novice to more expert states may not be able to identify appropriate links or anticipate the potential language diversity involved in conceptual definition. An alternative, complementary method is needed which anticipates language diversity and functions as a natural language query-response system.

Automated information retrieval methods based upon full text parsing are used with preexisting databases, but have not been adapted to developing databases, particularly those created by students in the process of learning. They have not been used as student controlled query-response systems.

This dissertation addresses the following questions:
1. Can an automated information retrieval system provide conceptual clustering in developing student-generated, free-formed databases?
2. Can an automated information retrieval system function successfully as a query-response system in developing databases?
3. Will an automatic information retrieval system, when learners use natural language to specify their knowledge needs, make a positive contribution to learning? and
4. Will students find this a useful and acceptable addition to their learning experience?

This dissertation documents the development and application of an algorithmic information retrieval system which involved controlling the vocabulary of student notes in computer conferencing, and used this vocabulary as the computational variables for principal component analysis. Initial investigations indicated that the procedure works as a conceptual clustering mechanism which focused around student-generated natural language queries. A fuller study, involving a small group of adult, community college students suggests that the procedure has a neutral or positive effect on learning and that students found the
query-response system to be a useful addition to their learning experience.

Further development of this procedure holds promise for education on the information highway since it can filter diverse types of information into conceptual clusters that can be accessed by student defined information needs.
Acknowledgements

This dissertation is dedicated to my father, Peter Gerald Hopperton, September 16, 1921 - November 17, 1993. You inspired me to believe in my dreams and taught me to work for their fulfillment.

I remember when I approached my supervisor, Dr. Phil Nagy with the idea for this dissertation. He not only took the time to read through my rough ideas and help me hone them into something workable, but he also warned me about the potential pit-falls which I could be facing. Over the five years that it took to conduct and present this research, he has been constantly encouraging and supportive, fulfilling the demanding role of mentor. Now, he is a friend.

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In particular, I want to thank Mr. Tony Tanner for his ongoing support. He authorized the full semester study that lies at the heart of this dissertation and which represented the first full credit subject offered through computer conferencing in the Ontario College system. Since that time, he and his wife, Heather, have continued to encourage me to develop on-line learning for the college population.

I would like to thank my family for their encouragement. My Canadian parents, Frances and Peter Hopperton, and Australian parents, Lyn and Jack Probert. They never fully understood what I was doing, but always believed that the efforts were worthwhile.

Finally, for my wife, Patricia Probert, who has believed in me since I first described my ideas on a brown paper-bag, helped me to focus and develop, shared every despair and triumph, and is now giving me the gift of our first child. I offer my love. Without you, this would have been impossible.
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Chapter 1.

INTRODUCTION

The use of computer conferencing as a teaching medium has recently been introduced to educational settings ranging from elementary schools to graduate and corporate levels. While the application of groupware systems has shown positive results in encouraging peer tutoring, collaboration, and greater communication among learning groups, there have been few significant technical advancements to the software that facilitate group learning, information location and retrieval, and the synthesis of developing ideas. Instead, developments have focused upon graphical user interfaces, linkages to external databases or Internet and intranet, and some automated note linking procedures.

Educational applications of computer conferencing that have shown positive results for both local and distance education situations are gaining wider acceptance and have been recommended by the Ontario Government in Excellence. Accessibility. Responsibility: Report of the Advisory Panel on Future Directions for Postsecondary Education (Dec., 1996). They are also being used for satellite-based distance education (Rawlings & Bacsich, 1995). The TeleLearning Research Network, a Canadian consortium of researchers and industry funded by a grant from the Federal government, states that one of their goals is to transfer new technologies that can support and sustain computer network-based learning (“TL-RN at a Glance”, 1996). The white paper on learning-centered education in Ontario Colleges prepared for the Council of Presidents (1995)
specifically recommends the use of computer conferencing for educational delivery. This acceptance, development, and availability will entail an ever increasing number of users.

In the 1994 Speech from the Throne, the Canadian Federal Government committed to develop a Canadian strategy for the information highway and, to that end, in September 1995, the Information Highway Advisory Council issued its final report. While that report addresses a number of issues including Canadian culture, job creation, and social impacts, education is one of its central foci.

The Information Highway Advisory Council (1995), quoting recent public opinion surveys which rank education at the top of the services that are wanted on the information highway, states that the information highway will become an integral part of lifelong learning for an information society, and that Canada will provide the widest possible learning opportunities and personal empowering tools in order to support the effectiveness of learning on the information highway. But the Council recognizes that there is a potential for information overload, and recommends the development of software management tools including information filters and pathfinders. This report sees extended potential for systems such as computer conferencing, ultimately seeing them integrally linked to any of the resources that can exist on the information highway.

On a narrower level, and from an institutional perspective, schools are seeking central communication management tools into which they can link other resources that exist on their local networks. These intranet resources include elements like large scale computer-aided instruction, library resources, and student services. On this smaller scale, the need for information management tools again becomes apparent.
Increased access to education, larger student enrollments, and the availability of extensive, internal and external data sources hold promise for education, but the risk of students becoming overwhelmed by the amount of information, or an inability to find appropriate information remains a problem. Computer conferencing systems, while able to provide the central educational function of communication, must be able to accommodate these information enhancements without aggravating the problem of information overload. They must provide conferencing management systems that can allow users to see the threads and development of conceptual contributions (Santoro, 1995). This must be one of the driving forces for the incorporation of new design features into the systems (Turoff, 1989).

From the technical standpoint, it is possible to develop information management systems, hypertext browsers, and hypermedia linking systems that are remarkably sophisticated. But the issue which developers often forget is the usability and effectiveness of these systems for learners. The most sophisticated system, if unused, adds nothing to education; the most used system, if it provides irrelevant information, is ineffective. This is the genesis of this thesis: will an information retrieval system which can filter a large and diverse database of free-formed information have an effect on student learning, and will students find the system to be a useful and successful enhancement to their learning experience.

The central proposal of this thesis is that the information which a statistically-based, automatic information retrieval (IR) system returns to students in response to free-formed queries will facilitate the learning of students studying through a computer conferencing system, and that the information clustering of a statistically-based IR system can facilitate idea synthesis. The methodology for considering this proposition is largely exploratory.
A secondary purpose of this study, in response to a request from the cooperating research site, was to consider the utility of computer conferencing as a learning tool in an Ontario College of Applied Arts and Technology. This issue is not specifically addressed in this document.

The procedures used in the data collection stage of this thesis are based on information retrieval (IR) methods operating on vocabulary controlled information bearing terms within student computer conferencing notes. This is used rather than alternative search and clustering techniques such as key words, text string searching, or message-reply linkages in order to indicate the evolving conceptual hubs within student-generated databases and to respond to natural language, student formulated queries. It will be argued that providing this type of conceptual clustering, augmented through a query-response interface as part of a toolbox for learning is associated with deeper levels of critical and analytical thinking by students, as demonstrated through the course notes which they enter into the conferencing system.

Chapter 2 provides an overview of computer mediated conferencing systems - and primarily asynchronous, or time and place independent, computer conferencing - in education. It considers the advantages of this medium as an educational tool and the impact which it can have in education. It also explores the limitations of the medium, particularly those associated with the amount of information which a conference may contain, its lack of organizing features, and the need for an information retrieval system.

Chapter 3 provides an overview of the field of information retrieval and draws the potential of statistically-based, information retrieval into the field of education. While these methods have been
used with considerable success in preset databases, they have not been bridged into developing educational databases in general, or computer conferencing in particular.

Chapter 4 discusses a series of developmental investigations into the creation and use of a statistically-based, automatic IR method as an information clustering and query-response technique in educational databases. After an initial exploration into the use of the controlled natural language used by students as information clustering variables, the next two studies demonstrated that these methods could cluster the contents of a text-based educational database around conceptual hubs, and that a hub could be identified as centered around a student query. The fourth study used these methods as a query-response system in a developing computer conferencing educational database.

Chapter 5 provides an overview of the course used for a more extended study of the application of an automated information retrieval system. For this exploration, the course was a senior level, optional literature subject taught at an Ontario community college through computer conferencing. This chapter outlines the literary theories that students were expected to use, and places automated information retrieval within the context of deconstructionism, an approach to literature introduced by Jacques Derrida in 1966. It also presents the methodology used in the exploration to evaluate the effect of automated information retrieval on student learning, and the qualitative material gathered on each subject.

Group results, documenting a positive effect on learning which can be associated with the introduction and use of an automated IR system are presented in Chapter 6. This is followed with case study discussions which document the acceptability of the system.
Chapter 7 discusses the implications of these explorations and identifies areas for additional research and applications of automated information retrieval in education.
Chapter 2.

COMPUTER CONFERENCING

A computer-based conferencing system is a powerful communication tool that allows users to meet, break into small groups, complete work assignments and discuss readings or other issues in electronic space within a central computer system. Berge (1994) describes it simply as a form of delayed-time, text-based messaging system. But it also provides facilities for structuring group processes and organizing the results of those processes. It provides opportunities for education outside of the walls of the institution, thereby providing the opportunity for increased enrollments for institutions, and flexible life-long learning for the population.

The relatively short history of educational computer conferencing shows that it is accepted as a valid learning environment, either as an alternative or supplement to traditional classrooms. The growth in its use shows that we can expect widespread application of the medium in education. Being a networked environment, it is now supporting communication between classes, schools and other institutions (Scardamalia and Bereiter, 1989).

2.1. Description of computer conferencing

A computer conferencing system is a database that provides some degree of organization to text messages, and an interface through which participants gain both input and output access to the communal database (Wolfe, 1990). It provides and environment which allows multiple individuals at multiple locations and disparate times to communicate, exchanging information and learning
through the keyboard (Cross, 1983: Berge, 1996). As a mainly text-based medium, it is designed to facilitate electronic group-oriented communication by automatically filing notes into topical discussions and notifying users about any new notes (Hargreaves & Harasim, 1986) and providing for the retrieval of previous notes (Santoro, 1995).

The technology required for an educational computer conferencing system is neither extensive nor expensive. At minimum, conferencing requires a single host machine which provides the functions of software for database compilation and storage, and one or more networked terminals which can access the host. In the case of the site for the large study discussed in Chapters five and six, the host was a remote VAX\(^1\) 11/780 Internet node to which subjects connected through college terminals and Internet, or by dial-in to the college and the Internet connection. The college computer provided all administrative and most teaching functions within the college, and the remote host for the conferencing system provided academic computing for a graduate faculty at a university.

Conferencing allows participants to input free-formed information as notes that are generally focused around a specific topic within hierarchically related conferences. Hence, to facilitate a logical grouping of items within conferences, a general topic can contain levels, or sub-topics, branching from the central root. The system records and posts input to participants sequentially and archives all entries, as computer storage space permits, so that they are available for reexamination according to the search procedures embedded in the software. Searching is generally conducted through the use of text string matching with boolean operators, condition matching such

\(^1\) Digital Equipment Corporation, Maynard, Massachusetts.
as date ranges, author or conference name, or through assigned hypertextual links. Students have access to the progression of the whole course rather than simply the readings, their private lecture notes, and whatever they may recall from immediate class discussions. Further, the sequential notification to users of new postings provides a linear rather than random organizing structure for conferences while still allowing for non-linear searching according to predefined parameters.

2.2. Asynchronous educational computer conferencing

While the traditional, face-to-face classroom relies upon the spoken word, fixed time-tables and geographical location, computer conferencing is largely based upon the written word. Since it can be distributed and asynchronous (place and time independent), it supports those learners who are unable to attend classes at specific geographical locations or at specific times, while encouraging social support and academic linkages between students and instructors (Hartley, Dickinson, Noakes, & Tagg, 1994). Students can structure their learning around their own weekly or daily schedules rather than those imposed out of necessity by institutions, instructors or personal commitments (Ellsworth, 1995; Hartman, Neuwirth, Kiesler, Sproull, Cochran, Palmquist, & Zubrow, 1995). This is of particular significance with adult education, continuing education, distance education, and life-long learning.

Asynchronous educational computer conferencing consists of the network of texts which are contributed and read by the participants in a given course (Wolfe, 1990). Students and instructors work through computers and communicate through the keyboard at their convenience, accessing the host machine for direct communication either through networked computers or through home computers with modems in order to participate in on-line learning activities in real contexts (Hartman et. al., 1995)
Computer conferencing encourages responsibility and active learning through the expectation of regular participation in on-line discussions (Collins & Berge, 1995). Students cannot sit back passively while a lecturer dictates to empty vessels (Barrett, 1995); instead, they must become actively engaged in a dialectic and scientific process of knowledge creation and expansion through interaction with peers. Further, although asynchronous, computer conferencing preserves the advantages of spontaneous interaction because students may respond to every entry if they so choose (Paulsen, 1995a, 1995b). Since students are not constrained by classroom schedules, they should have sufficient time to consider each message that they receive and to compose appropriate responses, which means that every learner has equal opportunity to participate in discussions. Participants can respond to any aspect of the conference and, while some systems with hypertextual capabilities will directly link responses to the notes which prompted them, in most systems, all new notes are added to the end of the sequence.

2.3. Advantages of educational computer conferencing

While text-based communication means the loss of visual cues, it trades these for specific advantages. These include the development of a retrievable, verbatim transcript of an entire course, and the potential for a greater level of cognitive interaction and intra-action. Written language, in the context of educational computer conferencing, is interactive, anticipating or reacting to the ideas or queries of other participants (Hunt, 1995; Barrett, 1995). The process of writing allows students the opportunity to see what and how they think, to share this, and to rethink it over time in an authentic, problem-solving activity (Berge & Collins, 1995; Hartman et. al, 1995).
2.3.1. Education as groupwork

Education is a form of communication for social and decision making reasons, and hence it is more than a process of filling empty heads with facts from a dispensing teacher who completely controls the process of learning (Ragsdale, 1988; Kay, 1995). Education can be considered as a social, dialectic process, actively involving students, teachers, and information in the construction of meaning (Jonassen, Davidson, Collins, Campbell, & Haag, 1995) in coherent, meaningful, and purposeful activities (Brown, Collins, & Duguid, 1989). Because of the potential diversity of attitudes and approaches to a subject, not only can teachers and other resources be considered as a source of useful educational information, but so also can students with their diverse approaches. Just as the diversity of attitudes and opinions on a jury can foster discussion leading to consensus through interaction, so too can the divergent perspectives of individual students lead to the furthering of educational goals. These can be brought together through discussion which is supported and augmented through consultation with collaborating teachers and peers. This describes a form of education which centres around interactive group work. If interactive group work is identified as a desirable goal within education, then any system or procedure which facilitates this deserves consideration. Since computer conferencing is premised upon group collaboration (Harasim, 1990), it lends itself to any educational situation which is similarly based upon group discussion and collaboration in the creation of knowledge and meaning (Collins & Berge, 1995).

2.3.2. Collaboration and interaction

Vygotsky defined learning as the acquisition of special abilities for thinking about a variety of things. In essence, learning is development or the process of achieving cognitive maturation (Vygotsky as quoted in Wertsch, 1985) which occurs through an interpsychological function, or
through interaction and discussion. This, then, suggests that social interaction as opposed to solo performance is a vehicle for education (Bruner, 1985). Further, the act of discussion discourages pre-emptive closure and conceptual rigidity, since conceptual crystallization cannot occur while interaction continues (Norris, 1991).

Following from Vygotskian educational psychology, modern pedagogical theory suggests that the social interaction of students through collaboration and peer tutoring adds significantly to peer education (Forman & Cazden, 1985; Scardamalia, Bereiter, McLean, Swallow, & Woodruff, 1989; Sneddon, Hopperton, & Fried, 1996). The students can produce something more than an individual could do independently. Through peer tutoring, individuals are forced to verbalize their thoughts to each other and therefore must strive to make their statements clear, more organized, and informative. This concrete verbalization forces the continual clarification of vague thinking into new mental constructs which can be fully internalized by both tutor and tutee.

Through open access to conceptual development and the expectation of participation, both required and perceived, computer conferencing encourages peer interaction in the learning process and this interaction augments the process of logical reasoning through an active and continual reorganization of information induced by cognitive conflicts. It forces students to recognize and reconcile conflicting opinion, thereby encouraging their integration of a variety of perspectives presented in a discussion (Forman & Cazden, 1985). This reorganization means that students are actively involved in their own process of knowledge building.

Through collaboration in a mutual task, peers are able to produce a result which no individual could accomplish alone. Since computer conferencing can facilitate collaborative interaction in the
educational environment (Yeoman, 1995), it assists in the group creation of an original, synergistic and synergetic process in which the identification and solving of identified problems depends on the creative thinking and informal, written discussion among a group of individuals with diverse experience and expertise (Beckwith, 1987) in an authentic environment (Hunt, 1995). Further, because of its asynchronicity and geographical distribution, it alleviates problems associated with this kind of problem solving such as assembling all individuals with the necessary expertise for sufficient time, tapping that expertise at an appropriate time, structuring the interchange so that ideas can build towards a solution, and largely eliminating dominant voices within a discussion. Computer conferencing stimulates and supports multiple viewpoints, so multiple authors can contribute without specific attention to the order of entries (Feenberg, 1986). The synthesis of this, if properly managed and supported, can produce a unique form of collaborative writing which facilitates cognitive development (Fowler & Wheeler, 1995).

Computer conferencing significantly changes the nature of interaction, de-emphasizing teacher input and accentuating interaction and collaboration between peers (Jonassen et al., 1995). Berge (1996) suggests that in general, instructors should contribute approximately one-quarter to one-half of notes in on-line courses. Harasim (1987) has shown that in the traditional classroom environment, speech by the instructor uses about 80% of the available time. But in two computer conferencing based graduate courses which were monitored, the instructor input represented 10% and 12% of the posted notes respectively. In these classes, students reported an awareness of pressure to communicate with their peers.
2.4. Student motivation and activity requirements

Since computer conferencing can lead to a more satisfying learning experience by shifting
delivery from a lecture mode to one of increased participation, it can lead to increased student
motivation and interest. But, because computer conferencing is premised upon active participation,
it does make demands upon students other than those to which they are accustomed in traditional
face-to-face classes. In face-to-face classes, students are prepared to be more docile and passive
(Fedderson, 1993). While the technology may present an initial, intrinsic attraction, the medium
alone cannot provide sufficient motivation for participation. Individual, extrinsic motivation and a
regular participation schedule are key elements in student success in computer conferencing
courses (Kaye, 1987). While assignments can require regular participation, the absence of strict
schedules in a computer conferencing class requires fully motivated individuals who are taking
direct responsibility for their own education. This, it could be argued, describes adult learners who
have freely chosen to pursue education for their own, personally motivated reasons. Further,
because of maturity levels, these are students who are more likely to spend increased time on task,
and who will be able to evaluate different viewpoints.

2.5. Problems with educational computer conferencing

As the activity of learning is considered, particularly as it applies to the emerging potential of
computer conferencing, researchers must recognize limitations of the existing systems and work
towards viable and useful enhancements. In connection with, but not restricted to, the immediate
application of conferencing, they must consider needs of learners and both teach to and help in the
development of these in order to actualize enhancements.
2.5.1. Supporting educational processes

Harasim (1990) argues that in order to facilitate sense-making and knowledge building within an educational computer conferencing environment, the system needs to support three essential educational processes:

- the divergent process of idea generating through such tasks as brainstorming, exploration, analogy and idea sharing;
- the convergent process of idea linking which involves reflection and synthesis; and
- idea structuring which entails organizing ideas into some structure, either hierarchical, sequential or both, which enables the ideas to be applied in problem-solving or decision making.

Current systems support idea generation and provide some mechanisms for idea linking, although much of this is left to the learner, but provide few supports for structuring information or assisting in information synthesis and analysis. One key to a successful computer conferenced class is not the physical connection but the way that information is extracted from sources. But Neilson (1990) suggests that novices often do not know what should be read, or the order in which it should be considered, and hence there is a need for a system that can point students in appropriate directions.

Kay (1995) argues that most learning in the future will be concerned with complexity, and educational computer systems should not necessarily make everything easy. Students should be challenged to delve deeper into interesting areas which they identify through their own questioning. Students should be challenged to consider differing perspectives, seeking answers in many places, and to engage in a lively exchange of views with others in order to test their understanding.
2.5.2. Information overload and scattered information

Modern pedagogical expertise that emphasizes group work, collaboration and the progressive elaboration of understanding, shifts the focus of education from information delivery to actively working to advance understanding (Scardamalia and Bereiter, 1989). Computer conferencing upholds this concept of education, but both asynchronous group and individual knowledge development and support difficulties, especially with large groups, represent a significant problem in comparison with working with small, face-to-face groups. Because computer conferencing emphasizes an asynchronous, many-to-many dialectic, Turoff (1989) argues that a computer conferencing system must be able to provide aids for the organizing of material over long periods of time. These organizing aids must be flexible over time since the addition of new information can affect current conceptual clusters or dramatically realign the overall clustering structure.

Major issues which computer conferencing systems do not currently address well are the problem of information overload and of concept threading or weaving of appropriate notes (Davie, 1989; Brack & Trevitt, 1995). These facilities are essential not only for students in the process of learning, but also for the instructors who must synthesize discussions. With many individuals actively contributing notes and comments sequentially to a central system, the sheer number of entries which learners must read and consider can become inordinately high for conceptual management (Berge, 1994). As increasing numbers of learners and students become involved in computer conferencing, everyone may become a victim of information overload (Harasim, Hiltz, Teles, & Turoff, 1995). Users can become inundated with useless information, but this problem can be addressed through the use of information filters and agents that weed out irrelevant information and select, order, link and rank information which users may need (Horton, 1994; Brack & Trevitt, 1995; Baker & Buller, 1995). But given the levels of participation which
computer conferencing entails, the large collection of potential resources is under a constant process of change and it can be difficult to maintain updated information (Harasim, Hiltz, Teles, & Turoff, 1995).

Computer conferencing displays notes in the order in which they were posted to a given conference, rather than by conceptual continuance. While this encourages local consideration of comments, it does not provide a conceptual order which students may follow and as a result, students may complain about too much jumping around in the discussion (Harasim, 1987). Search mechanisms, including key-word assignment, text matching, or limited hypertext links, allow for some restructuring of the database according to defined search parameters, but these can impose an artificial structure upon query formulation or student goals forcing students to become distracted from their goal of seeking information according to self-identified information needs, and to focus instead on the operations of the software. Clearly, there is a need for a system which will facilitate concept threading without imposing artificial constraints upon learners (Letsche & Barry, in press). This ability to shape information around the needs of learners in networked environments will facilitate the opening of learning opportunities (December, 1995).

Because of the sequential structure of computer conferencing, clusters of related input which varies from or builds upon the attributes of an original thought can become scattered throughout a conference (Ellis & McCreary, 1985). Further, because of the diversity of possible vocabulary, terminology for related clusters may not even coincide, making text-string searching unreliable. In order for students to develop useful and effective conceptual clusters, it may be desirable in computer conferencing for items to be read more than once, reconsidered, and given successive interpretations. But almost without fail, a message, once followed by five or six others, is forgotten
(Beckwith, 1987). Berge (1994) argues that information management places cognitive stress on users whose ability for information processing at the deep level is reduced when they are forced to deal with fragmentation. Schank and Farrell (1988) state that reminding is an important part of the learning process and this suggests that in order to enhance the effectiveness of computer conferencing as a learning tool, the system should provide greater encouragement and support for message ordering, reconsideration, and clustering around knowledge hubs.

2.5.3. Clustering: The need for information filters

Current system development is linking computer conferencing to external resources. This extension in both the number of potential users and the data capacity of computer conferencing suggests that systems will need modification in order to respond to increased demand. Currently, search procedures in computer conferencing systems are largely dependent upon what the information retriever thinks or guesses is significant within the knowledge base, or upon what the information provider deems to be significant. As the number of users in a given conference increases, and the amount of available collaborative information balloons, we can expect the complexity and variability of the content of knowledge clusters to increase in size and degree of relevance; hence, these knowledge resources, demanding personal effort in the definition of an inquiry, can be taxed beyond their capability (Lettsche and Barry, in press). Further, while current applications of computer conferencing systems make it possible to print or browse through the limited number of notes in order to find items of interest, vastly increasing the amount of information in a conference would limit the feasibility of this browsing ability.

Scardamalia and Bereiter (1989) address this issue by discussing the need for information filters in electronic information systems, especially as these systems achieve acceptability and their
content grows. Filtering systems that can help to maximize the potential of resources will facilitate the identification of clusters of related entries. These clusters of information, identified by vocabulary searches over the full text, can be fed back to the users for evaluation and assimilation into their cognitive structures. Notably, the idea of semantic clustering does not limit searching to pre-specified vocabulary but allows variability and flexibility to the semiotic indicators based upon their relationship to other indicators. For example, the text string, "ginger", takes on a modified meaning when it is placed in a relationship with the word, "hair". This influence of proximity can allow for the non-exclusive shades of meaning which the diversity of language entails.

With current computer conferencing systems, there is limited direct linking between notes, and few procedures for identifying and clustering unanticipated linkages. With the exception of specific references, such as keywords, being applied to a specific entry, or other predefined, embedded parameters such as text string matching, notes are simply sequentially organized under hierarchical topics, and any further clustering is done on an ad hoc basis with qualitative feedback to users largely non-existent. In full text searches, users are forced to guess at synonyms for information bearing terms; this is a form of direct, user-defined, vocabulary, but the feedback is only partially filtered. Users must still make personal, and possibly uniformed judgements about the applicability of what is retrieved.

2.5.4. Student questioning

In the traditional classroom, student questioning is controlled by the teacher. While the student may pose a query in search of information, this query is subject to the interpretation of the teacher who answers the interpretation, not necessarily the statement of it. While this may not be problematic in traditional classrooms, it does not necessarily hold true in an electronic,
collaborative learning system in which multiple responses from different sources may address the query to a greater or lesser extent.

Scardamalia and Bereiter (1989) have argued that one problem with electronic learning systems is that they can become clogged with unfiltered entries. Further, in connection with the use of questioning in education they have suggested that if student questions are to function successfully, there is a need for a process that will allow the wisest judgements to come forward (Scardamalia & Bereiter, 1991).

Questioning can serve a higher-level educational purpose than simply indicating the pursuit of factual information (Collins & Stevens, 1982) since it is an intentional, goal-oriented behavior that can strengthen the connection between elements of information and stimulate higher-order thinking (Jonassen et al., 1995). Questioning ranges from the search for basic information and the uneducated guess requiring a yes or no response, to higher order text or knowledge-based questioning which can lead to significant advances in knowledge (Scardamalia & Bereiter, 1991). Through questioning, as through other forms of verbalization between learners, students must be active agents in their knowledge building, striving for clarity and precision as they formalize their knowledge scaffolding.

Text-based questions are prompted by the text under consideration and are usually about the text. These can range from the critical and analytical to simple grammatical transformations of text. These are generally produced as part of a work unit and are based upon previous exposure to material. Knowledge-based questions arise out of interest or wonderment and represent an attempt to make sense of the world. They show a gap or discrepancy in knowledge and the desire to extend
the individual's knowledge base. They generally seek explanation rather than facts and hence require more complex searching since the solution is not limited to the information which is known or available as course resources (Scardamalia & Bereiter, 1991).

In this case, the knowledge-based question can be considered as the centre of a self-defined knowledge need. The possible responses, which can potentially range from factual restatement to the presentation or re-presentation of related ideas drawn from a wide variety of sources, address this knowledge gap. In computer conferencing, in which many possible responses may address the query to a greater or lesser extent, the questioner must make the final evaluation of the responses, incorporating what they deem as important into their cognitive structure.

But, if learners are in the process of moving from relative novice to relative expert states, then they need direction on how to evaluate the validity of responses to their knowledge-based questions. This suggests that an information filtering system must allow for the identification of conceptual clusters and show how messages which support threads can be distinguished from those which do not (Berthold, Sudweeks, Newton, & Coyne, 1997), but must also provide direction for the interpretation of the elements contained within that cluster.

2.6. Towards statistically-based conceptual clustering

By enhancing note linkages through related vocabulary co-occurrence across all notes in computer supported collaborative learning environments, experiments have shown that ranked, semantic clustering of the free-formed notes is possible (Hopperton & Probert, 1992; Probert, 1994). When coupled with a simple, natural language query-response system, developmental investigations, presented in Chapter 4, have demonstrated that participants can be provided with
subsets of the database notes which are closely associated with the concepts contained within the original query. These subsets can be used to direct further searching of a conference and encourage students to reexamine their own thinking and postpone conceptual closure in the light of either developing group consensus or divergence.

The idea of applying statistical methods to the study of computer conferencing conferences is supported by Turoff (1989) who suggests the application of scaling methods, such as multidimensional scaling, and structural modeling methods to aid in dealing with large scale, complex problems can aid the organization of information. Beckwith (1987) further suggests extending the search potential of computer conferencing systems by applying an evolving system of classification which uses keywords to facilitate access to information of potential interest. But rather than focusing on user defined key-words, the procedure applied in the exploratory data collection stages of this series of investigations, and discussed in Chapter 3, used the domain specific vocabulary as actually used in notes as the operational linking feature.

2.7. Conclusions

Computer conferencing provides a tool which can enhance some aspects of education. But while facilitating group communication, collaboration, and peer interaction, it has limitations. There is an identified need for a system which would allow each participant to see how ideas relate to each other (Beckwith, 1987) while allowing them control over their access to content (Poncelet & Proctor, 1993) and which would facilitate student searches for conceptual information. Allowing increased access to the learning situation, increasing the numbers of responses or availability of external resources, and the possibility of duplication can easily create threading and information
overload problems. These signal a need for information filters which can assist in the developing process of structuring information and ideas without imposing rigid constraints upon the learner.
Chapter 3.

AUTOMATED INFORMATION RETRIEVAL

3.1. Introduction

The field of automated information retrieval (IR) is not new. In 1851, Joseph Henry, then Secretary of the Smithsonian Institute, stated,

One of the most important means of facilitating the use of libraries...is well digested indexes of subjects, not merely referring to volumes or books, but to memoirs, papers and parts of scientific transactions and systematic works.... Everyone who is desirous of enlarging the bounds of human knowledge should, in justice to himself, as well as to the public, be acquainted with what has previously been done in the same line, and this he will only be enabled to accomplish by the use of indexes of the kind above mentioned. (Cited in Kent, 1966, p4)

The pioneering work in information retrieval systems took place following World War II and grew out of the fields of psychology, philosophy, computer science and engineering, linguistics and mathematics with the main focus being psycholinguistics and natural science (Jones, 1964). By 1964, when the United States Department of Commerce, National Bureau of Standards sponsored a symposium focusing upon methods for mechanized documentation retrieval involving statistical association and other automated methods, the field was fully defined. Since that time, it has fallen largely under the purview of library science, computer science and, to a lesser extent, electrical and computer engineering.
3.2. Information retrieval in computer-based educational systems

Information retrieval systems and procedures have the potential to play a significant role in the development and application of computer-based education systems. In a computer-based system for facilitating learning, the goal of the user is to further understanding and obtain information for critical and analytical thinking, and problem solving purposes, and the goal of the system ought to be to understand and respond appropriately to the demands of the user (Frisse, 1988). A learning system should allow students to browse in order to see what has already developed conceptually, and units of information should be retrieved according to interest and applicability. The system should provide students with direction towards existing and evolving knowledge clusters (Brack & Trevitt, 1995). If, as with computer conferencing, we define the goal of users as collaborative exploration of a field of knowledge, then a learning system should provide them with guidance in that exploration by not only allowing the freedom for individual knowledge growth but also by directing them towards clustering collaborative knowledge. Information retrieval techniques can assist in actualizing these goals.

According to modern pedagogical theory, in which the learner actively works to advance understanding (Scardamalia et al. 1989), a learner using an information retrieval technique in a learning system would pose queries in order to satisfy an information or knowledge need. The requirement of the system, then, is to easily satisfy that need by providing as much relevant information as the user deems necessary in order to answer self-generated questions (Poncelet & Proctor, 1993), and a level of direction on how to interpret the retrieved information.

IR procedures can also be considered as cognitive tools. Jonassen et al. (1995) suggest that cognitive tools are both mental and computational devices that support, guide, and extend the
thinking processes of learners. Effective and generic IR tools can be domain independent procedures (Turoff, 1995) that provide students with the ability to organize, reconsider, and interpret knowledge. Semantic structures within databases can be augmented with control techniques that can be translated to mathematical analysis which in turn can be used to refine the resulting knowledge base. Turoff (1995) suggests that this process should be used as a design process for educational computer-based systems.

3.3. Information retrieval strategies and their limitations

Any information system, including those that are computer-based, consists of a database and a set of heuristics for accessing and manipulating the data (Marchionini, 1988; Anderson, 1988). Because computer functions are based upon binary operations and hence are incapable of understanding meaning within a natural language context, Anderson (1988) suggests that an information retrieval system cannot know (in human memory terms) which information items would satisfy the query, and so it must assign probabilities or, in simpler terms, rankings to the various possible files to be returned. In an effective IR system, these rankings can function as indicators of the relative importance of items of information.

Current information retrieval systems are based upon four different kinds of search and retrieval strategies. Conventional systems rely upon boolean operators and text-string matching (Salton 1989). More sophisticated systems use boolean operators extended through thesauri, hypermedia, or probabilistic, associational techniques.
In many IR systems, such as ERIC\(^2\), articles or abstracts are read by researchers, who then assign keywords. In indexing a book, an author or indexer assigns terms to topics. This produces a form of controlled vocabulary focusing on aboutness (Weinberg, 1987) associated with text. Searches are conducted on these assigned keywords using direct term matching, near matches, and the boolean operators, AND, OR, and NOT. The problem is that manual indexing can be unreliable and there is no guarantee that the vocabulary used by indexers will match that used by researchers (Furnas et al, 1988; Frisse, 1988). Experiments have shown that the incidence of co-occurrence of vocabulary between users seeking identical information is less than 0.20 (Furnas et al, 1988). Probert (1994) found that even with a committee assigning keywords from their group-defined list, not all entries were assigned coincidental keywords based on content or knowledge structures. Further, as the number of terms in a query increases, the practicality of the search suffers. or. in the case of using the OR operator, the number of documents that use at least one term greatly increases, thereby increasing the chances of retrieving irrelevant documents (Stanfill & Khale, 1985; Salton & Buckley, 1988).

Full text, or text-string searching eliminates keywords by using the actual vocabulary contained in the entries as the search variables, and seeks direct matching between the query vocabulary and the entry vocabulary. In the case of an electronic encyclopedia, for example, the index for the search is the whole of the content (Lando, 1987; Marchionini, 1988). But, again, since this is based on searching for an arbitrary combination of words, the technique can lead to either poor recall or the recall of irrelevant information.

\(^2\) DIALOG Information Services. Palo Alto, California.
A fundamental property of language, that people use a large number of words to refer to the same thing, means that no single access word will cover more than a small proportion of user search attempts (Berry, Dumais, & Letsche, 1995). Consider the earlier example of "ginger hair", in which meaning exists in the overlap of the terms, and compare it to "red hair". A text-string search on either "ginger" or "red" will eliminate the other possibility, while a search for "hair" will also retrieve "brown" and "blond". This limits the success of various designs for vocabulary driven human-system interaction since they depend on users typing in the correct text string (Furnas et al, 1988). Users are forced to guess at the correct text string and connectives that should be used. Generally, the trade-off between precision, that is the proportion of retrieved documents that are relevant, and recall, the proportion of relevant documents in the entire database that are retrieved (Salton, 1989) limits the utility of boolean and text-string searching (Stanfill & Khale, 1985).

The identification and retrieval of records depends on the degree of coincidence between the document and the query formulation (Salton & Buckley, 1988). Further, problems of language synonymy (different words with the same or similar meaning) and polysemy (words with multiple meanings but the same spelling) are not addressed by full text searches.

In hypermedia, information units, or nodes, are linked in a non-linear fashion by authors and/or readers. But this simple node and link model is not sufficiently rich to support all information representation, management and presentation tasks required by many applications (Halasz, 1988). The process of converting text to fragments and developing the appropriate links could be simple if all information needs could be anticipated, but information needs can have an infinite variety of criteria and the explicit links embedded by a domain expert may not match the actual needs of the users. This tangle of problems involved in the defining of all links explicitly, especially in large
corpora of texts, many or all of which have not yet been created as in a computer conferencing system. Raises a question about the utility of hypertext (Raymond & Tompa, 1988). Although some systems such as HyperCard® or Intermedia (Landow, 1989) will allow individuals to define their own links, the individual must first locate and remember the appropriate nodes to link together. Further, the linking mechanisms are not designed to anticipate all potential links to a new entry, or the impact of a new information item on the rankings of other entries.

3.3.1. Evaluating information retrieval systems

Salton (1989) proposed that the effectiveness of an IR system could be measured through an evaluation of the relevance of the documents retrieved and precision of the recall of the documents that would be appropriate. Four measures, recall, precision, fallout, and generality are established through an examination of the notes returned or not returned for a query. The most common measures are recall and precision since these provide an indication of the suitability of documents returned. Tables 3.1 and 3.2 illustrate the basis for these measures.

<table>
<thead>
<tr>
<th>Retrieval</th>
<th>Database contents</th>
<th>Number of relevant notes in the database</th>
<th>Number of irrelevant notes in the database</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Notes retrieved by the search</td>
<td></td>
<td>a</td>
<td>b</td>
<td>a + b</td>
</tr>
<tr>
<td>Number of notes not retrieved</td>
<td></td>
<td>c</td>
<td>d</td>
<td>c + d</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>a + c</td>
<td>b + d</td>
<td>a + b + c + d</td>
</tr>
</tbody>
</table>

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3 Apple Computer Inc.
Table 3.2. The evaluation measures of an IR system.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Evaluation measure</th>
<th>Formula</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>Recall</td>
<td>( \frac{a}{a + c} )</td>
<td>Proportion of relevant documents that are actually retrieved</td>
</tr>
<tr>
<td>P</td>
<td>Precision</td>
<td>( \frac{a}{a + b} )</td>
<td>Proportion of the retrieved documents that are relevant</td>
</tr>
<tr>
<td>F</td>
<td>Fallout</td>
<td>( \frac{b}{b + d} )</td>
<td>Proportion of non-relevant documents retrieved</td>
</tr>
<tr>
<td>G</td>
<td>Generality</td>
<td>( \frac{a + c}{a + b + c + d} )</td>
<td>Proportion of relevant documents per query</td>
</tr>
</tbody>
</table>

3.4. Probabilistic information retrieval

Systems such as Adaptive Information Retrieval (AIR) (Belew, 1989) or System for the Management of Automated Retrieval of Text (SMART) (Salton, 1964), and models such as the spreading activation method (SAM) (Salton & Buckley, 1988) and singular value decomposition for latent semantic analysis (SVD) (Dumais, Furnas, Landauer, Deerwester, & Harshman, 1988; Furnas et al., 1988), are based upon probabilistic models of relevance. The content of documents is captured purely in the statistics of occurrence of individual words within documents and the statistical dependencies between the use of the words (Croft, 1986). The premise behind these systems and models is that statistical analysis moves away from the intuitive reality of ideas to a study of external, observable manifestations through an examination of patterns of terms and synonyms rather than the extant existence of specific terms (Jones, 1964).
Since the potential language that a user may incorporate in the definition of a concept is extensive and dynamic, any verbalized query is not usually more than an approximation of the information that a user desires. The subset of documents which can answer a query can be very large and differentiated according to their degree of relevance (Switzer, 1964). Document relatedness and association can be defined as follows: if a person is searching for A, will they find something useful in B? If the answer is yes, then B can be associated with A since B is related to A (Lancaster, 1986). For example, if a person is searching for information on ships, will information on boats be useful? If the answer is yes, then information on boats should be associated with information on ships. If a person is looking for information on large ships on the ocean and they are returned information on big boats on the sea, then the likelihood of usefulness is greater even though vocabulary does not directly coincide. If the formal aspects of text can be used to predict meaning and content (Blair & Maron, 1985), then closely related documents should contain semantic similarity which, once associated through term manipulation and other vocabulary control procedures, should represent a neighborhood of related texts (Furnas et al., 1988).

These models have led to the use of associations and dependencies between single terms as document components. They support an argument for the advantage of indirect term associations over text string to document associations and move from a query based upon term matching to full, associated document feedback (Belew, 1989). Search and retrieval in these systems is based upon the probability estimation of the relevance of documents which in turn is based upon the occurrence of individual, associated content identifiers. A complete probabilistic model will account for all dependencies between all subsets of the terms (Salton, 1983).
While experiments using probabilistic models of information retrieval have been based upon a variety of statistical methods, the literature supports the use of term frequency data and factor analytical techniques (Belew, 1989; Dumais et al, 1988; Furnas et al, 1988; Kwok, 1989; Letsche and Barry, in press; Probert, 1994; Switzer, 1964; Wong & Raghaven, 1984; Yu & Lee, 1986) in order to compute linear document associations based upon the assumption that the diversity of information bearing terms within documents forms a relationship.

Much insight into probabilistic models can be gained by considering them in the framework of vector spaces (Wong & Raghaven, 1984; Letsche & Barry, in press). A vector in information retrieval is simply a tuple or one dimensional array, or, in other words, a data structure. If we consider a document as a vector in $N$ dimensional space in which each dimension corresponds to semantic content, the vector of the term, or the essence of the document meaning, can be decomposed into projections onto the dimensions of the space. Another document can be similarly decomposed, and the loadings in common, determined through scaling or other factor analytical techniques which reduce the dimensionality, can be interpreted as a measure of meaning overlap and therefore potential relevance. This is an improvement over a system which is based upon the direct matching of terms alone since it begins to consider the statistical relationship between defined variables.

Table 3.3, an oversimplified term by document matrix, illustrates how the patterns of terms throughout a database can form a hierarchical relationship of entries. Across the top, numbered T1 to T7, are all terms contained in the database. Documents are numbered D1 through D6. The query represents the terms of the actual question posed by a user. Within the matrix, the existence
of a term in a document is signified by a 1, and the absence of the term is signified by 0. The final column shows the number of vocabulary matches between the query and the documents.

Table 3.3. A simplified term by document matrix in which 1 indicates the presence of a term and 0 represents the absence of the term.

<table>
<thead>
<tr>
<th>Document</th>
<th>Term T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>T7</th>
<th>Matches to query</th>
</tr>
</thead>
<tbody>
<tr>
<td>Query</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>---</td>
</tr>
<tr>
<td>D1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>D2</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>D3</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>D4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>D5</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>D6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Although D6 contains no direct matches with the query, it does share common terminology with D2, D3, and D5, each of which does share terms with the query. Hence D6 could still be associated with the query, albeit more weakly than other documents.

Factor analytical techniques can decompose a large matrix of term-to-document associational data to a set of orthogonal factors, or linear combinations, which capture the major associational structure of the matrix while discarding the most noise (Dumais et al., 1988; Probert, 1994). The relation of term objects is determined by the overall pattern of term usage in all documents so that individual document objects can be classified together regardless of the precise words that they contain. Although documents may not contain exactly the same terms, they can still end up closely related, consistent with a major pattern of association. If there are no obvious connections between
documents, or between a query and the documents retrieved, then the factor analytical techniques have based the association of documents upon a broad set of weak relationships between the pattern of terms (Belew, 1989). While calculations are based upon the pattern of terms in documents, the actual feedback to users is either a listing of source documents, or the actual related source documents which contain the terms or elements of the pattern, in other words, the closely related terms. Since factor analysis returns loading weights for each document, these can be used as indicators of the relative importance of each document to the central hub defined by the query.

This background to automatic information retrieval became the basis upon which the IR system used in this study was built. The next step became the identification of the variables upon which the statistical procedures would operate.

3.5. The importance of controlled vocabulary

Statistically-based information retrieval is based upon patterns of associated semantic content within documents and the assumption that dynamics of language diversity entail that numerous terms can have the same or similar meanings. This language diversity limits the potential for the direct and absolute association of terms and hence probabilistic methods, like most information retrieval methods, rely upon some form of controlled vocabulary. Since the identification and retrieval of documents depends upon the degree of coincidence of information bearing terms, then augmenting the degree of coincidence between those terms through controlling procedures should augment the retrieval effectiveness. This process of indexing will directly affect the effectiveness of a system as measured by precision and recall (Stanfill & Khale, 1985). Precision can be amplified by increasing the specificity of the vocabulary, thereby narrowing the scope of a search, and recall can be increased by including non-specific vocabulary thereby broadening the scope of
Both of these measures rely upon a degree of controlled vocabulary.

The conceptual analysis and translation of a document into a controlled vocabulary creates a limited subset of information bearing terms whose resolving power is as high as possible and that represents the semantic content of the document. The objective in vocabulary control is to provide a consistent representation of meaning by controlling synonyms and near synonyms and thus facilitate the search (Can & Ozkarahan, 1987; Lancaster, 1986). This may be done through indexing, the process of constructing document surrogates by assigning identifiers to text items (Salton, 1989), and is generally handled through an automated thesaurus.

A thesaurus, in information retrieval, is a set of items related to a specific area and a set of semantic relations connecting those items (Defude, 1984). The intent is to standardize references while indexing and retrieving relevant documents. It is used to eliminate noise words, define items, equivalences, documents and semantic relations, to create proximity relations (for example, if the term 'boat' is used, it is likely that the terms 'ship' or 'sloop' would be relevant), and as a knowledge reference. Most thesauri are made up of nouns or nouns with modifiers (for example, birds of prey) (Lancaster, 1986; Reed, 1985). Like other parts of speech that are not essential information bearing terms, adjectives are generally not included unless they are attached directly to specific nouns.

The intent behind any indexing is to assign terms in the hope of differentiating relevant from extraneous documents. This process of indexing leads naturally to the construction of a master thesaurus which will increase the number of associations between terms and hence between
documents (Furnas et al. 1988). Indexing exhaustivity reflects the degree to which all aspects of a subject or collection of texts are recognized in the indexing product. In exhaustive indexing, a large number of terms is assigned so that even minor aspects of the content can be reflected (Salton, 1989).

While the process of indexing can be handled from a top-down perspective by a committee of subject experts or, in the case of education, by curriculum developers, this approach is not the most reliable since it assumes that all knowledge is available prior to the processing of the documents and queries (Croft, 1986; Lancaster, 1986). Because it is difficult to identify all possible subdivisions which a collection of documents could require, a bottom-up approach, in which the terms actually appearing in the documents are used, is recommended (Lancaster, 1986; Salton, 1989). This algorithmic procedure is referred to as literary warrants in that a semantic signifier is identified as a computational variable if it occurs often enough to be considered significant and useful. These terms meeting the criteria for literary warrant can be augmented through the creation of a small, base thesaurus, constructed in consultation with expert sources external to the document who specify expected vocabulary relationships that may be unfamiliar to naive users and hence may not meet literary warrant.

While literary warrant is the most reliable source for indexing, there is a need for a general entry or beginning vocabulary. This is made up of terms which are synonyms and near synonyms, categories of terms, an inclusion list of terms, a hierarchy of specific to general terms, and an exclusion list. Much of this can be handled through pre-set, non-exhaustive lists. These lists can be designed to handle homographs (words spelt the same way which have different meanings), compounding and fracturing, and keys to groups of general words (Jones & Bell, 1984). Further
identifiers and checklists for specific needs such as names, places or other specialized vocabulary can also be included (Lancaster, 1986) along with stopping conditions so that the whole list need not be examined (Buckley & Lewitt, 1985). It has been argued that a literary warrant rather than a top-down approach to thesaurus construction is more effective although some pre-designing and vocabulary identification will be necessary. Croft (1986) suggests that a front-end, automated intermediary can provide effective retrieval results using an incomplete and relatively simple domain knowledge base.

In a learning support environment in which students are moving from relative novice to more expert states, we can expect student vocabulary to change over time. Hence, we can expect evolution in the vocabulary which merits literary warrant. This emphasis on descriptions of domain knowledge acquired from users rather than a single, pre-set, global description assumes that vocabulary at any specific moment is incomplete and dynamic (Croft, 1986); therefore, there is a need for control programs which will periodically review the thesaurus and provide a criterion for deletion (Defude, 1984; Lancaster, 1986). A controlled vocabulary must be allowed to grow. Lancaster (1986) suggests that in a controlled vocabulary based largely upon literary warrant within the system, we can expect to see immediate and rapid growth. But true subject descriptors will level off early and change only to accommodate new topics or learning.

It is apparent that an information retrieval that is completely domain independent is a very difficult goal to achieve. All experimental systems examined have relied upon a degree of domain specificity in order to achieve acceptable precision and recall. Increased effectiveness of retrieval systems can only be attained through the incorporation of explicit domain knowledge, defined through a pre-set thesaurus which will expand query and document terms (Croft, 1986; Salton,
1964: Salton, 1989). This suggests, then, that an effective information retrieval system is a modified expert system made up of a knowledge base and a simulated intelligence procedure which includes a linguistic module for formalizing semantic interpretations (Defude, 1984).

3.6. Conclusion

Experiments with probabilistic information retrieval systems indicate that full text retrieval based upon term associations is possible. The use of a thesaurus application and other vocabulary control procedures will not only facilitate term association but still allow for language diversity, and the use of literary warrant suggests that procedures could be applied within evolving databases. Using factor analytical procedures, the factor loading of each information item retrieved can be used as an indicator of the degree of importance.

Chapter 4 outlines a series of four, short-term, exploratory studies which incorporated statistically-based information retrieval procedures in the development of an expert system which was used in educational databases for conceptual information clustering and as a query-response system. The results of each study led to the design of the subsequent study, and collectively, the results of these investigations led to the long-term study presented in Chapters 5 and 6.
Chapter 4.

DEVELOPMENTAL EXPLORATIONS

4.1. Introduction

This thesis explores the utility of natural language information retrieval methods for conceptual clustering of notes based upon semantic relationships rather than keyword, boolean linking, or direct referencing of notes, in computer conferenced educational delivery.

Asynchronous computer conferencing supports free-formed participant input of information, generally focused around specific topics within conference branches, and the collective information base grows and changes as a result of contributions to discussions. Most systems record input sequentially and all entries are archived, available for reexamination according to set search procedures. Users can respond to any aspect of the conference and their comments are generally added to the end of the sequence. Although in current graphical systems such as Lotus Notes¹, Netscape Collaborator², or FirstClass 97³, some pointers can be embedded into notes that link to specified referents.

Computer conferencing preserves the advantages of interaction through group participation in the communal database, and fosters active learning since students are expected to participate in on-

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¹ Lotus Notes is a registered trademark of IBM Corporation  
² Netscape Collaborator is a registered trademark of Netscape Communications Corp.  
³ FirstClass is a registered trademark of SoftArc Inc.
line discussions. The success of conferences depends upon how well groups think together towards common goals. But because of the sequential aspect, clusters of related input which vary from, or build upon, the attributes of an original thought can become scattered (Ellis & McCreary, 1985). This can hinder the process of synthesizing collaborative databases and prevents easy searching and retrieval.

Under current computer-based collaborative educational systems, there is little system-enabled, automatic linking between notes. Within sequentially organized conferences, access to information is provided through specific keyword references applied to specific entries for keyword clustering, boolean operators by explicit vocabulary matches, or conscious, direct connection. Any further clustering is done on an ad hoc basis by individual participants familiar with the database content and extant methods for accessing it. Automated information retrieval has the potential to provide an alternative, complimentary procedure for information clustering.

In bridging information retrieval theory to educational databases, a flexible algorithm for vocabulary control had to be developed as part of a full information control and retrieval utility, called CAIRS (Computer-based Automatic Information Retrieval System), so that results could be replicated and the procedure could be applied in a variety of domain specific subject areas and in a variety of computer-based learning systems. The development and application of CAIRS as a utility for facilitating learning in computer conferencing-based education is the thrust of this dissertation.

This chapter discusses a series of experiments in the development and application of CAIRS. The initial exploration involved college students who were enrolled in a literature course.
Subsequent, increasingly more detailed experiments drew their databases from two different systems. CSILE (Computer Supported Intentional Learning Environment, described in section 4.4) and computer conferencing, both of which shared the characteristic of being computer-based and text-based. The CSILE information clustering experiments used a database created by grade five and six students examining the evolution of human beings. After the database was completed. The first, active investigation of CAIRS as an on-line student query-response system used a Masters of Education level computer conferencing course in which students were examining educational applications of conferencing systems; this study was conducted while the database was in the process of being created. The results of these investigations lead directly into a fuller study on the effects of CAIRS as a query-response system on student learning. Significantly, the principles of probabilistic information retrieval discussed in Chapter Three had never been used in educational databases prior to these explorations, and had never been used with a database in the process of being created. Subsequent to the initial investigations, Probert (1994) showed that factor analysis with controlled vocabulary in student-generated notes produced robust conceptual clustering when compared to the structure achieved through expert keyword indexing.

4.2. Initial exploration

The first exploration of information clustering was conducted as a final project for a graduate course, Philosophy of the Teaching of Literature. Fifteen students at a local community college who were studying poetry from the Romantic to Modern periods were required to produce three different writing assignments on a single, complex poem, Kubla Khan, by Samuel Taylor Coleridge. These were, a brief essay which sought a personal response to the poem before it was taught in class, and, following a presentation of the poem by the instructor, a required question on
the mid-term examination, and a question on the final examination. These writing samples were used to simulate a collective database.

Each piece of writing was fragmented into individual paragraphs, and these were then specified as the information elements. The domain vocabulary, including line references, which the students actually used was subjected to an ad hoc vocabulary control process by a committee of two researchers and identified as the variables for analysis using a binary approach such that the existence of a given term in a note was labelled 1 and the absence of the term was labelled 0. This became the input into a term by paragraph matrix.

Principal component analysis was selected as the statistical procedure since it explains the total variation in the observed variables (Dunteman, 1989) without requiring an inversion of the matrix, and is computationally simple. Khama (1990) defines principal component analysis as a method for identifying interesting but unanticipated structure in high dimensional data sets. Dunteman (1989) describes it as a statistical technique that transforms a set of variables into a smaller, uncorrelated set of variables that still represents most of the information in the original data set. This method forms linear composites of the variables which summarize and simplify the data, while maintaining most of the information from the larger set of data. Composites show a high correlation with the original variables, and explain the bulk of the variance. The components involve the selection of weights, based upon variable frequency, so that the total variation of the factors that make up the composite variable is at a maximum (Dunteman, 1989). From the output of the principal component analysis, and using the general guidelines for this method, the algorithm selects those components whose eigenvalue is greater than one and identifies those variables (that is, the specific notes) for which the absolute value of the principal component loading is equal to or
greater than 0.3. This procedure creates subsets of the database notes focusing around semantic hubs and this output can be further ranked according to degree of relevance of the notes.

It was expected that the documents associated with the content of components could indicate relationships within a large and diverse dataset. This analysis reduced sixty-nine variables to thirteen components which accounted for 92% of the variance of the original variables. The first six components accounted for 82% of the original variance and these were selected for qualitative inspection.

An examination of the notes associated with components and their respective loadings suggested that the group of students had developed a coherent approach to the poem which was radically different to that presented in the classroom, and different from any individual student's interpretation of the poem. This suggested that the group could produce more than an individual and that an intervention could facilitate the reaching of consensus. But while these results were interesting, because they were labour intensive and interpretation was subjective, they showed little hope for a practical application. In order to carry this research forward, an automated procedure which would reduce time and subjectivity needed to be developed.

4.3. Specification of the CAIRS vocabulary control algorithm and cognitive engine

In creating an automated vocabulary control process, a simulated linguistic vocabulary manager was initially developed for the pre-processing of text before statistical analysis. This involved the creation of a series of lists that could handle the diverse vocabulary of student notes in a given domain of learning. These lists included the following:
1. An initial, non-domain specific deletion list of noise words made up of non-content specific words including adjectives, adverbs, verbs, student and teacher names, class specific words, prepositions and articles. This delete list effectively eliminated the non-informing words and reduced the vocabulary of notes to mainly nouns.

2. A non-domain specific term equivalency list so that near synonyms could be grouped together. For example, the terms science, scientific and scientist can be grouped under the single term, science.

3. A domain-specific term expansion list so that student short forms could be restored to their full form. For example, CC can become computer conferencing.

4. A domain-specific contraction list so that multiple word terms with consistent meaning could be considered as a single variable. For example, homo sapiens becomes homosapien.

5. An inclusion list of domain specific words which could otherwise be candidates for deletion. For example, in the field of mountaineering, the word "climb" can be a noun, rather than a verb, and specify a rock face.

The expert manager also included a spelling checker and root dictionary for term standardization.
The following automated algorithm for vocabulary control identified the terms that were used as computational variables:

1. read all notes;
2. delete any system related note headers;
3. delete the noise words to reduce the size of the data set, such as to, the, and which;
4. apply the expert manager for spelling checking and reducing terms to their roots;
5. apply the expert manager term expansion list, so that, for example, Wm. was changed to William;
6. apply the expert manager term contraction list, so that, for example, William Wordsworth was changed to WW;
7. apply the expert manager term equivalency list, so that, for example, Wordsworth was changed to WW;
8. apply the inclusion list to stop deletion or other manipulation; and
9. delete terms which do not meet specified literary warrant levels.

This produced a reduced, controlled vocabulary, based largely upon nouns, which is still attached to the notes in which the terms are contained. This is the input data for the term by document matrix that in turn becomes the input for a statistical analysis technique which can reflect conceptual groupings of entries.
As a result of the successful clustering in the first exploration, the statistical analytical
technique used for the following investigations continued to be principal component analysis.

4.4. Second study: Note clustering in CSILE databases

Two investigations with the CAIRS algorithm used free-formed, student-generated databases
about human evolution constructed by students over a six week learning period (Hopperton &
Probert, 1992). These were conducted with the intention of exploring the utility of automatic
information retrieval techniques rather than user assigned keywords for the clustering of
information around conceptual hubs. The hypothesis under consideration was that student entries
would cluster around conceptual hubs which student assigned keywords would not indicate. The
investigations were conducted on databases compiled by grade five and six students studying the
evolution of man through the CSILE (Computer Supported Intentional Learning Environment)
project, developed at the Ontario Institute for Studies in Education.

CSILE is a hypermedia database shell into which students enter free-formed notes on assigned
topics. Using student-assigned keywords as the linking mechanism between entries, CSILE was
intended to cluster group learning around conceptual hubs that could be accessed by all students
through any linked path. But misuse or misunderstanding of the nature and function of
summarization skills needed for keyword assignment to entries could lead to incomplete clustering
within the database. Further, while an expert may group sets of associated keywords together, a
novice may not understand the relationship between similar terms within a domain and hence may
not be prepared to link related concepts. Because the content of the CSILE database was entered
by learners in the process of moving from relative novice to relative expert states, irrelevant or
trivial information could be easily entered into the database and, due to misassigned keywords, be
included within clusters. CSILE did not provide procedures for filtering these entries, and keyword clustering not only imposes constraints on the process of writing but could lead to inappropriate knowledge clusters.

Rather than using the student-assigned keywords for identifying clusters, the information bearing terms actually used by the students and which merited literary warrant, that is, appearing more than once across the database, were used as the clustering variables. In accordance with the statistical model of information retrieval, the variables were defined as the domain specific vocabulary that the participants actually used less the noise words such as non-domain specific words including verbs, articles and prepositions. Although the data had the potential for hierarchical clustering of terms under general content descriptors (for example, grouping short or tall under the category of height), the current experiments incorporated this hierarchical vocabulary minimally.

The first investigation, a pilot study of the application of the CAIRS algorithm, used the first fifty student notes of the database, and the second used all four hundred and eighty four notes contained in the complete database. After the notes dealing with specific class assignments (vocabulary definitions, book reviews) were removed, the experiments used forty-one and four hundred and nine entries respectively for analysis.

The language control reduced the size of the original data sets by three quarters and still yielded a large number of variables which, in keeping with the theories of literary warrant and vocabulary usage, increased disproportionately over time, beginning with many new terms being introduced to the database but leveling off as students neared the end of the study unit. Forty-one notes used for
the first experiment yielded 179 controlled content terms, and 409 notes used for the second experiment yielded 407 controlled content terms. These terms were entered into a disproportional term-by-note matrix per experiment, in which the individual cells represented the frequency of observations. These matrices in turn became the input for the principal component analysis, the output of which yielded 18 acceptable components for 41 notes for the first experiment and 71 acceptable components for 409 notes in the second experiment.

4.4.1. Discussion

Qualitative analysis of the contents of each selected component in comparison to the full content of the database showed that while the vocabulary and keywords which students used did not coincide, and the number of notes which loaded into the components varied from over sixty notes down to a single note, the content of the components generally did represent a consistent juxtaposition of conceptually connected ideas. Further, the order of the components showed that as many as possible of the significant conceptual links were satisfied with priority given to the strongest conceptual relationships. The analysis also discarded at least three notes which, upon inspection, were found to be content empty.

An interesting side effect of the application of CAIRS as a conceptual clustering mechanism addressed the issue of the isolated learner. One student had entered a note into the early man database that pertained to the influence of the environment on evolution, and used Australian dingoes and Alaskan Huskies as contrasting illustrations. Using the student-assigned CSILE keywords of "dingoes and huskies", this note did not connect to any others in the database; however, through the CAIRS clustering system, it did group in with other notes about
environmental influences. This indicated an advantage of vocabulary-based, algorithmic information retrieval over student-assigned key-word clustering.

Using the CAIRS application of automatic information retrieval theory, experimental results showed that automated techniques which relied on conceptual associations rather than keyword or text-string matching could direct students towards knowledge clusters. While knowledge did cluster around identifiable conceptual hubs using the algorithmic techniques, the CSILE applications of keyword linking and searching neither clustered satisfactorily nor would have directed students to appropriate and complete conceptual hubs of notes.

The application of the CAIRS algorithm showed promising results for the development of a powerful procedural support system for computer supported learning environments. Focusing on enhanced knowledge clustering could address the problems of poorly structured databases, provide overviews of the consensual knowledge represented in the database, direct students towards related information, and address the issues of irrelevance and triviality. Further, this clustering began to address the problem of information overload which can arise from having many learners involved in the exploration of a field of knowledge and from expecting students to be able to navigate through a large volume of entries by creating semantic subsets.

4.5. Third Study: CAIRS as a query-response system in CSILE

As the analysis of the CSILE database was considered to have successfully clustered knowledge around conceptual hubs, further exploration was undertaken to ascertain whether CAIRS could function as a query-response system. The hypothesis under consideration was whether CAIRS could retrieve information focused around specific queries. To test this, the ranking of the hub in
which a model query note appeared most dominantly was considered incidental. While the size of
the correlations for a particular principal component reflects the importance of that component in
explaining the variation in the original variables (Dunteman, 1989), it was not considered to be
important whether the query had its strongest loading in the first or last component, or the degree
of variation which that component captured; the component in which the query had its most
dominant loading was selected for evaluation. What was considered important was how the notes
within the hub related to the query. It was anticipated that the notes within the identified component
would most closely match the original query, and the loadings of each note within the component
would indicate the degree of appropriateness.

Six questions of varying types from within student notes were isolated and re-input to the
CAIRS procedure as individual notes. The output of the procedure was then examined to identify
into which components a given query note loaded, and into which component it loaded most highly.
The notes comprising these components were then examined qualitatively in comparison to the
entire database to see how closely the concerns of the query were addressed. With one exception,
that of an uninformed query ("Did Cro-magnons communicate?"), the notes with the highest factor
loadings in the component in which the query note loaded most strongly did address the query.

4.5.1. Discussion

From these explorations, it became clear that the accuracy of retrieval of the CAIRS system
was a function of the information contained in the query. The more information that the query
contained, the more accurately the feedback of CAIRS responded to that query. Since the system is
based upon linguistic associations rather than text matching, it appeared to lend itself to the higher
order questions which students posed. Because of its associational nature, the more qualifying
information a student was able to supply as a basis for the query, the more reliable was the output of the procedure. While the nature of the database and the CAIRS procedure dictated that no direct answer to queries could be provided. CAIRS did retrieve notes which were closely associated with the question. These, it is argued, are the best-fit responses to the query, and this leads to the hypothesis tested in this dissertation.

One particularly interesting outcome of this exploration focused around the question, "Did Neanderthals live in caves all their lives or just stay there for a short time to paint?" In fact, it was the Cromagnons who created the cave paintings. Interestingly, CAIRS returned notes pertaining to Cromagnon cave painting, the evolutionary connection between Neanderthals and Cromagnons, and the fact that the Cromagnon moved into the caves previously occupied by the Neanderthal. The CAIRS response, unable to answer an incorrect question from the database, returned notes which could lead to the reformulation of the query in a more fruitful direction.

The CSILE studies suggested that the CAIRS procedure could function as an information filter. The clustering of notes around specified hubs pointed to convergence of conceptual content as indicated by semantic associations, and these clusters could be used not only to point students towards group consensus, but also as a tool for instructors which assists in the synthesis of the evolving discussion. The clustering of notes around queries allowed appropriate notes for a given query to be brought forward, suggesting that CAIRS could successfully function as a best-fit query-response system.
4.6. Fourth study: CAIRS as a query-response system in computer conferencing

The CSILE experiments provided encouraging results for the CAIRS system; however, the CSILE database did not present the computational complexity of a continuously evolving, collaborative learning system since it was fully complete and static when the experiments were run. In order for CAIRS to function as a useful query-response tool in evolving educational databases, further experimentation with databases in the process of evolving was necessary. If the argument was to be made that CAIRS, as a query-response system, functioned across domains and populations, experiments in a different domain of learning to the CSILE experiments, and with a different population to the grade five and six children, were necessary. Further, since there were no time constraints on the analysis of the CSILE database, it was not certain whether the procedure could cluster and return best-fit responses within an acceptable time-frame from the user standpoint, and whether these best-fit responses would be useful to learners.

In order to address these issues, and to move CAIRS into a computer conferencing environment, a real-time experiment was designed using a class of thirteen graduate education students studying a Masters of Education course through the Participate\(^4\) (Parti) computer conferencing system. Students were required, as part of their regular course assignments, to post at least five relevant and readable entries per week on course materials.

Students were required to work in groups of two or three and to compare the utility of search techniques in the Parti computer conferencing system to CAIRS. Six short essays were submitted for grading. Students were instructed on-line on how to pose queries to CAIRS and how to

\(^4\) Participate is a registered trademark of NETI Corporation. Ann Arbour, MI.
interpret the meaning of factor loadings in results. The experiment ran over a three week period and began four weeks into the semester, after a reasonably sized database of entries had been compiled. This meant that the CAIRS procedure had to process not only the entries from previous weeks as literary warrants changed, but also the entries from the three week duration of the experiment as they were entered, and in response to student queries. It was anticipated that CAIRS would give overnight responses to queries, that the database would be updated with new entries and for literary warrant three times per week, and that queries would have no effect on literary warrants. During the application of the CAIRS procedure, literary warrant was specified as five occurrences of a term across the database.

Because the students were active in their contribution of notes to the database, the size of the data matrix grew rapidly. This presented problems with computations given the computer hardware configurations. For example, vocabulary control procedures were run on an 8 MHZ 80286 computer and a 33 MHZ 80386 computer, and once the matrix was generated, it had to be transferred by modem to a remote VAX for statistical analysis. Analysis then had to be transferred back to the 80386 by modem for final evaluation and assembly of the notes associated with the statistical output, which in turn had to be transferred back to students.

While vocabulary control procedures operated smoothly, statistical computation proved to be impossible until hardware configurations were adjusted by the on-site computer services staff. Once these adjustments were made, statistical processing time dropped from in excess of ten CPU hours to under four CPU hours for matrices with up to one-half million elements (550 documents by 900 terms), and turn around time from receiving a query to providing output dropped from three days to less than 24 hours. While the initial problems with statistical computation meant that some
stop-gap solutions, such as database partitioning, were attempted, and the delays in turn-around could have led to negative feelings about CAIRS, particularly since students were being evaluated based upon its operation. These problems were solved within the first week of the experiment.

Further, in the second week of the experiment the full process was transferred to a new, state-of-the-art, stand-alone 80486 DX2/66. This reduced the process time further to an average of eighteen hours.

4.6.1. Results

In five of the six essays that were submitted for evaluation, students consistently reviewed the CAIRS procedure positively. The sixth essay provided pointed, critical but constructive comments on the CAIRS procedure. While accepting its experimental nature and inevitable 'bugs', the students felt that it made a positive contribution to learning through computer conferencing.

The precision of CAIRS responses was consistently high. Essays citing figures for precision, based upon the student's comparison of the CAIRS output to the full content of the database, placed CAIRS at 64%, 78%, and 72% respectively as opposed to 44% or 45% using the Parti FIND command which relied on text string matching. Statements offered to explain this included,

CAIRS does look for terms that bear similar meanings, essentially doing some second-guessing on behalf of the users...[and] can give meaningful results even where a topic does not fall neatly into pre-existing organizational patterns...

and

CAIRS was superior to /FIND/ in that it found related concepts.

Where essays did not cite specific figures for precision, they did include evaluative statements:
...all notes had some relation to the questions although the direct relevance was often weak due to the context of the discussion. The nature of the notes do not lend themselves to simple searches.

Figures leading to recall percentages were available in only two essays. In these two, recall was stated as being 61% and 100% respectively.

The essays suggested that the CAIRS response did approximate the best-fit feedback to student-defined queries, although this feedback was not always that which was anticipated:

CAIRS offers a significantly improved retrieval technique over text string searching. [It] demonstrates a selective and focused retrieval technique, with a ranked sequence which would be very powerful and useful in database researching.

If the intention was to retrieve notes that help to answer a query, then the CAIRS strategy has been successful...the search does not itself answer the question, but it does lead to information that would help in the formulation of a response to the question...One must still construct personal meaning on the basis of their content.

The CAIRS query results were surprisingly more specific and direct [than those provided through other search techniques]. CAIRS often reveals what the searcher didn't realize.

CAIRS...effectively filtered information about our query into 11 notes, 8 of which were relevant.

Significantly, though, and in keeping with post-Vygotskian educational theory, these responses also suggest that the CAIRS response introduced cognitive conflict which the individual was forced to resolve.

CAIRS provided both the more refined selection and note order automatically, which was a significant competitive advantage... [and it] promoted divergent thinking as opposed to convergent.
The essays also pointed towards limitations in the system. As expected, students were less satisfied with results when the database was split due to initial computational complexity and resource limitations which were solved by an adjustment the memory allocated to the researcher’s computer account. Further, the time lag and thesaurus construction procedures were identified as weaknesses. The sixth, critical essay stated this most clearly:

CAIRS, in its present form, is not efficient. It uses too much CPU time, and is labour intensive.

There was also concern expressed about the fact that individuals did not know exactly how CAIRS established its results:

...the CAIRS process was more exotic [than the PARTI search techniques] but worked essentially as a ‘black box’ as far as we were concerned.

Individuals also suggested that more formal guidelines for query writing and interpreting results would be helpful. These suggestions were incorporated into the final dissertation study through both printed and on-line directions on query formulation, and examples on the interpretation of results.

4.6.2. Discussion

Results from the computer conferencing investigation showed that an application of the CAIRS procedure as a best-fit query response system in an evolving database would work. Although the size of the database became a significant problem in terms of computational complexity, this was ultimately addressed without resorting to the ineffective and misleading splitting of the database. The responses generated by CAIRS show consistently high precision and recall ratios in comparison to those generated through the conventional search techniques available through Parti.
It was suspected, and essay comments confirmed, that this is due to the relating of terms through the vocabulary control procedures.

4.7. General discussion

These explorations suggested that CAIRS could be a useful learning aid in computer based collaborative learning environments. Results indicated that it could cluster free-formed databases around conceptual hubs and function effectively as a best-fit query-response system in both static and developing databases. The differences between CSILE and computer conferencing, the diversity of populations and the different learning domains suggested that CAIRS was not limited to a specific topic, level or system. It appeared to facilitate group work by making the searching of collaborative databases easier and aid the movement from relative novice to relative expert states by the introduction of cognitive conflicts which has to be resolved by the individual. These indications were encouraging especially since the turn-around time from query to response posting was never cited as a problem.

The final question for examination, and the focus of the main study in this dissertation, was whether this kind of information retrieval system would make a difference to the learning of students, and whether students who did not view the system as purely experimental would find it to be an acceptable and helpful addition to their studies. This issue is addressed in a fuller, more extended study with a different student population. This study and its results are presented in Chapters 5 and 6.
Chapter 5.
FULLER EXPLORATION:
COURSE DESCRIPTION AND METHODS

5.1 Introduction

The results from the initial explorations, discussed in Chapter Four, suggested that the CAIRS procedure, as a model of an automated information retrieval system, could cluster notes around conceptual hubs and could function as a student query-response system. Enhancing note linkages through vocabulary control and automated information retrieval procedures created acceptable conceptual clustering of free-formed collaborative databases. These clusters focused around both unanticipated and unspecified conceptual hubs identified through a statistical procedure, and around hubs centred in contextualized queries. This could save students time and effort in sorting through ever-growing databases in order to identify notes pertaining to self-identified topics.

But the question of the utility of this clustering remained. The developmental explorations did present limitations to the generalizability of the results. Databases for the "Kubla Khan" and CSILE investigations were static, and the graduate student population for the three-week computer conferencing investigation were highly motivated and recognized the purely experimental nature of the procedure. While the results were encouraging, they also begged a series of questions:

1. Could the CAIRS procedure function successfully in an authentic learning environment?
2. Would the information which the CAIRS procedure returned to students make a difference to their learning? and

3. Would students find that the CAIRS procedure made a positive contribution to their learning experience?

In order to explore these issues, a more carefully designed investigation, based upon a full semester, credit subject, with self-selected students learning through computer conferencing at a local community college was designed. It was anticipated that the use of information retrieval techniques in the form of a query-response utility would facilitate learning gains for students and provide them with an acceptable study tool.

5.2. Course overview

The course for this investigation, Literature from the Romantic to the Modern Period, was one of a number of optional subjects that fulfilled diploma requirements for an upper-level literature-based general education subject at an Ontario College of Applied Arts and Technology. These literature-based general education subjects use themes and examples from literature in order to stimulate critical thought and expression. These subjects carry a prerequisite of Freshman Composition, which focuses upon critical thinking and extended writing using a variety of academic rhetorical modes and includes a major essay assignment involving research and documentation.

Upper-level general education courses, intended to further develop student abilities for critical and analytical thought and expression, encourage students to think independently and to justify their conclusions, both verbally and in writing. Bond (1993) describes these critical thinking skills
as the student's ability to evaluate responses to causes, consequences, and relationships of both social and psychological events. Often in these courses, research and writing are central activities, at least partially replacing lecturing or text-book activities (Hunt, 1995).

But most program specific curriculum at the Ontario Colleges of Applied Arts and Technology focuses students on more prescriptive, factual approaches and vocationally relevant procedures, unlike these general education subjects which involve students in the process of conceptual creation. As a result, students, who define appropriate curriculum as relevant to their vocational objective and use this as the basis for determining the acceptability of specific courses, are confronted with a divergent approach and outcome, and often resist general education courses (Fedderson, 1993).

The course for the fuller investigation of the utility of automated information retrieval in education was offered simultaneously in traditional classroom and in mixed-mode (classroom and computer conferencing) formats; however, because of the radically different approaches and the non-random selection of subjects, the face-to-face class was not used as a control group. In this course, themes in literary development were examined, primarily using poetry as the illustration. The course was intended to stimulate discussion, interpretation, critical and analytical thinking, and written expression. Topic highlights included a general introduction to literature and literary criticism, and major literary features and authors of Romantic, Victorian, and Modern periods (see Appendix A for a complete, standard subject outline).

While passive, non-participation in class discussions is possible in regular classroom delivery of subjects, silence was not an option for mixed mode students whose required comments were
addressed to the group. Because the CAIRS search procedure was introduced half way through the semester for the mixed mode sections, this group functioned as both experimental and control groups for the CAIRS consideration, providing data in the form of conference entries both with and without the use of the CAIRS system. Notes became the before and after points of comparison for content analysis procedures discussed in section 5.11.

5.3. The critical approaches to literature

Since discussion was central to this subject, students were provided with a modified approach to literature involving the applications of practical criticism and reader response criticism which they were expected to use as a framework for discussions. While the application of CAIRS was based loosely on literary applications of deconstructionism, this critical approach was not explained to students because of its inherent complexity and anticipated student resistance to this subject.

Students were given a seven page handout entitled "Notes towards an understanding of poetry and literature" (Appendix C). This document had been used in this subject and had evolved over ten years of teaching by the instructor. It provided students with a series of questions and examples to assist them in approaching new works, and included a glossary of basic literary terms with examples and discussion. This guide introduced students to judging a piece of literature based upon the evidence which it contains and suggested that, just as in a court of law, evidence can be used to argue many options. Students were told that, ultimately, judgement is based upon the best argument, and the argument would be the basis for grading computer conferencing notes. Critical self evaluation in which students must question and justify the validity of their judgement was involved in this approach.
The following sections outline the literary criticism approaches involved in this course, both for student responses and for the CAIRS system.

5.3.1. Practical criticism

Practical, or applied, literary criticism is an analytical method for people who wish to know what they think and feel about pieces of literature (Richards, 1929), and an educational method for developing critical discrimination and understanding, entailing an intense approach to pieces in order to grasp their essential qualities, and illustrating these qualities by careful and close references to details. Theoretical principles underlying the analysis, interpretation, and evaluation are often left as implicit or brought forward if occasions demand (Abrams, 1993). It provides readers with a 'toolbox' for literary analysis and suggests that the skillful application of these tools can lead to a substantial understanding, or commentary, of the work under examination. The intent is to achieve a full appreciation of the work in question through close reading (Preminger, Warnke, & Hardison, 1974), after which the commentary becomes irrelevant. The assumption of practical criticism is that all great literature is complex, and any remark must be grounded in the text, as revealed through the application of the tools of literary criticism.

5.3.2. Reader response criticism

Unlike practical criticism, reader response criticism considers the changing mental response of readers as they consider a work. Reading becomes mental activity, and meaning becomes an active process of creation for readers (Abrams, 1993). No single correct reading of a work exists; rather, there are individual perceptions of external manifestations (Roberts, 1995). Meaning exists in a triangle of interactive participants -- the author, the text, and the reader -- and cannot be
established until readers enter into the transaction of assimilation and actualization in light of personal knowledge.

5.3.3. Deconstructionism

The CAIRS operation was consistent with the principles of deconstructionism since it was based upon the principle of a constantly changing and unstable body of knowledge in the creation of the statistical matrix. Deconstructionism suggests that full and complete understanding of text is never possible since meaning is dispersed among innumerable alternatives (Abrams, 1993), lying in an unending interplay between ideas which can have many shades of meaning, including possible future readings (Roberts, 1995). Deconstructionism argues against logocentric Western philosophy which assumes that absolute truth is central and entire; instead, it suggests that wilful statements of truth by readers are unstable since they entail elimination of other possibilities which may be equally valid; therefore, absolute meaning is a dialectic condition of undecidability (Abrams, 1993); it is in a state of constant deferral.

Deconstructionism can compliment both Vygotskian ideas of peer tutoring and collaboration, and the discussion aspects of computer conferencing. Vygotskian psychology suggests that cognitive conflict introduced through the verbalization involved in peer collaboration can lead to continual building of knowledge scaffolds, every aspect of which is subject to challenge and reorganization. While peers strive towards the crystallization and internalization of truth, the dialectic entails constant challenge to its final definition. Computer conferencing, which facilitates ongoing discussion, encourages the active and continual reorganization of information elements. When enhanced by a procedure such as CAIRS, which discourages preemptive closure or any note from becoming stale because of its date of introduction, all information items become continuously
re-related elements in the ever-changing kaleidoscope of final truth which is subject to personal interpretation and group challenge.

For literature, this means that there is not one reading of a piece, but many possible readings, based upon reader selections of elements of signification. Consider the use of figurative language in literature: language signifies - or substitutes for - reality other than that which the language states, and this signification is open to a realm of interpretation decided upon by individuals. But every selection of signification entails confinement of the utterance, and confinement entails the willful elimination of alternatives. Every piece of literature, and the elements which it contains, calls forth the possibility of infinite substitution and selection, and this makes definitive statements impossible. In this play of possibilities, absolute meaning can only be deferred; a work can have infinite readings (Culler, 1975). As long as possibilities of discussion continue, absolute stability is impossible and assumptions of meaning must be postponed. Deconstructionism seeks to valorize such notions as ambivalence or ambiguity, and to encourage readings which consider chains of signification where crucial, vital links contain possibly contradictory, multidirectional, mutually exclusive readings.

5.3.3.1. CAIRS as a deconstructive operation

Because the CAIRS system selected responses based only upon what was contained in the database, and every new entry into the database created a different matrix upon which the CAIRS procedure operated, CAIRS never provided a definitive response to any query; rather, it provided a range and degree of possibilities in an expanding and changing network of signification. This was intended to stimulate critical, analytical, and convergent thinking in students since they were required to reconcile ranges of potential responses and to justify their reconciliation. This thought
process required that students construct a personal knowledge base and, through the posting of subsequent notes, deliver to the class something that may be of use to peers and would feed into the CAIRS engine and its changing output. At the same time, this activity meant that students were required to increase the depth of personal understanding through the active process of reconciliation. Since CAIRS retrieved both supporting and contrary notes, it allowed ambiguity and contradiction, leaving the student to reconcile the conflicting possibilities and to construct readings. No response from CAIRS could be identified as stable and decisive; rather, all responses allowed for discrepancy, ambiguity, and lack of resolution, since every new entry could, potentially, change the stability of a CAIRS response to the same query by changing the dimensions and elements of the matrix upon which it operated.

Because CAIRS and this computer conferencing investigation created an artificially closed system of discourse, limited by the number of participants and the semester constrictions, the closest that it could come to definitive areas of conclusion occurred when students and instructor ceased to enter notes, and a final run of the system took place. This artificial closure is examined through an analysis of the output resulting from the posting of a comprehensive query following the conclusion of the course discussed in section 6.3.4.2.

5.4. Student selection

Students who participated in this study were self-selected, adult, continuing education, community college students. The mean age of students included in this study was 27.8 years. Most students selected the course and delivery mode based upon a brief description of the subject and mode in the Faculty of Continuing Education Calendar. Four students who subsequently dropped the course reported that they had misread the calendar, not realizing that the subject involved
extensive computer usage. This was understandable since computer conferencing had never been used in an Ontario community college prior to this course. One student (subject 3), informed of this mode during the first class of the parallel face to face section of the subject, elected to transfer to the computer conference mode because of its flexibility which could accommodate personal responsibilities. All students in the computer conferencing section were reminded of the parallel, face-to-face section but none, including those who subsequently dropped the course, transferred. It was anticipated that class enrollment trends would be consistent with those experienced by the instructor in previous years, and those reported by Fedderson (1993); enrollment in each class begins high but stabilizes at about half the original number of students by the fourth or fifth week. Enrollment in this mixed-mode section started at a high of ten students, one transferred student, and one late registrant, and dropped off rapidly, stabilizing at five students by the third week of the class.

5.5. Grading criteria

As specified in the weekly course outline for the Faculty of Continuing Education, students were required to achieve a passing mark in both the term work and the examination in order to achieve a passing grade. Appendix A. the general subject outline for this course, specifies the standard college grading criteria.

5.5.1. Grading criteria for computer conferencing class

While the evaluative criteria specified in Appendix A applied in traditional classes, realities of computer conferencing, involving the high levels of direct written input of ideas, dictated a relaxing of the grammatical precision requirement. For the computer conferencing class, writing assignments and class participation combined into regular, weekly conference participation since
student notes to the conferences constituted both of these variables and were documentable. Oral
seminar presentations were delivered as lead-discussant presentations in the conferences. Other
assignments (testing and essays) remained constant. Grading for the class was adjusted to
accommodate anticipated differences in student responses based upon the delivery mode.

Students of the mixed mode class were required to contribute a minimum of four acceptable
notes per week to the conferences in order to achieve a passing grade for the week. Acceptable was
defined as putting forward an idea and explaining it so that other students would understand it.
This eliminated the possibility of "I dunno" statements or passive silence since participation was
mandatory and graded. and explanations of the basis of misunderstanding or confusion were
treated as acceptable and gradable. and these explanations were considered to indicate points of
self-identified cognitive conflict seeking collaborative resolution. All of an individual's
contributions were evaluated by the instructor and the best five in terms of their application of the
principles specified in the Guide for Understanding Literature and Poetry were selected for
grading. These were commented upon and returned to the student privately on a weekly basis
through the conferencing system.

The class was given an addendum (Appendix B) to the general weekly outline explaining on-line
seminars and specifying grading criteria for conference participation. Students were instructed to
contribute seven notes per week, and informed that grading would be based upon their best five
entries. A note was specified as a minimum of four sentences so as to present and explain an idea
to classmates, and a maximum of 1.5 screens so as to both encourage precision in writing and to
facilitate reading and understanding by classmates.
Since one or many students could contribute a series of notes ostensibly pertaining to the same topic, this direction on note writing encouraged text fragmentation, and this absence of clearly defined text boundaries (Bauman, 1997) supported an intertextual reading on the part of learners. Intertextuality also supported the CAIRS procedure since notes were not necessarily bounded by explicit intellectual homes, but could converge around conceptual content. This allowed any statement to have multiple potential readings depending upon its juxtaposition with other entries. This pedagogical strategy was intentionally built into this course.

Table 5.1 illustrates the evaluative criteria for student notes.

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Numerical Mark</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>0 - 54</td>
<td>The student made less than three relevant and readable contributions.</td>
</tr>
<tr>
<td>D</td>
<td>55 - 59</td>
<td>The student made at least four acceptable (relevant and readable) contributions.</td>
</tr>
<tr>
<td>C</td>
<td>60 - 69</td>
<td>The student made at least five acceptable (relevant, readable, clear, and concise) contributions which make direct reference to either the reading materials or the contributions of classmates.</td>
</tr>
<tr>
<td>B</td>
<td>70 - 79</td>
<td>Contributions help to further the discussion. They provide new, relevant information or perspectives. They address the questions raised by others and/or they pose thought-provoking questions for the group.</td>
</tr>
<tr>
<td>A</td>
<td>80 - 100</td>
<td>Contributions provide a &quot;net-weaving&quot; effect by integrating the ideas, concepts, issues, and problems raised throughout the discussion and the course as a whole.</td>
</tr>
</tbody>
</table>

Issues of readability and relevance required judgements and written justification by the instructor (Hiltz, 1995). As the grading criteria shows, incentives were built in to encourage interaction.
Lead discussant (seminar) assignments required students to become the teacher (Hiltz, 1994), to post 500 to 700 word written presentations on a specific, self-selected work, and to be prepared to direct on-line discussions on their selected work. Because there were fewer students than works, the instructor assumed this role for most pieces.

While not used for experimental control purposes, along with the common pre-tests, mid-term tests, and post-tests used for comparative purposes for the college, students were required to complete a major essay which entailed the synthesis of three opposing literary theories, those of Plato, Shelley, and Eliot, and the application of this synthesis to specific works studied within the course. In Book IX of The Republic, Plato presents a moralistic and utilitarian view of art and poetry in which the value of a work is to be judged in terms of its utility for society. The Defense of Poetry by P. B. Shelley, a major Romantic poet, justifies imaginative art in a world that finds its value questionable. In Tradition and the Individual Talent, T. S. Eliot argues that art should be judged by clearly defined standards of evaluation (Holman, 1972). These statements occupy central roles in modern literary criticism. Students were required to reconcile these theories at a personal level, and to apply their reconciliation to any four works which were studied during the course. In typical face to face classes, these theories are discussed in general terms with the instructor. Students in the mixed-mode delivery had a conference opened for the discussion of the opposing theories and the essays were points of comparison between course concepts. To parallel the class discussion and hand-outs in the face to face class, the instructor posted overviews of each theory on-line, and students were provided the opportunity to discuss the theories in a conference. It was expected that CAIRS would be a useful tool for students as they sought to reconcile the theories, and as they attempted to apply their reconciliation to works studied. If CAIRS was used, there would be a record of the query and the response.
5.6. Conference structure

In order to facilitate the organization and administration of the course, a series of conferences were established. Table 5.2 details the conference structures used in the course.

Table 5.2. Conference titles, the week of opening, the total number of notes contributed from the opening of the conference to the completion of the course, and a general description of the purpose of the course conferences.

<table>
<thead>
<tr>
<th>Conference title</th>
<th>Week opened</th>
<th>Number of notes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LITERATURE</td>
<td>1</td>
<td>441</td>
<td>Read/write conference for student discussion. This was the main, public conference for the discussion of course materials. All participants were expected to post to and read messages from this conference. This conference, the INSTRUCTOR, and the ESSAY conferences were the database content used as input for CAIRS searches.</td>
</tr>
<tr>
<td>INSTRUCTOR</td>
<td>1</td>
<td>147</td>
<td>Notes by instructor which were read-only for students. This was used for the posting of any background information for the course such as general lectures or specific instructions.</td>
</tr>
<tr>
<td>INTRODUCING</td>
<td>1</td>
<td>15</td>
<td>Autobiographical student introductions. This public conference was used on the first night of class in order to familiarize students with computer conferencing and their class-mates. Students were asked to post a brief, biographical message for their fellow students.</td>
</tr>
<tr>
<td>HELP PLEASE</td>
<td>1</td>
<td>35</td>
<td>Technical support on Parti. This public conference was for posting requests for, and receiving answers to technical questions about the computer conferencing system. Queries were answered daily.</td>
</tr>
<tr>
<td>PARTY TIME</td>
<td>1</td>
<td>46</td>
<td>Open discussion. This public conference was for general discussions about non-course related activities, and intended to build a sense of community with course participants.</td>
</tr>
<tr>
<td>ALERT</td>
<td>4</td>
<td>12</td>
<td>Administrative bulletins. Course related announcements including forthcoming due-dates.</td>
</tr>
<tr>
<td>ESSAY</td>
<td>4</td>
<td>13</td>
<td>Discussion about the major essay. This public conference was used for discussion of the opposing literary theories which students considered and reconciled for their major essay.</td>
</tr>
<tr>
<td>THE TRIAL</td>
<td>10</td>
<td>21</td>
<td>Major essay of student 3 (see below).</td>
</tr>
<tr>
<td>CAIRS 2</td>
<td>8</td>
<td>22</td>
<td>Posting CAIRS queries and discussion of information retrieval. The instructor posted a general introduction to CAIRS, instructions on query formulation, and sample queries and results from the course conference. Students were able to ask questions about CAIRS and receive answers posted to their private conferences.</td>
</tr>
<tr>
<td>Instructor's private conference</td>
<td></td>
<td></td>
<td>This was for students to privately contact the instructor for private communication.</td>
</tr>
<tr>
<td>Student private conferences (by student name)</td>
<td></td>
<td></td>
<td>Private messages from the instructor, CAIRS responses, or other private correspondence were posted here. Private conferences could not be tracked.</td>
</tr>
</tbody>
</table>
It was expected that participation in the Parti conferences would be hesitant at first, but as familiarity with the system increased, the number of weekly entries would also increase. This held true.

5.7. Student support

Along with the initial training session (described in Section 5.7.2.1) and the "HELP" conference, the instructor was present at the college computer facility at preset times, daily for two weeks as the semester began in order to provide immediate support for the learning of computer conferencing. Students were also furnished with the instructor's home telephone number and encouraged to call when any difficulties arose. Students rarely used these services.

5.8. Course events

The first six weeks did not include the CAIRS procedure in any way. This allowed students to familiarize themselves with the system and for a sufficient database upon which CAIRS could operate to be built.

5.8.1. Face to face classes

Because this was the first time that computer conferencing was used as an educational delivery medium in an Ontario college, the administration of the Faculty of Continuing Education required that this section of the subject was offered in mixed-mode format (scheduled classes and computer conferencing) rather than exclusively through computer conferencing. There was concern about plagiarism and cheating, and fear that the system would be too complex for students to master. If this happened, the course would have reverted to the traditional classroom format. From the research standpoint, the mixed-mode allowed for additional training sessions to be scheduled for
the introduction of students to search and retrieval procedures, both those embedded within the computer conferencing system and with CAIRS.

As this course started one week late in order to boost the enrollment, content was compressed to thirteen weeks by accelerating the pace in the first half of the course. This provided a seven/six week split for an examination of student activity before and after the introduction of CAIRS. Seven face-to-face classes including the course introduction, the mid-term test, and the final examination were scheduled. The balance of the subject was delivered over the Parti computer conferencing system.

One face-to-face class was cancelled in Week 4, since this was intended to address conferencing problems and none were identified by students. The class slated for taking up the mid-term test was attended by two students and was terminated after 30 minutes. Table 5.3 summarizes the purpose of each face-to-face session, based upon the original, 14 week outline.

<table>
<thead>
<tr>
<th>Week</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to subject and requirements, computer training</td>
</tr>
<tr>
<td>2</td>
<td>Background to the Romantic period, computer support, Study Process Questionnaire</td>
</tr>
<tr>
<td>4</td>
<td>Computer support, CANCELLED</td>
</tr>
<tr>
<td>7</td>
<td>Proctored mid-term test.</td>
</tr>
<tr>
<td>8</td>
<td>Take-up test, TERMINATED</td>
</tr>
<tr>
<td>13</td>
<td>Subject summary (optional)</td>
</tr>
<tr>
<td>14</td>
<td>Proctored final examination</td>
</tr>
</tbody>
</table>
5.8.2. Training sessions

Training sessions for the conferencing system and the search techniques used a combination of face-to-face and on-line instruction.

5.7.2.1. Parti training

Students were introduced to the class and the concepts of computer conferencing in an initial, classroom based session. More advanced features of the system, particularly searching and retrieval, were introduced as need arose and as database content increased. In the initial session, general outlines were distributed along with other subject specific materials, and subject requirements and grading policies, particularly those pertaining to regular participation in electronic conferences, were discussed.

Although it was assumed that students had some awareness of the mode of delivery since they were self-selected based upon the subject description in the Continuing Education calendar, the instructor presented a general theory of computer conferencing, stressing the flexibility of the delivery mode and the advantages of peer interaction. Simplified Internet connections between the research site and the location of the conferencing system were diagramed and explained to participants so that they would understand the relationship between their computer accounts and the Internet connections to the Participate computer conferencing system housed at the Ontario Institute for Studies in Education. The intent of this discussion was to provide students with a conceptual framework which would facilitate their learning of the system connections. The nature of the study, both for this dissertation and for the college, was explained. Informed consent forms (Appendix J) were distributed and explained, with particular stress placed on the fact that declining to sign the consent form would have no repercussions on grades.
Students were informed that an artificial participant, Anne Student, a pseudonym of the instructor, would be involved in the first few weeks of class. The sole function of this character was to model interaction and to present the initial on-line seminar as a model. Students then returned the consent forms to the instructor; all students had signed the forms. This was followed by the distribution and completion of the general biographical questionnaire.

The *Participate Conferencing System Manual* (Appendix D), developed by the researcher with specific references to the College-OISE connections, was distributed and discussed. This manual was divided into five sections:

1. a general introduction to the features and benefits of computer conferencing;
2. The Electronic Campus which walks students through the direct connection to the host site, the Telnet connection to OISE, joining Parti, writing and reading conference notes, and logging off both the OISE computer and the College computer;
3. guidelines for writing notes;
4. modem settings; and
5. a general Parti command manual.

Students were given a listing of the main conferences for their course and the purpose of each conference was explained.

The manual also provided space for students to record their host site usernames and passwords, the one OISE username and password, and their Parti usernames and passwords. Students were also provided with a hot-line number — specifically the home telephone number of the researcher — and instructed to call if they were experiencing difficulties with their computer connections.
Students were instructed that the general goal of computer conferencing was to talk through the fingers, directly to the group as a whole as if they were all physically present. Class was then adjourned for a break. Once the class reassembled in the computer lab, the nine remaining students were assigned to their own terminals and walked through an initial Parti session by the instructor and a second, experienced Parti trainer. While the main conferences had been opened, they were largely empty since the purpose of the training session was to get students on-line and comfortable with the medium of delivery. They were told to enter a personal note into the INTRODUCTIONS conference and to join the chat which had been set up in an open discussion conference called PARTY TIME.

The on-line training session in the college computer lab lasted for 90 minutes, at the end of which, students reported that they were comfortable with Parti. Follow-up, private training sessions were held with the student who transferred and the student who registered late. All students were urged to log into the system a few times over the week in order to acclimatize themselves, to begin their participation, and to call the instructor with any problems.

5.9. Searching

Since students were expected to use two different search techniques, these were introduced separately.

5.9.1. Parti search

The searching procedures in Parti were introduced to students during the fifth week of class, once sufficient notes had been posted to make the procedure useful as a study tool, in the form of a handout (Appendix E, Searching in Parti, Part 1: Text String and Date Searches) and a
discussion about PARTI FIND in the HELP PLEASE conference. The database at that time contained 132 notes in the LITERATURE conference and 67 notes in the INSTRUCTOR conference. While students were not required to use searching, practical examples posted in the HELP PLEASE conference illustrated the utility of this procedure as a study tool.

5.9.2. CAIRS search

The CAIRS procedure was introduced as a tool for knowledge-based queries on the night of the mid-term test in the form of a hand-out (Appendix F, Searching in PARTI. Part 2: CAIRS Searches) and a discussion about conceptual information retrieval. The number of entries by that time had risen to 217 in LITERATURE and 98 in INSTRUCTOR, providing 315 note entries in the term by note matrix for the CAIRS procedure.

The CAIRS hand-out introduced students to the idea of conceptual searching. In order to avoid a "black-box" effect as had been reported in the Master of Education level computer conferencing investigation of CAIRS, students were given sufficient information in order to understand the framework of the CAIRS system, simple instructions on knowledge-based query formulation, and explicit direction on the relationship of the query to the CAIRS response.

The CAIRS 2 conference was opened during the following week. Three CAIRS examples were posted, one of which included a model summary of the response. These examples were based upon notes isolated from the main "LITERATURE" conference and re-input as queries. The intention behind the posting of these CAIRS examples was to show students the potential utility of the procedure.
An ungraded CAIRS assignment required students to post at least one query into the system and to synthesize the results of the query. Students were instructed on the use of CAIRS prior to this assignment. The purpose behind this assignment was to provide a minimum amount of data on how students synthesize CAIRS responses for transcript analysis and follow-up interviews, and to provide them with practical experience with the procedure so that they could reach a level of comfort. Following this assignment, students were encouraged, but not required, to use CAIRS on a weekly basis and particularly in the preparation of their major essay. Since all CAIRS queries were posted to the CAIRS conference, and the results of the search were processed and sent back to each student by the instructor, there was a record of student use of the procedure. It was assumed that even if subjects did not use CAIRS regularly again in the course, the CAIRS assignment would give them a basis for an opinion of the utility of the system. This assumption was shown to be unnecessary since all subjects used the CAIRS system.

5.10. Electronic instruction

Moving the students from a teacher-centred to a discussion-centred environment required adaptation of teaching styles (Hiltz, 1995) in order to both provide content and to stimulate discussion. After providing conceptual frameworks for the course and brief social histories of the literary periods, the notes placed in the INSTRUCTOR conference were intended to elicit responses from students and to stimulate their thinking in unanticipated directions. These notes were coded according to six variables.

Table 5.4 summarizes note content in the INSTRUCTOR conference, detailing the type of note, the highest and lowest number of each type of note and the weeks in which these notes appeared, the median and the mean of each note type per week. Open-ended notes contained elaborations...
upon content and stimulus, generally in the form of a question, and were intended to promote student discussions or higher levels of thinking (Yeoman, 1995). Closed-ended notes contained elaborations on content or theoretical frameworks for consideration, but no specific queries or directions. Cross-reference notes made specific reference to student notes in the LITERATURE conference. Explanation notes presented factual discussions, primarily of literary terminology, which would assist students with understanding and interpretation. Summary notes drew student and instructor discussion threads together, mainly on a per poem basis. Synthesis notes drew together conclusions for units and generalized these either to the field of study or to practical life. The free-formed nature of the notes, which often contained multiple paragraphs, meant that single notes could serve a number of purposes. A summarizing note, for example, could cross-reference and act as a basis for an open ended statement. As a result, variables were not mutually exclusive.

In addition to the main teaching notes, additional conferences provided specific support for assignments and information retrieval.

<table>
<thead>
<tr>
<th>Table 5.4. Note content in the INSTRUCTOR conference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note Type</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td>Open-ended</td>
</tr>
<tr>
<td>Closed-ended</td>
</tr>
<tr>
<td>Cross reference</td>
</tr>
<tr>
<td>Explain</td>
</tr>
<tr>
<td>Summary</td>
</tr>
<tr>
<td>Synthesis</td>
</tr>
</tbody>
</table>

The relationship between the median and mean numbers indicates consistency across the course. Week seven, the consistent low across all measures, involved the face-to-face mid-term
test, a time during which both students and instructor were focused upon an evaluative tool external to computer conferencing participation.

5.10.1. The on-line stooge

Since it was assumed that subjects would have had no previous experience with computer conferencing as an educational delivery medium, and that they may need coaching to adjust to this mode of delivery, an innovative technique for modelling student responses was created. This was the use of an on-line stooge in the electronic classroom.

Subjects were informed that one name, Anne Student, was an artificial character to be used by the instructor. The stooge was used to model cognitive apprenticeship in an authentic learning situation (Brown, Collins, & Duguid, 1989) by posting initial student questions, responses and interactions, and, based upon the request of subjects for a model lead discussant presentation, to post the first electronic lead discussant presentation. The use of this character was discontinued after the third week after students had adjusted to the medium and were participating in discussions. Qualitative inspection of student notes entered during the period in which the on-line stooge was active shows that even though subjects were informed of the purpose of the stooge, they treated this character as another on-line person, responding to her queries as if she were another student and asking personally relevant questions based upon her posted biography.

5.11 Method of investigation

Since attempts were made to explore the data from multiple perspectives, the data collected provided both class and individual measures. This data included questionnaires, recorded follow-up interviews, and transcript analysis. Interactive methods were further supplemented with the
collection of a range of records on and by the participants in the study. These included CAIRS search results, conferences usage, common written assignments and examinations, and college records.

The methodology for this study considered aspects of the utility of natural language information retrieval. Quantitative analyses, using values assigned to notes through the assignment of Structure of Observed Learning Outcome (SOLO) scores (Biggs & Collis, 1982), and through the application of critical thinking ratios (Newman, Webb, & Cochrane, 1995), were used to indicate general changes in subject thinking before and after the introduction of the CAIRS information retrieval system. This augmented qualitative analysis which showed system utility and acceptability for individual participants. Case study methods explored individual perceptions of the CAIRS procedure.

5.11.1. Holistic ethnography

For case studies, the main research methods were based upon observation, focused on participants' perceptions and were context oriented. Naturalistic, inductive, response-adaptive methods were the main techniques employed. Jacob described this methodology as holistic ethnography in which researchers attempt to describe all or part of a community or culture by describing the beliefs and practices of the group and showing how the parts contribute to the reality as a whole (Jacob, 1987; 1988). Holistic ethnography specifies that researchers gather empirical data, document participants' points of view using verbatim statements, and collect a wide range of data using various techniques. This descriptive and interpretive activity is intended to bring about understanding rather than judgement, and to look at individual behaviors as part of a larger system. Ethnography is a valuative tradition committed to discovering how things are and how they
developed rather than how they ought to be (Wolcott, 1984). To establish the current status of things and their development, researchers use behavioral observation as the primary tool for the articulation of culture, and gain empirical access through inspection (Geertz, 1973). While investigations can neither prove nor disprove hypothesis validity based upon quantitative measures, they argue validity based upon a preponderance of the evidence available through inspection.

In qualitative research, there is a question as to whether researchers should have a stake in the final outcome, and, as a result or participation, whether the data will be reliable and results replicable with similar populations (Glesne and Peshkin, 1992). Because culture is a context with significance for the group under consideration, researchers intentionally suspend familiarity in order to observe culture in action and describe it in its own terms (Geertz, 1973). Researchers consciously avoid preset knowledge of intended outcomes and attempt to determine actual outcomes through observation, and sensitize themselves to the side and unanticipated effects of a project, in this case an educational innovation, in order to provide analyses based upon neutral expectations (Scriven, 1974; Ragsdale, 1988; Berge, 1994).

The primary method for data collection involved field work. Data were collected over a thirteen week period using participant observation techniques and archived computer conferencing transcripts. In order to observe natural interaction of the participants independent of the instructor/researcher, a second researcher recorded all student involvement in any face-to-face classes on audio tape and in field notebooks. All computer conferencing interactions were archived, thereby turning details of passing events into an account for subsequent analysis intended to discover systematic patterns of routine behavior. Observation provided a point of comparison with participants' self-reports of anticipated behavior gathered through written surveys completed.
by participants. Transcript analysis procedures (discussed in Chapter Six) revealed integration of collaborative ideas and CAIRS responses. During observation and recording stages of the research, inference was intentionally kept low. Interpretive comments were added to the field notes during the transcription process.

5.11.2. Study Process Questionnaire

Students completed the Study Process Questionnaire (SPQ) (Biggs, 1987) as part of the class standardization process. This 42 item, self-report, normed to Australian post-secondary students, yields scores for three fundamental motives for learning, three learning strategies, and the approach to learning which is formed by the combination of motives and strategies on three levels: surface, deep, and achieving (Biggs, 1987). These can be used as indicators of the approaches to learning, but not rigid categories (Whyte, 1982). Table 5.5 illustrates the meaning of these scores. The total range of scores for any factor can be used to indicate high and low students within the group. Subsequent to the course, SPQ was used to further help to explain relative performance levels of individual students with respect to the group, and hence to help explicate results of transcript content analysis.

5.11.3. General biographical questionnaire

Students completed a general biographical questionnaire (Appendix G) which asked for self-reports on educational background, computer experience, and instructional preferences. The purpose of this was to ascertain general personal information, computer literacy levels and attitudes towards computers and to assist in the subsequent elucidation of performance following the course.
Table 5.5. Study Process Questionnaire: Approaches, Motives and Strategies for Learning.

<table>
<thead>
<tr>
<th>Approach (Motive + Strategy)</th>
<th>Motive</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students using a Surface Approach (SA) retain factual detail but often miss structural relationships.</td>
<td>Students using a Surface Motive (SM) want to meet the requirements minimally; they balance between failing and working more than is necessary.</td>
<td>Students use a Surface Strategy (SS) to limit the target to the bare essentials and reproduce them through rote learning.</td>
</tr>
<tr>
<td>Students with a Deep Approach (DA) try to understand structural complexity.</td>
<td>Students with Deep Motive (DM) are intrinsically interested in what is being learned; they want to develop competence in particular academic subjects.</td>
<td>Students with Deep Strategy (DS) attempt to discover meaning by reading widely and inter-relating learning with previous relevant knowledge.</td>
</tr>
<tr>
<td>Students with an Achieving Approach (AA) perform well in exams and have good academic self concepts.</td>
<td>Students with an Achieving Motive (AM) seek to enhance ego and self-esteem through competition; they wish to obtain the highest possible grades.</td>
<td>Students with an Achieving Strategy (AS) organize time and working space; they follow up suggested readings, schedule time, and behave as 'model students'.</td>
</tr>
</tbody>
</table>

5.11.4. Follow-up interview

Field notes and computer conferencing transcripts were supplemented by informal interviews with key informants, four of the five subjects, who volunteered additional information. All interviews took place after semester completion and final grade submission. Most interviews were conducted by an assistant coordinator for continuing education at the research site. One additional follow-up interview with subject 3 was conducted by the researcher. Interviews focused upon the search techniques used within the course and their results, how students reconciled information provided by a CAIRS search, whether this reconciliation was of educational value, and whether CAIRS was an acceptable tool. A general script of the follow-up interview is included in Appendix H.
During interviews, informants were encouraged to elaborate on issues of interest and items relevant to the research. Interviews were used to explicate what was observed and to discover some of the underlying values of participants. They allowed participants to interpret the behavior which defined their culture by asking them to elaborate on observed situations and to introduce unanticipated information. All information provided during interviews was used as a research guide, subject to cross-checking through participant observation.

5.11.5. College records

Unobtrusive measures were also used for confirmatory and background purposes. The college, with the approval of students, furnished the investigator with student transcripts at the time of the completion of the course, and again, three years later. These transcripts indicated subject results and grade point averages of individuals. But since students could excel in some program-specific courses while encountering problems in others, English grades were examined in isolation in order to establish individual performance on this subject category. These were used for subsequent comparisons following the teaching of the computer conferenced course, and as a cross-check with the Study Process Questionnaire results.

5.11.6. SOLO taxonomy

A fundamental tool for establishing student levels as they progressed through the course was the SOLO (Structure of Observed Learning Outcomes) taxonomy (Biggs & Collis, 1982). This provided entry-by-entry and weekly points of contact. The application of SOLO provided a measure of the conceptual progression of students in the course. All contributions to the course, including computer conference entries, written assignments, and tests, were coded concurrently by two qualified researchers (one held an M.A. in English Literature, and the other was completing a
Ph.D. in Educational Psychology) according to the SOLO taxonomy. This taxonomy provided a five point, rank-order scale for scoring free-formed open-ended responses. It is a criterion-referenced measure which can be used for judging how much and how well an individual has learned. It relies upon high student involvement and low levels of structure provided by instructors. This describes the structure of the discussion-based course under consideration. SOLO was used with English courses by Biggs and Collis during the process of its development. As such, it has been designed to incorporate such areas as literal or metaphorical meaning, rhythm and rhyme, structural features and techniques, and the integration of cognitive reactions with affective reactions. The guide to the SOLO taxonomy that was used as a reference tool is given in Appendix I.

5.11.7. Content analysis

Content analysis of each note posted to the conferences was undertaken in order to evaluate learning processes and cognitive dimensions evident in each entry at a finer level that those measures provided by SOLO analysis. The method for content analysis involved the application of an experimental set of paired opposites developed by Newman, Webb, and Cochrane (1995). This was an evolution of the work done by Biggs on the SOLO taxonomy, in that it considered deep and surface learning manifestations, Garrison's (1992) five-stage model of critical thinking, and Henri's (1991) five dimensions for the evaluation of computer mediated communication. The intent behind Newman's categories was to measure the amount and type of critical thinking evident in each note and to provide a basis for the scoring of the textual indicators of critical thinking.
Newman's analytical method used paired opposites within ten global categories on the basis of the presence or absence of one of the indicators within each note in the database. Table 5.6 lists the pairs and categories.

Each note was scored on the basis of whether an indicator existed or not, thereby providing a score of -1. 0, or 1 depending on the value of the indicator and the existence of it within each note. Since free-formed notes could contain multiple manifestations of both positive and negative aspects of each indicator, indicators were examined in isolation, totaled for each note, and CT scores were calculated for the two halves of the database, before and after the introduction of the CAIRS system using the formula

\[
CT = \frac{(\text{Number of positive aspects}) - (\text{Number of negative aspects})}{(\text{Number of positive aspects}) + (\text{Number of negative aspects})}
\]

Three additional indicators were added to the Newman paired opposites to assist further in note identification. These fell under the general category of explicit textual referencing to notes in the class conference, notes in the Instructor conference, and notes specifically referencing CAIRS. As entries were coded, specific other entries to which they referred were noted.

5.12. General discussion

It was assumed from the basic course design, its history of delivery in traditional classroom mode, and investigation design stages of this study, that students would have the tools for discussing the subject matter, but that no single research method would prove the effect of the
<table>
<thead>
<tr>
<th>Category</th>
<th>Code +</th>
<th>Definition</th>
<th>Code -</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevance</td>
<td>R+</td>
<td>Relevant statements</td>
<td>R-</td>
<td>Irrelevant statements, diversions</td>
</tr>
<tr>
<td>Importance</td>
<td>I+</td>
<td>Important points / issues</td>
<td>I-</td>
<td>Unimportant, trivial points, issues</td>
</tr>
<tr>
<td>Novelty</td>
<td>NP+</td>
<td>New problem - related information</td>
<td>NP-</td>
<td>Repeating what has already been said</td>
</tr>
<tr>
<td>New ideas, information, solutions</td>
<td>NI+</td>
<td>New ideas for discussion</td>
<td>NI-</td>
<td>False or trivial leads</td>
</tr>
<tr>
<td></td>
<td>NS+</td>
<td>New solutions to problems</td>
<td>NS-</td>
<td>Accepting first solution offered</td>
</tr>
<tr>
<td></td>
<td>NQ+</td>
<td>Welcoming new ideas</td>
<td>NQ-</td>
<td>Squashing, putting down new ideas</td>
</tr>
<tr>
<td></td>
<td>NL+</td>
<td>Learner brings new things in</td>
<td>NL-</td>
<td>Dragged in by tutor</td>
</tr>
<tr>
<td>Bringing outside knowledge / experience to bear on problem</td>
<td>OE+</td>
<td>Drawing on personal experience</td>
<td>O-</td>
<td>Sticking to prejudice or assumptions</td>
</tr>
<tr>
<td></td>
<td>OC+</td>
<td>Refer to course material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OM+</td>
<td>Use relevant outside material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OK+</td>
<td>Evidence of using previous knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OP+</td>
<td>Course related problems brought in (e.g. students identify problems from lectures and texts)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>QQ+</td>
<td>Welcoming outside knowledge</td>
<td>QQ-</td>
<td>Squashing attempts to bring in outside knowledge</td>
</tr>
<tr>
<td>Ambiguity: clarified or confused</td>
<td>AC+</td>
<td>Clear, unambiguous statements</td>
<td>AC-</td>
<td>Confused statements</td>
</tr>
<tr>
<td></td>
<td>A+</td>
<td>Discuss ambiguities to clear them up</td>
<td>A-</td>
<td>Continue to ignore ambiguities</td>
</tr>
<tr>
<td>Linking ideas, interpretation</td>
<td>L+</td>
<td>Linking facts, ideas and notions</td>
<td>L-</td>
<td>Repeating information without making inferences or offering an interpretation.</td>
</tr>
<tr>
<td></td>
<td>L+</td>
<td>Generating new data from information collected</td>
<td>L-</td>
<td>Stating that one shares the ideas or opinions stated, without taking these further or adding any personal comments.</td>
</tr>
<tr>
<td>Justification</td>
<td>JP+</td>
<td>Providing proof or examples</td>
<td>JP-</td>
<td>Irrelevant or obscuring questions or examples</td>
</tr>
<tr>
<td></td>
<td>JS+</td>
<td>Justifying solutions or judgements</td>
<td>JS-</td>
<td>Offering judgements or solutions without explanations or justification</td>
</tr>
<tr>
<td></td>
<td>JS+</td>
<td>Setting out advantages and disadvantages of situation or solution</td>
<td>JS-</td>
<td>Offering several solutions without suggesting which is the most appropriate.</td>
</tr>
<tr>
<td>Critical assessment</td>
<td>C+</td>
<td>Critical assessment / evaluation of own or others' contributions</td>
<td>C-</td>
<td>Uncritical acceptance or unreasoned rejection</td>
</tr>
<tr>
<td></td>
<td>CT+</td>
<td>Tutor prompts for critical evaluation</td>
<td>CT-</td>
<td>Tutor uncritically accepts</td>
</tr>
<tr>
<td>Practical utility (grounding)</td>
<td>P+</td>
<td>Relate possible solutions to familiar situations</td>
<td>P-</td>
<td>Discuss in a vacuum</td>
</tr>
<tr>
<td></td>
<td>P+</td>
<td>Discuss practical utility of new ideas</td>
<td>P-</td>
<td>Suggest impractical solutions</td>
</tr>
<tr>
<td>Width of understanding (complete picture)</td>
<td>W+</td>
<td>Widen discussion (problem within a larger perspective. Intervention strategies within a wider framework.)</td>
<td>W-</td>
<td>Narrow discussion. (Address bits or fragments of situation. Suggest glib, partial, interventions)</td>
</tr>
</tbody>
</table>
CAIRS procedure. The nature of the study entailed that many variables could not be controlled. Nevertheless, the intention behind the study design was to provide avenues for exploring results and indicators of likelihood based upon multiple perspectives of the same issues.
Chapter 6.

OUTCOMES OF THE FULLER STUDY

6.1. Introduction

Since this thesis investigates whether the use of a natural language information retrieval system is a useful, consistent, and effective addition to the use of computer conferencing in education, this results section intends to show two specific results; namely, that students' critical thinking, as manifested in written conferencing entries, remained constant or improved following the introduction of the CAIRS treatment, and that students found the CAIRS procedure to be a usable and useful addition to their conferencing experience.

This chapter considers the implications of group stabilization, group activity in the conferences and critical thinking indicators before and after the introduction of the treatment in the experimental course. It examines subject responses to general and annotated sample runs of the IR system, and expert validation of both the runs and the student responses. It also considers individual case studies and their implications.

6.2. Group issues: Group stabilization

Although results are based upon a group of five subjects, there was originally a registered enrollment of ten students. This was augmented by one transferred student (student 3), one late registrant (student 5), and the on-line stooge, Anne Student. One student (student 1), although registered at the beginning of the course, started late due to her return date from a family holiday.
As anticipated, and consistent with regular face-to-face, upper-level, optional classes, enrollment dropped rapidly, stabilizing at five students by the third week. Four students who dropped out reported that they had misread the Academic Calendar description and were unprepared to take a subject by computer conferencing. Two students who spoke English as a second language reported that they felt that the writing requirements and literary vocabulary were beyond their abilities. One student who had been performing at a B grade level dropped the course for personal reasons at the end of the third week, the official college drop date, but, in a subsequent semester, re-enrolled in the conferencing section and achieved a final grade of A. The on-line stooge, Anne Student, whose purpose was to model participation in a computer conferencing class, was discontinued during the fourth week, after the remaining subjects had become comfortable with computer conferencing interaction and the first on-line seminar had been delivered as a model. The remaining five students completed the course, and four of these participated in voluntary, follow-up interviews.

6.2.1. Study Process Questionnaire

Data on the students' approaches to learning was collected through the administration of the Study Process Questionnaire (Biggs, 1987) which measures learning motives and strategies on three levels. This 42 item, self-report questionnaire measures six factors influencing a personal approach to learning, yielding scores on three basic motives for learning, three learning strategies, and three approaches to learning which are formed as an additive result of motives and strategies.

Table 6.1 summarizes the group results for SPQ with the stabilized group. Table 6.2 presents individual results, which are discussed further in later in this chapter. Although the questionnaire was developed with Australian students, the following assumptions were made:
1. Subjects under examination would interpret the questions as they were meant and in the same manner as Australian subjects.

2. The goals of education are generally comparable between Ontario and Australia.

<table>
<thead>
<tr>
<th>Table 6.1.</th>
<th>General SPQ Results for Computer Conferencing Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure</td>
<td>SM</td>
</tr>
<tr>
<td>Mean</td>
<td>15.8</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>1.3</td>
</tr>
<tr>
<td>Min.</td>
<td>14</td>
</tr>
<tr>
<td>Max.</td>
<td>17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 6.2.</th>
<th>SPQ results by subject.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject</td>
<td>SPQ</td>
</tr>
<tr>
<td>Student 1</td>
<td>15</td>
</tr>
<tr>
<td>Student 2</td>
<td>17</td>
</tr>
<tr>
<td>Student 3</td>
<td>16</td>
</tr>
<tr>
<td>Student 4</td>
<td>17</td>
</tr>
<tr>
<td>Student 5</td>
<td>14</td>
</tr>
</tbody>
</table>

While consideration of minimum and maximum scores, and standard deviations indicate differences within the group, results suggest that the group mean focused on surface approaches, motives, and strategies. Research by Biggs (1987) has shown that students who use a predominantly surface approach generally plan to terminate their academic career following their first qualification. This is consistent with the profile of college students suggested by Fedderson (1993), the practical, career-oriented education offered by the Ontario community colleges and
information provided to the researcher by subjects through the general biographical questionnaire, biographical notes in the *Introducing* conference, and through personal notes to the instructor.

### 6.2.2. General biographical questionnaire

The general biographical questionnaire was designed to elicit personal responses to a series of learning-related issues. The questionnaire is provided in Appendix G. Analysis of answers to questions showed that the audience for the CAIRS treatment was internally consistent.

Responses to general questions showed the following:

* No subject had completed a university degree, although two subjects reported completing previous college certificates.

* All students had easy access to computers and communications facilities, either from home or through their employment.

* Subjects could type at least twenty-five words per minute and reported familiarity with at least one word processing package. Four subjects reported familiarity with at least three software packages. The fifth subject reported familiarity with a word processing package only.

* All subjects reported that they had taken courses which involved extensive discussion with classmates.

Further, responses to questions focused around computer usage reported the following:

* Subjects enjoyed discussing course requirements with classmates.

* Subjects knew that this course was offered through computer conferencing.
Subjects believed that the use of the computer would help to tailor course presentation to their personal needs.

Subjects believed that the computer would either help them to become active learners or, at least, would not hinder them.

Subjects did not anticipate mechanical difficulties or other course delivery-problems.

Subjects felt that conferencing would allow them to set a pace for learning which was personally appropriate within the semester structure.

6.2.3. Quantitative analysis

The CAIRS treatment was introduced to subjects during the eighth week of the course, following the mid-term test at the end of week 7, and the introduction of the Parti FIND command in week 5. General indicators suggest that a positive change may be associated with the introduction of the CAIRS procedure.

6.2.3.1. Event influence

Particular events within the course appeared to have direct influence on the numbers of notes contributed, and the quality of those notes. While steady conference participation was expected, events such as the mid-term test at the end of week 7, the due date for the major essay in week 12, and the final examination in week 13 all appeared to have direct, negative influence on both the quality and quantity of notes contributed. While there is no specific, documented explanation for this, it is likely to be the result of subjects focusing upon external evaluative events.
6.2.3.2. Conference activity

Table 6.3 provides the number of notes entered by subjects per week. Throughout the course, subjects were given regular, private feedback by the instructor which actively encouraged participation. Further, public instructor notes, documented in Chapter 5 were intended to stimulate interaction between students.

<table>
<thead>
<tr>
<th>Week</th>
<th>Student</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>0</td>
<td>2</td>
<td>10</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>7</td>
<td>0</td>
<td>8</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>7</td>
<td>6</td>
<td>11</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>8</td>
<td>8</td>
<td>12</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>7</td>
<td>3</td>
<td>13</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>7</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>7</td>
<td>0</td>
<td>20</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>11</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>1</td>
<td>6</td>
<td>5</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>15</td>
<td>7</td>
<td>5</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>8</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>8</td>
</tr>
</tbody>
</table>

While there is a difference in the weekly number of notes entered by subject, this pattern will be discussed in the case study section of this chapter. Table 6.4 summarizes the mean number of notes per week by subject and the total number of notes per week before and after the introduction of CAIRS.
Table 6.4. Summary of notes entered per week by subject and cumulative totals.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Total Notes Part 1</th>
<th>Mean Per Week</th>
<th>Total Notes Part 2</th>
<th>Mean Per Week</th>
<th>Total Number of Notes</th>
<th>Mean Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35</td>
<td>5</td>
<td>42</td>
<td>7</td>
<td>77</td>
<td>5.9</td>
</tr>
<tr>
<td>2</td>
<td>23</td>
<td>3.3</td>
<td>17</td>
<td>2.8</td>
<td>40</td>
<td>3.1</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>10</td>
<td>42</td>
<td>7</td>
<td>112</td>
<td>8.6</td>
</tr>
<tr>
<td>4</td>
<td>46</td>
<td>6.6</td>
<td>46</td>
<td>7.7</td>
<td>92</td>
<td>7.1</td>
</tr>
<tr>
<td>5</td>
<td>36</td>
<td>5.1</td>
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<td>Weekly Mean</td>
<td>Total Notes Part 2</td>
<td>Weekly Mean</td>
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<td>30</td>
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<td>195</td>
<td>32.5</td>
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6.2.3.3. SOLO analysis by group

Table 6.5 displays the mean results of SOLO content analysis of conference entries, by week, developed by two independent researchers using the Structure of Observed Learning Outcomes taxonomy. SOLO provides a five-point scale and transitional levels which is used to evaluate the quality of learning in student responses. Individual SOLO scores are discussed in the case study sections.

Notes were scored in isolation, regardless of their order in the general discussion. Language inconsistencies were disregarded since the independent researchers read for conceptual content rather than verbal expression. While agreement between the two independent coders was 62%, disagreements were resolved through discussion. Most disagreements focused upon transitional notes, scored as plus or minus, which had been scored, for example, as 3+ by one coder, and 4− by the other.
Table 6.5. Mean SOLO scores by subject and week. The final mean has been adjusted to reflect missing data for weeks in which subjects did not post notes.

<table>
<thead>
<tr>
<th>Week</th>
<th>Subject 1</th>
<th>Subject 2</th>
<th>Subject 3</th>
<th>Subject 4</th>
<th>Subject 5</th>
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<td>3.6</td>
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<td>3.9</td>
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</tbody>
</table>

Figure 6.1 displays the mean results of SOLO analysis for the computer conferencing class.

![SOLO weekly average score, all students](image)

Figure 6.1. SOLO weekly average score, all students.
As a point of interest, this SOLO output was compared to the SOLO scores assigned to the brief writing assignments given to the face-to-face class. Table 6.6 displays these results. SOLO scores for the face-to-face class (n=11) were stable throughout the course, averaging 4.0 over eight assignments with an average low of 3.9 and high of 4.2. Within the scores for individual students, there was little variation from their means.

Table 6.6. SOLO scores on the written assignments for the face-to-face class.

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Subject</th>
<th>1</th>
<th>2</th>
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<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>Mean</th>
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</tbody>
</table>

Unlike the scores for the face-to-face class, SOLO scores for the computer conferencing class display a general trend upward in the critical thinking contained in student notes. The weekly means before and after the introduction of the CAIRS procedure changed from 3.7 to 4.0 overall, indicating that the depth of thinking as evidenced by student notes generally increased. While this

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1 The students in the face-to-face class completed the same informed consent form (Appendix J) as did the mixed-mode class. Two students declined to participate, and their assignments were not supplied to the coders.

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cannot be attributed directly to the introduction of the CAIRS treatment, and may simply be a result of the direct student involvement in discussion, it does show some change following the introduction of CAIRS. The obvious dip in SOLO scores at week 9, immediately following the introduction of the CAIRS treatment, can be attributed to confusion on the part of subjects as to what they were expected to do and how they were expected to interpret the results of CAIRS outputs. This potential confusion was addressed through the provision of CAIRS samples, one of which contained annotated considerations for interpretation, and further, on-line instruction on query formulation and output interpretation.

6.2.3.4. Critical thinking (CT) output.

Two CT scores were calculated for the database based upon all notes entered before, and all notes entered after the introduction of the CAIRS system in order to provide an alternative view to that indicated by the SOLO coding. Scores rose from 0.63 for the first half of the course to 0.66 for the second half. This small but positive change suggests that the introduction and use of the CAIRS information retrieval procedure did not have a negative effect on student learning.

6.2.4. Discussion

Both the SOLO and the critical thinking scores suggest some change in the group learning followed the introduction of the CAIRS system. But this cannot be considered as empirical evidence for the effectiveness of CAIRS. Other uncontrollable variables were also present, most notably the use of computer conferencing itself and the number of subjects under consideration.
6.3. CAIRS presentation and usage

CAIRS usage by subjects was sporadic. Subjects posed a total of sixteen queries through CAIRS and each subject posed at least two queries. In addition, two CAIRS assignments were given which were largely ignored, since, according to information provided in follow-up interviews, they did not have any grading motivation attached to them. This is consistent with the SPQ results for the group. Three CAIRS examples, one of which contained a general analysis of the response by note, were also included in the CAIRS 2 conference.

6.3.1. Limits of CAIRS training

As a result of the suggestions made by participants in the computer conferencing pilot study, and in order to attempt to stimulate higher-order questioning, students were given a hand-out on CAIRS that provided an overview of the system and its application; this is shown in Appendix F. This had followed a hand-out on Parti search procedures distributed in the fifth week, shown in Appendix E. and assumed subject usage of Parti search. Both of these search procedures introduced subjects to the idea of linking pieces of information and reconciling them for a personal interpretation. But even with the CAIRS hand-out, students showed confusion about posing queries; for example, the first query posed to CAIRS asked, "What did the romantic poets say about truth and literature?" CAIRS operated very poorly on this query since insufficient information was provided in either the query or was contained in the controlled vocabulary of the database. Subjects needed further instruction on the query procedure.

As a result, the instructor posed a series of notes on query formulation and how CAIRS worked in the on-line conferences. The following note, number three in the CAIRS 2 conference, provides an example of the way students were instructed further on query formulation:

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POsing QUESTIONS IN CAIRS
As I mentioncd in class, there is an art to asking a question. The more context which you can provide, the better the answer becomes. Let me give you an example:

You are in the country. You point to a piece of land with crops growing on it and say "What's that?" The answer is a farm, or a field. If you ask "What is that growing in the field" the answer will be more precise. You have provided a context for your answer. If you ask, "What is that building on the edge of the corn field", the answer becomes a barn or a house. Again, because you provided a framework for your question, the answer can be more exact.

Think of it as the difference between a shotgun approach as opposed to a rifle. The shotgun, like a very general question, will hit everything in sight but with little precision. The rifle will hit a target precisely.

The PARTI FIND command provides you with a shotgun approach. If you look for the word 'meter', it will return 7 notes, in no particular order. It goes looking for everything that mentions the word. CAIRS is like a rifle: asking about the relationship between meter and meaning in Romantic poetry will return a limited but focused subset.

I strongly suggest that in posing a question through CAIRS, you write two or three sentences explaining the kind of thing that you are seeking. This will focus the search to what you want.

The system will treat each note as a question, so when you want to ask multiple questions, place them in separate notes.

This kind of instruction was intended to encourage students to consider their information needs in more detail. With one notable exception, that of Student 2 presented and discussed in section 6.4.2, student queries did become more precise and meaningful; hence, CAIRS responses could become more appropriate.

6.3.2. Literary warrant changes over time

While vocabulary control procedures remained constant, literary warrant, the required number of observations per variable in order to judge it as an important part of the database, as expected,
changed over time and by query. For this experiment, the intent behind the decision on literary warrant was to maintain the maximum information in any note while still providing for a convergence of the matrix using principal component analysis. Literary warrant was not an automated procedure: rather, it was held as low as possible at the point of matrix creation throughout the experiment, and increased only when statistical calculations required it.

6.3.3. Sample CAIRS queries and analyses

In this section, two sample CAIRS queries are presented. Following each sample are student responses to it. The second example also includes an expert's answer to the same query and using the same CAIRS output as a point of comparison. Further, following the CAIRS sample is the expert's analysis of CAIRS as a deconstructive operation, and a second expert's response to a CAIRS output produced following the completion of the course and operating on a broad query.

6.3.3.1. Annotated CAIRS response

After an initial sample CAIRS query and response were posted for students, in a second sample the instructor annotated each note in the responses in order to show subjects how to look at CAIRS output. This second example was presented to subjects eight days after the first example, and two weeks after the introduction of the CAIRS treatment. The reason for presenting this example was that subjects had failed to respond to the first example or the follow up, explanatory notes about query formulation. It was decided that subjects needed a second, annotated model as an example of CAIRS interpretation.

The note selected as the CAIRS seed was one written by the instructor as the on-line stooge, Anne Student, at the end of the first week of the course. In formatting the output, conference
headers were deleted, notes were presented in the order of their loading weight in principal component analysis, and the loading of each note was given. This was done to eliminate bias due to authorship of notes, and to provide a direction on interpretation. Instructor annotations were preceded and followed by "***". The full output of this run is provided in Appendix K. Only instructor annotations are provided here, following the sample query. Each note returned is preceded by its note code, and loadings are used to indicate the degree of importance of the note with regard to the original query.

I thought you would be interested in seeing a CAIRS run on a broad question that we have considered during the course. I took a note from early in the "LITERATURE" conference and made it into a question:

CAIRS QUESTION:
Many poems are about making use of the time that we have. But I get a sense of fear from the poets, particularly through the undertone of death that we see in some references, like Easter and snow. There seems to be a sense of urgency and helplessness in that the inevitable - death - is going to catch up. Is this right in poetry?

The question is basically asking about how the attitude towards death is presented in poetry as a whole. After each of the 10 notes returned, I have included a comment on what it might suggest in relation to this question.

At the end of this note, I will ask you to summarize the CAIRS response in a note that you post to "LITERATURE".

CAIRS RESPONSE:

||noteli384|| LOAD .75
*** This is certainly putting forward the argument that people do fight against the inevitability of death, and this is appropriate. But what is the attitude of the father? ***

||noteli389|| LOAD .68
*** Here we are given the idea that the defiance of death is an attitude that is common to all mankind. But once again there is the issue of the attitude of the father. This can lead one to think that maybe fear and defiance is not the only attitude that poets present towards death. ***
This note looks at poetic techniques. But notice the contrasts that are mentioned. First, there is the contrast between "Rage, rage" and "that good night", and second, there is the contrasted attitude of the father and son. It seems that fear and defiance are not the only type of attitude that poets put forward. ***

*** Seems like the undertone of fear is very strong. The urgency of life is clear.
***

Hmmmm... Death seems to be a necessary, and positive, part of life. This is expressed through feeling. How fearful does this sound? ***

This sounds a little bit like "Rage, rage against the dying of the light" mentioned in the first few notes... [more of the original note follows]*** No, this is different to "Rage, rage..." This is openly welcoming death as an adventure. The idea of fear is absent. This is more a heroic acceptance. ***

This note seems to address the issue of the poetic references to death. It's showing how an image can have a double meaning, and a double use in one poem. ***

Another image of death. But there is no fear or doubt. Instead, we have the sense of death as the appropriate, or correct thing. It also makes me think of the attitude of the dying father in "Do Not Go Gentle into That Good Night." Is this the kind of attitude that you see in the father? ***

This is a poetic image of fear. The story teller seems to be afraid of the monsters of this world. Then there is the hero who is going out to face the monsters. Sounds a bit like Ulysses. How does this response relate to a question about the poetic portrayal of death? ***

This note certainly mentions the urgency of life, Easter, and snow but it didn't rank as highly as other notes. What it does do is show us traditional images being used for opposite purposes. Easter, the time of spring, is here discussed as a time of death. ***

Following this annotated example, subjects were asked to provide a summary of it:
You have just gone through a good CAIRS response to the following question: *Many poems are about making use of the time that we have. But I get a sense of fear from the poets, particularly through the undertone of death that we see in some references, like Easter and snow. There seems to be a sense of urgency and helplessness in that the inevitable - death - is going to catch up. Is this right in poetry? How would you summarize the CAIRS response in answer to this?*

Only one subject, Student 1. provided a summary for this example. Most of this response follows the annotated CAIRS output sequentially.

Re : CAIRS 2 on "how the attitude towards death is presented in poetry"

Here is my summary on the CAIRS responses on the above topic. Basically, there are two attitudes towards death presented in poetry. First is "fear" and second is "defiance". In "Do not go gentle into that Good Night", these two attitudes are obvious. The son is fear of death because it will take his father away, he pleads his father to fight for life. On the other hand, the father is defiance of death, he has no fear nor doubt of death as if it is part of life.

Besides these basic attitudes, some people treat death as a necessity, a positive part of life. In "Ode to the West Wind" the destruction, the sweeping away of the old must occur before any new life come. It comes naturally just like winter goes and spring comes.

Some treat death as an adventure. They even describe journey of death and the process of dying, like "Ulysses" is predicting his own eventual death and expecting it would be like the adventures he enjoyed in the past.

From death, we are guided to life. The image of death can have a double meaning, that is image of life. In "Crossing the Bar", the bar is the boundary separating life and death, however, the poet requests "no moaning of the bar" or "...no sadness of farewell", it again brings out the no fear and no doubt (defiance) basic attitude towards death.

Furthermore, related attitudes such as "poetic image of fear" in "Jabberwocky" and "Easter as a time of death" in "Loveliest of Trees" are also mentioned.

This response is, largely, a reiteration of the instructor annotations to notes in the CAIRS response. While it shows a difficulty with the internalization of information and an engagement with personal, critical thought, it illustrates willingness to become engaged in the experiment. This
is in keeping with the general SPQ results which show that students operated on a surface level. If this response is taken as representative of the group, it illustrates that subjects did read and think about the juxtaposition of information provided through CAIRS. Since case studies will show that subjects sought CAIRS output in response to personally defined information needs, this can be considered an acceptable assumption.

6.3.3.2. A second CAIRS example

The following entry is the last note posted to the CAIRS 2 conference. It was posted at the end of the twelfth week of the course, after students had submitted their major essays and while they were beginning to prepare for the final examination. While this group of notes was found in the output of a CAIRS run in response to a student query, since the principal component analysis procedure clustered related notes together, it was a simple process to isolate and analyze this cluster. The complete cluster is provided in Appendix L.

Hi gang.
I was looking through the CAIRS output for Paula’s last question, and I found another, interesting group of notes. As you know, one of the things I’ve been asking you to do for the last 13 weeks is to consider the implication of the details that a writer uses. The following note in "CAIRS 2" is the top 10 notes in a cluster which shows that the implications of the superficial details of a work can lead to a completely contrasting statement of meaning. As you know, we need to look at the implications of ideas and details as we construct our statement of theme.

Write a note and post it to "LITERATURE". What does this group of notes suggest about the implication of details, as they relate to meaning in literature? The group of notes is about 4 pages long.

The CAIRS output generally addressed the sense of contrast and paradox which becomes apparent in poetry through the manipulation of details. Collectively, while maintaining a strong sense of conditionality in statements, thereby leaving open the possibility of contradiction, the
output suggests that there is a need to find resolution of the contrast, and closure on a personal level.

Two subjects responded to this cluster of notes. The first of these responses provided a synthesis of the CAIRS response, augmented by personal opinion. The second response looked at individual CAIRS elements in particular while augmenting it with outside knowledge. While the opening statement by the instructor contained an element of an advanced organizer for students, 
"... a cluster which shows that the implications of the superficial details of a work can lead to a completely contrasting statement of meaning...", neither of these responses focused upon this. Both responses used the CAIRS output by the end of the treatment as a stimulus for higher order thinking, and both responses were coded as extended abstract in SOLO by the independent SOLO coders.

The first subject has provided a high level, general synthesis of the CAIRS response without focusing on any particular piece mentioned. The response supports the idea of personal resolution, drawing upon sources external to CAIRS for support of the thesis:

Student 3 Re- CAIRS 2 response on details in Literature.
The variety of details and their effect on the selected poems and their overall effect on literature is in keeping with T.S. Eliot's ideas on truth in literature. He states that truth is left completely up to the individual as no two people are the same. The analysis of the details in each poem seems to support this concept. We have all looked at these poems but may not have come to the same conclusion about the meanings of the details within.

Also, while the details in one poem support a certain theory another poem may completely disagree. But no one can say with confidence that one is right and another is wrong.

There are two types of details, those which support the basic idea of the poem and those which move towards the contrary. It is the contrary details which cause us to
look deeper into the possible meaning of the poem. This is where our personal perception comes in. Each of us has a separate impression of each possible meaning. This means that there are indeed very few definite rules that are universally agreed on when analyzing a poem. Does this help at all?

Like the first student response, the second moves beyond the content of the CAIRS output. The student has picked up the idea that details provide hints and implications, but it is up to the reader to resolve these on an individual basis. Unlike the first response, this focuses on individual pieces and seeks closure on each in order to support the thesis.

Student 1 Re: CAIRS 2: Relationship between details and meaning in literature

Poetry, as well as other literature, leads mankind to virtuous action. Literature creates an ideal world and let readers know what perfection is, therefore it has the ability to move mankind for truth, goodness and beauty.

There are many ways writers present their ideas. Some speak ideas out directly, like Francis Bacon's "Of Studies" or Alexander Pope's "Essay on Criticism", but these works seem too bossy. Readers may not agree wholly with them. Some speak ideas out indirectly, they imply their ideas by giving hints to readers, lead them to think about the ideas themselves. It is all up to the readers on the depth of their understanding of the writers' hidden meaning or the extent of their approval on the writers' ideas.

As a matter of fact, a lot of literature use implication to hint the actual meaning. The superficial details of a work always lead to completely contrasting meanings. In Housman's "Loveliest of Trees", superficially, it talks about the beauty of blooming tree, but actually it tells people life is short, so live it, take advantage of what you get, because when you die, you have nothing.

In Wordsworth's "The World is too much with us", besides telling the poet's meditation by the sea, it hints that "as humans we are so concerned about ourselves that we would never expose ourselves. If we were more in tune with nature, we would not feel threatened."

In Tennyson's "Ulysses", it talks about an old king and his voyages, on top of that, it hints that "he is still looking for something more, for some extra challenge, extra goal in his life". His followers, the mariners are the ones that have the same feeling of him: "Free hearts, free foreheads", they are the ones that can shake off human boundaries and seek for further desires of life.
In Keats's "Ode on a Grecian urn", it focuses on the contrast between life and art, in art, there are eternal life and happiness, in real life, there are unsatisfying and sorrow. The images presented by the urn try to imply the nature of beauty and truth. The images in the urn is timeless but human world is temporal, art has all the eternal beauty and truth.

In Coleridge's "Frost at midnight", we can tell that the expectation of a father to his son. In the contrasting of the two life styles, obviously, the father wants his son's life a different from his.

Same as Blake's "The Lamb" and Tennyson's "Crossing the Bar", the writers are trying to hint something. The white colour of a lamb hints for purity and innocent, while the "bar" hints for the boundary of life and death.

Given the full CAIRS output provided in Appendix L, these are both strong responses that demonstrate higher order thinking. Students were able to synthesize the response. Both students use the CAIRS response as a stimulus to their personal thinking, and their responses demonstrate that they are able to incorporate the diversity of the output into their knowledge scaffolding.

6.3.4. Deconstructionism and CAIRS

This same, second CAIRS output was given to an independent researcher for analysis. This researcher was completing a doctoral thesis in deconstructionism in literature and had taught both composition and literature at the college level for six years. He was given the output with no further direction, other than the meaning of the principal component ranking as indicating a degree of importance, and asked to answer the same query posed to the students; namely, "What does this group of notes suggest about the implications of ideas and details as we construct our statement of theme?" His response follows:

The more astute/careful/experienced/able readers clearly pick up on the fact that the accumulation of detail is a central factor in developing a determinate sense of meaning in a poem, but for the "expert" reader, details do not need to be aligned. The more expert reader picks up on the majority of salient details on a wide
variety of levels (image, diction, style, meter, metaphor, and so on) and measures how the details are either consonant or dissonant with the general thrust of his or her interpretation. Of course, what this type of reader understands is that many of the details will be paradoxical or at least contradictory, and the expert reader does not feel a necessity to make all the details "fit" into an interpretation. Expert readers are more comfortable with notions of ambiguity and disharmony than are less expert readers.

While largely ignoring the implication of the note rankings, like the students, this expert has picked up on the potential ambiguity of detail and the personal nature of interpretation. Of course, this expert approached the question at a significantly higher, more synoptic level than the college students: nevertheless, there is consistency between his answer and those of the students. This supports the assertion that the reconciliation of the CAIRS response by students was possible and could be successfully handled.

6.3.4.1. A deconstructionist reading of the CAIRS run

The validating researcher who commented upon the second CAIRS output also provided a deconstructionist discussion of the output. His comments follow:

Deconstructively, the responses underline that readings (as opposed to interpretations) often intuitively recognize the inherent disjunction between apparent or surface meaning and the ways in which specific details don't conform to that meaning. One of Derrida's seminal insights is that very frequently details of the text work against or disrupt the ostensible message of the work of literature. As well, some of the responses, such as Noteli13, pick up on the fact that logic and language don't always work in tandem. In looking at the specific detail of the season and noting that the detail of "snow" doesn't make any "logical, sequential" sense; nonetheless, the reader also recognizes that there are possible meanings that he/she may or may not be able to pick up.

As a nexus of interpretation, perhaps the most overtly deconstructive aspect of CAIRS is the fact that it leads to an open-ended, inter-interpreter mode of reading that allows for readings to inter-penetrate and feed off of each other without "competing" directly for superiority.
This explicitly deconstructionist reading of the CAIRS output, without access to the student responses, underlines a success of the system. The sense of inter-participant connectivity -- of personally potential reconciliation and convergence of content -- among participants is successfully facilitated by the CAIRS output while no single interpretation is imposed upon the subjects from outside the developing universe of discourse.

6.3.4.2. CAIRS: The deconstruction cognitive operation

While consistent with deconstructivist theory which suggests that absolute meaning can never be finally identified as long as the provision for discussion continues, the nature of the output from the CAIRS procedure was subject to change as long as further notes were being entered, and the breadth and content of the statistical matrix was subject to change. However, in order to test the validity of the CAIRS responses, a final test of the data was run following the completion of the course. At that point, the database was complete since nothing further was being added to it.

In order to test the validity of the response, a test question was created. Information bearing terms are italicized:

_Reality in literature_ can be both _personal_ and _generalizable_. It is _personal_ to the _writer_ who _creates_ within the confines of _imagination, history, and tradition_, but it is _intended_ to be _general_ for _readers_ who may _consider_ works from different _experiences_, and _interpret_ from their own _sense of truth_. But if _truth is absolute_, can this _paradox of literature_ be _resolved_?

In creating this query, the intent was to use as many information bearing terms as possible while maintaining little repetition so as to cast a broad net into the database. Consequently, this query contains twenty-two information bearing terms and only two repeated terms. In establishing literary warrant for the creation of the matrix, the intent was to maintain as low a warrant as
possible while maintaining the highest possible loading of the note. The initial test matrix used a
warrant of five observations per variable. This warrant was moved up in successive runs to eleven
observations per variable at which point there was no solution. Note weightings ranged from a low
of 0.30 for a warrant of five, to a high of 0.45 for a warrant of ten. At warrant of nine, the note
loaded at 0.43 in factor 18 and yielded sixteen notes loading at 0.3 or better. Of these the top ten,
loading at 0.39 or better, were selected for expert evaluation.

This output was given to a second external researcher who was completing a Ph.D. in English
Literature and who had five years experience as a composition and literature instructor at the
college level. He was given specific direction neither on what was sought nor on how notes were
selected but was briefed on what their principal component loadings meant; he was simply asked to
evaluate the CAIRS response and provide a brief report of his analysis. He reported the following:

The way the system has answered the question is by addressing different
components with different emphases -- but overall what students seem to be doing
is enacting inside their various answers a sense in which "truths" in question are a
function of the process of their own readerly analysis. The students pose various
philosophical queries, advance hypotheses, and follow their implications as a
means to pose further queries, but nowhere is the attempt made to provide THE
ANSWER [emphasis in original]. Each answer on some level dramatizes a process
whereby the student bridges that gap of personal and general: some students are
more self-conscious about doing this than others, but this is how virtually all are
answering the question -- not with a nugget of truth (Eureka!) that shuts down
discussion (X is how you get to from personal to general truth), but with an
involvement of themselves (personal) and relationship of that to their personal
understanding of the more general implications of the poem. Pretty cool, actually -
- there's a real subtlety to this, as opposed to the usual idiot oversimplification.

This analysis tends to focus on the content of the CAIRS output. But in confirmation of the
statements made by the previous external evaluator, no doubt is expressed about the
appropriateness of the output; rather, it is simply accepted as valid. A number of key issues pertain
to the application of the literary theory discussed in Chapter 5. While students used practical
criticism as their analytical toolbox. This analysis clearly focuses around reader response criticism in which reading and meaning are active acts of personal creation from individual perceptions of external manifestations. The CAIRS response suggests that, even in the static database, absolute meaning is a dialectic condition of undecidability, subject to discussion. While the CAIRS response provided to this external researcher was judged to contain "...a real subtlety...", the external researcher's evaluation of the full database was that it did contain examples of "...the usual idiot oversimplification...", but these marginal notes, which included absolute statements and simple paraphrases, had not been selected through the CAIRS analysis. Their factor loadings had fallen below |0.3|, and so they had been discarded. The external researcher's judgement was that the CAIRS output contained an appropriate neighbourhood of response to the original query.

6.3.5. General discussion

Discussions of Parti Search procedures, and the introduction and samples of CAIRS presented subjects with the idea of linking information, resolving cognitive conflicts, and evaluating responses. This was an unaccustomed activity for subjects operating at a surface level.

Evidence suggests that the introduction and use of the CAIRS natural language information retrieval system had a neutral or positive effect on the subjects' ability to engage in critical and analytical thinking. Both SOLO and Critical Thinking indicators show a difference in student thinking following the introduction and use of the system; however, because of the small sample size, no stronger conclusion can be drawn.

Student syntheses of CAIRS outputs indicate that, following appropriate instruction, responding subjects were capable of synthesizing the output at a personal level, and this synthesis
was consistent with that supplied by experts in the field. Expert analysis further suggests that the CAIRS output was robust at both the course level, and at the level of theoretical literary criticism. Further, with respect to both theoretical criticism and subject content, the CAIRS procedure indicates a conceptual convergence of content to be finally resolved by the individuals and in response to their personally defined information needs.

These results are explored further in the remainder of this chapter, in which usage of CAIRS by students at different academic levels but within the same course is examined.

6.4. Case studies: The acceptability of automated information retrieval

Of the five subjects who participated in this study, four consented to follow-up interviews in which they were encouraged to discuss the course in general, the use of computer conferencing as a teaching method at the community college level, and the utility of information retrieval in general and the CAIRS system in particular. Interviews were conducted by an assistant coordinator at the college, after the course was completed and students had been informed of their final marks.

It should be noted that interviews served a dual function in that the college was actively evaluating computer conferencing as a teaching method. This aspect of the interview has been edited out in the following case studies.

The case studies present student profiles, document the use of the CAIRS system, and, where information exists, their evaluation of the system. All subject names have been changed and the order of presentation is incidental. Student queries selected for inclusion in the case studies are
those which contain a high number of information bearing terms and for which the best responses were retrieved

6.4.1. Student 1, Doris

6.4.1.1. Background

Doris was a recent immigrant to Canada who used English as a second language outside of the home; however, having studied English before immigrating to Canada, both her written and oral proficiency were good. She had completed sixteen of the twenty credits required for the Library Techniques program at the college, and she held a cumulative grade point average of 3.2 on a four point scale. She achieved a final grade of B in the course under consideration which was required for her program and followed an earlier course, Origins of Literature. This prior course had been taught by the same instructor and had used the same basic approach to the critical analysis of literature. Students in that class had been informed of this experimental teaching method and its relation to doctoral research, and Doris had chosen to participate in it. Doris subsequently graduated with a grade point average of 3.3.

During this semester, she was taking three general education subjects and reported that she was working seventeen hours per week as a Library Assistant, handling general circulation and periodical indexing. She started the course two weeks late because she had been overseas. She did not own a computer when she started the course but did purchase one during her second week in the course.
6.4.1.2. Study Process Questionnaire

Analysis of the Study Process Questionnaire showed that Doris predominantly displayed Surface Strategy, Achieving Motivation, and Achieving Approach. This suggested that her intention was to achieve the highest possible grade, whether the material was interesting or not, that she attempted to limit her learning to the bare essentials and reproduce them by rote, and that her performance on tests of factual knowledge should be consistently high. This held true on the mid-term and final examination on which she attempted to produce factually correct, rote answers.

6.4.1.3. Quantitative analysis

Table 6.7 summarizes the number of weekly entries, SOLO scores and CT scores for Doris' entries.

<table>
<thead>
<tr>
<th>Week</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Notes</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>7</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>11</td>
<td>1</td>
<td>15</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Solo Score</td>
<td>0</td>
<td>0</td>
<td>3.9</td>
<td>3.6</td>
<td>3.5</td>
<td>4.7</td>
<td>4.1</td>
<td>4.3</td>
<td>4.7</td>
<td>4.3</td>
<td>0</td>
<td>3.8</td>
<td></td>
</tr>
<tr>
<td>CT Ratio</td>
<td>0</td>
<td>0</td>
<td>.23</td>
<td>.41</td>
<td>.84</td>
<td>.68</td>
<td>.71</td>
<td>.85</td>
<td>.31</td>
<td>.78</td>
<td>.59</td>
<td>0</td>
<td>.74</td>
</tr>
</tbody>
</table>

Posting patterns

There was no consistent pattern for Doris' logon schedule. As reported in section 6.2.3.2, she posted an average of 5.9 notes per week over thirteen weeks; however, when this is adjusted to exclude the first two weeks, during which time she did not logon at all, she averaged seven notes posted per week, the number of expected posting prescribed in the course outline. This is consistent with the results of the Study Process Questionnaire in that she was limiting learning to essential requirements. But significantly, many of Doris' notes were based upon the use of outside critical
resources rather than personal critical thinking. This too reflects upon her desire to present correct or acceptable answers to the instructor.

Date and time stamps on notes indicate that she tended to logon late in the week and post all required notes in one or two sessions. This limited the level of conversational interaction in which she could participate and indicated that she tended to use the computer conferencing environment as part of a self-directed course rather than a participative environment. Consequently, few of her notes contain explicit cross-referencing to those of other participants.

SOLO patterns

While performing well throughout the course, there were the expected drops at weeks seven and twelve, corresponding with the mid-term examination and the essay due date. During the first half of the course, her SOLO score averaged 4.0 and, in the second half of the subject, following the introduction of the CAIRS treatment, her SOLO score averaged 4.2. This suggests that she was consistently working at the relational level, within the confines of the subject parameters.

CT scores

Table 6.7 shows that Doris' critical thinking patterns increased somewhat as the subject progressed, particularly following the introduction of the CAIRS procedure. Her mean CT ratio prior to the introduction of the CAIRS system was 0.57 and, following the introduction, the mean increased to 0.65.
6.4.1.4. Query postings and analysis

She posted four queries to the system after it was introduced and following instructor direction on how to pose a query. These were:

1. In the Romantic Period as well as the Victorian Period there is a tendency to use first person narration. What is the effect of the use of the first person narration? (Seven information bearing terms after vocabulary control).

2. The works of the Romantic writers are to reveal wonder and loveliness of nature in order to attain idealism. In order to achieve this naturalness, the writers use a lot of imagination and meditation. How does this use of imagination and meditation achieve their purpose? (Twelve information bearing terms after vocabulary control).

3. What are Wordsworth and Hopkins' attitude towards God as in "The World is Too Much With Us" and "God's Grandeur"? (Six information bearing terms after vocabulary control).

4. Both sonnets ("The World is Too Much With Us" and "God's Grandeur") admit the existence of God, but the way the poets present are different. What is their difference? (Seven information bearing terms.)

All four questions provided the CAIRS system with a context upon which it could operate; consequently, the information retrieved by the system was reasonably robust. Doris reported that the information which CAIRS provided to her did assist her in completing her assignments, particularly the assignment connected with her third and fourth query. She also reported that CAIRS provided her with unanticipated but still useful information.

Her second question contained twelve information bearing terms (work, Romantic, writer, reveal, wonder, lovely, nature, use, ideal, imagine, meditate, purpose) and five of these terms appear twice in the query (writer, nature, use, imagine, meditate). CAIRS retrieved four notes, weighted 0.73, 0.5, 0.48, and 0.42. The strongest loading focused on the idea that a major
innovation of the Romantic period was the use of lyric poetry written in the first-person singular, focusing on the internal workings of the mind of the poet. It suggested that the source of poetry lay within the individual rather than the external world. The second note, which referred to a poem from the Victorian period, focused on the application of personal emotion to an external world. The third note focused on the use of the common place in poetry which should be coloured by the emotion of the poet and presented to the reader as something new and wonderful. The fourth note drew these concepts together and universalized them to the Romantic period as a whole and the influence of the Romantic period on subsequent literary history.

The responses can be summarized as follows:

By focusing on their individual responses to situations, externalizing and applying this response to the real world. Romantic poets were able communicate a unique and wonderful vision of the world.

This does directly address the issues of her query.

6.4.1.5. Follow-up interview

In a follow-up interview, Doris reported that she used the Parti FIND search technique only once or twice and was dissatisfied with it:

...the worst thing is [that] we do not have enough data in [the] conferences. No matter how hard you try to retrieve [notes], you can't really retrieve anything because we don't have enough data.

Language difficulties may have influenced this attitude since Doris used English as a second language and may not have had the linguistic dexterity to try synonyms in her searches.
Nevertheless, it is somewhat surprising that she disliked the FIND command since she should have been familiar with its basic operations. having taken two subjects on computer applications to the Library Techniques program, and two courses on referencing.

Doris had adopted an alternative to the FIND command, and she reported this in her follow-up interview:

...my habit is to print out every note so I can look back at my notes instead of [using] the FIND command.

While this process was time consuming, it did work sufficiently well for this subject in this course and avoided the use of a command with which she was dissatisfied.

While reiterating the concern for the amount of information contained in the database, Doris was more positive about the CAIRS search procedure. She stated that the CAIRS responses which she received during the semester did help her to formulate ideas. But while providing a generally positive response to the usefulness of the CAIRS information retrieval system, particularly in contrast to the Parti FIND command, and accepting the overall validity of the CAIRS responses to both her self-defined queries and the samples presented to the class as a whole, Doris did offer a number of qualifying comments.

The CAIRS [system] only retrieves the most appropriate note.... The most appropriate one was not really what I wanted to know. I wanted something that is deeper but because there is [sic] no data, [it could not retrieve anything else].

This identifies a weakness in this application of the system, particularly with the process of query formulation. Because there were so few subjects actually involved in the course, there was a limited amount of information contained in the database.
Doris felt that the most useful application of CAIRS was when the instructor used it as a summarizing tool:

The first time we were using the CAIRS example and [the instructor] gave us the example and then he printed out something like this (refers to a sample CAIRS response in the hand of the interviewer) and then he highlighted the part that is most relevant to the classroom.... At that time I really knew that he [was] pinpointing the point that is most relevant to the question. I really feel that it is very useful. But when I give (sic) me the CAIRS response just like here (referring to the sample) without highlights, well I have to read through it many times and select the things out.... But [when the instructor] highlights, I find it's very easy.

This response suggests that CAIRS could be used as an instructor's summarization tool, but it also reflects on Doris' results from the Study Process Questionnaire. As mentioned, Doris displayed Achieving Motivation, Surface Strategy, and Achieving Approach. Since she attempted to limit her learning to the bare essentials and reproduce them by rote learning, it is not surprising that she did not rephrase questions when the results of CAIRS queries did not meet her complete expectations. Since she wanted to meet all requirements, she did use the CAIRS system as directed by her instructor. The fact that she preferred rote learning to critical analysis explains why she preferred instructor summaries of CAIRS responses. This allowed her specific directions on what knowledge should be internalized and did not require that she engage in critical and analytical thinking activities which, potentially, could lead her in an "incorrect" direction.

This explanation leaves the issue as to why both SOLO and CT scores increased throughout the semester unresolved; however, SPQ results can again be used to indicate an explanation for this. Since weekly feedback showed that increased marks were awarded for engagement in critical thinking, and Doris wished to attain the highest grades possible, specific knowledge of grading criteria could stimulate her to perform an appropriate level for achievement of optimal grades;
however, this performance on a focused note level was very different from the activity required to successfully summarize and synthesize a CAIRS response.

6.4.1.6. Conclusion

While expressing some reservations about CAIRS that were based on the amount of information in the system, Doris found the system to be useful and acceptable. Since the introduction of the CAIRS system focused around critical and analytical thinking, and this became a significant focus for the second half of the course, it is not surprising that it is associated with her increased performance.

6.4.2. Student 2, Gert

6.4.2.1. Background

Like Doris, Gert was a new immigrant to Canada. But Gert displayed significant English as a second language problems. While she reported that she was enrolled in the Computer Programming Analyst program, college transcripts indicated that she had been withdrawn from it by the college for poor performance in her courses and had subsequently enrolled in the General Arts and Science program. Her cumulative GPA at the time of this study was 1.5 on a four point scale, having failed thirteen of the thirty courses in which she had enrolled. While she had successfully completed basic and intermediate oral English as a second language, and introductory written English was a second language, she had failed the prerequisite College English course twice before passing it with a grade of D. Subsequent to the course used in this study, Gert withdrew from the college without graduating, having been unable to complete the English requirements for any diploma. During this semester, she was taking two computer subjects and this literature subject through the Faculty of Continuing Education. She failed all of these subjects.
6.4.2.2. Study Process Questionnaire

Analysis of the Study Process Questionnaire showed that Gert predominantly displayed Surface Motive, Surface Strategy, and Surface Approach. This suggests that, while wanting to achieve her college certification, she memorized facts in isolation and did a minimal amount of work. The content of her entries in the conferencing system, her posting patterns, and her refusal to seek additional assistance from the instructor even though weekly evaluations informed her that she was performing consistently below the passing level (help was repeatedly offered both on line and face-to-face). supports this interpretation for her preferred learning profile.

6.4.2.3. Quantitative analysis

Table 6.8 summarizes the weekly number of entries, SOLO scores, and CT scores for Gert's entries.

<table>
<thead>
<tr>
<th>Week</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>8</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SOLO Score</td>
<td>3.5</td>
<td>2.7</td>
<td>2.7</td>
<td>3.0</td>
<td>3.8</td>
<td>3.3</td>
<td>3.8</td>
<td>3.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT Score</td>
<td>-.58</td>
<td>-.82</td>
<td>-.72</td>
<td>-.78</td>
<td>-.62</td>
<td>.27</td>
<td>-.54</td>
<td>-.73</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Posting patterns

Gert's note posting pattern was consistent throughout the course. While she had been told to logon three or four times per week in the initial face-to-face class, and this instruction had been repeated in most weekly evaluations, Gert logged in late Sunday evening, immediately prior to the midnight deadline, to post notes. Her notes typically addressed pieces of literature which had been discussed two or three weeks earlier, and simply restated in very poorly written prose -- often
incorrectly -- statements of fact made previously. She posted only 40 of the 441 notes in the student conference. No other students referred to her notes throughout the course except for one reference during the first week, made by her friend, Student 4.

SOLO patterns

Gert's SOLO pattern does not correspond to those of other subjects which suggests that she was not affected by the same constraints. Her SOLO scores rose from a mean of 3.1 for the first seven weeks, to a mean of 3.5 for the last six weeks. While showing a rise these figures must be taken as unreliable since Gert participated little more than as an occasional observer, and for only eight of thirteen weeks. Her entries were mainly restatements of entries made by other students up to four weeks previously, but the timing of her postings was not considered by the SOLO coders. There is insufficient data from which to attempt to generalize.

CT scores

Gert's Critical Thinking scores rose from a mean of -0.70 during the first half of the course, to -0.33 for the second half. Both of these scores indicate an absence of positive CT scores, and can be interpreted as a reluctance to engage in critical and analytical thinking; however, due to the lack of data, both in terms of number of weeks in which she participated, and the number of notes posted, no reliable conclusion can be drawn. As with her SOLO scores, Gert's CT scores must be taken as unreliable indicators.

6.4.2.4. Query posting and analysis

Gert posed three queries to the CAIRS system in a single note. These were:
1. Hopkings (sic) uses the word "Fresh thought" in spring and fall, what does he mean by that?

2. What are the suggestions for the words "wan wood" and "leafmeal" in the spring and fall by Hopkings (sic).

3. What would be the effect of the poem "My last Duchess" if the poem were set in the twentieth century?

None of these questions provided sufficient information for the system. At the time of the query, the theories of twentieth century literature were in the process of being introduced and so the database contained nothing which could address the third query. The first two questions were text-based, asking for definitions of words. For these, a good dictionary would have been a better starting point. The first two queries were grouped together into a single entry for a CAIRS search in order to increase the overall number of information bearing terms. CAIRS returned two notes, loading at 0.48 and 0.32 respectively, which suggested that there was a relationship between sound and meaning. While this suggestion is somewhat appropriate given the metrical and syntactic structure of the poem under consideration, it does not directly answer a question which requests definitions of terms. No notes factored into the third query. Although Gert was provided with further direction on the use of CAIRS by the instructor, she did not use the system again.

6.4.2.5. Follow-up interview

Gert declined to give a follow-up interview.

6.4.2.6. Conclusion

Little can be drawn from this case. Clearly, the subject was only minimally involved in the course and resisted remediation even though it was offered repeatedly. Her single engagement with
the CAIRS system shows that this kind of information retrieval system, if used for a purpose other than that for which it was designed, provides, at best, marginally useful responses.

6.4.3. Student 3, Jim

6.4.3.1. Background

Jim was a Marketing Administration student. He had completed five subjects through Continuing Education with a GPA of 3.8 on a four point scale, including an A in the prerequisite College English course. He achieved a final grade of A in the course under consideration. After transferring to full-time studies and completing his diploma, he won a college leadership award and was named to the President's honour list. During the course under consideration, he worked for twelve hours per week as a computer graphics illustrator and balanced studies and child care responsibilities. He decided to join the computer conferencing section after hearing about it in the parallel face-to-face section of the class.

6.4.3.2. Study Process Questionnaire

Analysis of the Study Process Questionnaire showed that Jim predominantly displayed a surface strategy, deep motive, and deep approach. This suggests that he wanted to understand the structural complexity of a subject while not having to work more than is necessary, and to develop competence in it. But while seeking to interrelate information with previous learning, there was also a strong element of rote reproduction involved.

Jim worked well throughout the semester. While his notes did focus almost exclusively on works under consideration at the moment, he did look for broader contextualization in his statements. His mid-term test, final examination, and major essay, while capturing the crux of
specific works, generally looked towards larger contextualization for the works under consideration. For example, for his major essay assignment, Jim presented, with the approval of the instructor, an on-line mock-trial about truth in literature, using Plato, Sydney, and Eliot as witnesses, and finally passing judgement based not only upon the critical arguments but a larger, personal experience as well.

6.4.3.3. Quantitative analysis

Table 6.9 summarizes the number of weekly entries, SOLO scores and CT scores for Jim's entries.

<table>
<thead>
<tr>
<th>Week</th>
<th>1</th>
<th>2</th>
<th>3</th>
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</tr>
<tr>
<td>Solo Score</td>
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<td>4.6</td>
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<td>3.8</td>
<td>4.3</td>
<td>4.2</td>
<td>4.3</td>
<td>4.0</td>
<td>3.6</td>
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</tr>
<tr>
<td>CT Ratio</td>
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<td>.8</td>
<td>1.0</td>
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</tbody>
</table>

Posting pattern

Jim posted notes throughout the week, averaging three logons per week. He posted an average of 8.5 notes per week, but this ranged from a high of 19 to a low of 3. Further, he was one of a very few students who actively cross-referenced other notes. In follow-up interviews, he explained this logon pattern on the basis of time flexibility and the continuous interchange of ideas which the computer conferencing system provided.
SOLO patterns

During the first half of the course, his weekly SOLO scores averaged 4.1, and during the second half, following the introduction of the CAIRS system, his score rose to 4.4. An expected drop, which was still above the reported means, was observed on the week prior to the mid-term test.

SOLO scores indicate that Jim worked consistently at the relational level. The change in means indicates that his depth of discussion improved following the introduction of the treatment and particularly at the point where he was integrating the responses into his schema for the sake of the final examination and his major essay.

CT scores

His CT scores rose from a mean of 0.85 during the first seven weeks, to 0.94 in the second half of the course, following the introduction of the CAIRS system and its related stimulation of critical and analytical thinking.

6.4.3.4. Query postings and analysis

Jim posed only two queries to the CAIRS system; however, in two follow-up interviews -- one conducted within a month of completing the course and the second conducted four months after completing the course -- he reported a high level of acceptance of the system. His two documented queries were:

1. What did the Romantic poets say about truth and literature? (four information bearing terms)
2. What is T.S. Eliot's opinion on truth within literature? Does he regard it as an internal or external influence upon the poet? (eight information bearing terms)

Both of these queries were very broad. Following the first query, which returned twelve notes ranging in loading weight from 0.82 to 0.32, the whole class was provided with further direction on how to pose a query in the CAIRS conference.

The second query returned two notes, weighted 0.33 and 0.30 respectively. The first of these suggested that while there is a context for a literary reading which included definitions of terms and understanding of literary conventions, readers should also bring personal attitudes forward and should seek support for these personal opinions. The second note suggested that external reality bears a strong influence on poetry. These two notes are appropriate given the query, but provide little definitive responses for the subject.

Jim was cautioned that the response was vague and he was asked to comment on it. In a written response to the researcher, sent within a week of receiving this response, he said,

The results I received from the CAIRS search were quite interesting. As you know, the question I asked was rather broad so the end results were notes which fitted with the generality of my question. The notes CAIRS selected were more thought provoking than problem solving. They gave me some direction in my thinking.

I suppose my only problem with using CAIRS was composing a question that wasn't too vague or short. It takes some time to come up with a sensible question for CAIRS to research.

This response suggests that the CAIRS response was acceptable as a starting point for further reflection. But the statement also suggests a direction for teaching with an IR system, and a direction for further research, namely that detailed teaching of the process of questioning is needed, and the relationship between query formulation and subsequent learning should be investigated.
6.4.3.5. Follow-up interview

Analysis of Jim's follow-up interview presents some challenges since his statements do not completely correspond to his behavior over the course. This could be a result of the fact that two interviews were conducted. The first, which focused on general acceptability of computer conferencing in education was interrupted because Jim had brought his infant along to the interview and she suddenly required his attention. The second, which focused on the use and acceptability of the CAIRS system, occurred four months after the completion of the course. Jim perceived that he had used the CAIRS system to a greater degree than the actual computer conference transcript indicated. This may be explained by the fact that the instructor did post a series of CAIRS examples, one of which contained a summary of the output.

During the second follow-up interview, Jim offered a number of specific comments about the utility of the CAIRS system.

In order to refresh his memory, Jim was provided with the model query (Appendix K) about divergent attitudes towards death, and the CAIRS result. When asked about how the model response fitted his initial attitude towards the query, Jim stated.

It gives me a good number of different directions to consider it from.... I think it gives a good amount of reference material for thinking about the question....I mean I've read this over just once but I think it would, if not give me the complete answer at least give me enough information that if I were to actually read the poems over again...that it would steer me in the right direction. I could of course base an essay on just these notes. I could do an OK job but for an answer that I thought was suitable, of course I'd go back, read the poem over again taking any suitable information that I thought was relevant. These notes would give information but also give a direction telling me, "Hey! Why don't you have a second look at, say, this poem over here or that poem over there."

I think the CAIRS system would come in handy for the student who wanted to be a little more creative about their thinking or [to] delve somewhat deeper than what was being
discussed at the time...I'm not sure [that] they would get an adequate response using, for instance, the FIND command.

This is a positive evaluation of the system. According to Jim, the CAIRS results from the model run not only provided sufficient information for the completion of assignments, but, more significantly, it provided direction which would stimulate critical and analytical thinking. Although this comment was offered over four months later than the initial note quoted above, and a full semester after final grades had been processed for this subject, his initial, positive response to the CAIRS system remained largely unchanged.

In the course of the interview, Jim also highlighted the lack of information in the overall database, but suggested that the overall subject conference could be seeded with external, critical resources in order to improve the quality of information that was retrieved.

Where is Gutenberg? He's electronic already, Right?...I think [that] if it was put together that way [including outside, secondary material], then you'd see a lot more student references towards outside pieces as well as the given curriculum...Of course, it depends on how willing the students are to participate in the system because there were some that didn't want to put that many notes in.

6.4.3.6. Conclusion

Based upon his posting patterns, increased SOLO and CT scores, and his SPQ results, Jim was an active learner who became increasingly engaged in critical and analytical thinking. Interview transcripts show that he enjoyed the subject and the method of teaching, and found the CAIRS intervention to be useful.
6.4.4. Student 4, Paula

6.4.4.1. Background

Paula had completed five semesters of the Computer Programming Analyst program and she held a GPA of 3.2 on a four point scale. She had previously achieved final grades of B in three writing courses, College English, the prerequisite to the course under consideration, Business Letter and Report Writing, and Creative Writing. She enrolled in this course based upon its description in the Continuing Education Calendar and was taking five subjects in the full-time program concurrently. This course was one of the literature options which Paula needed for her diploma. She subsequently completed her diploma, achieving a final GPA of 3.3.

6.4.4.2. Study Process Questionnaire

Analysis of the Study Process Questionnaire showed that Paula displayed surface motive, strategy and approach. The output strongly polarized to these categories. This suggests that Paula was a rote learner who wished to meet minimal requirements but who would often miss the relationships between concepts. Tests of knowledge, specifically the mid-term test, final examination, and major essay confirmed this analysis since Paula attempted to produce acceptable answers without reaching beyond the confines of the assignment.

6.4.4.3. Quantitative analysis

Table 6.10 summarizes the number of weekly entries, SOLO scores, and CT scores for Paula's entries.
Table 6.10. Scores for Student 4

<table>
<thead>
<tr>
<th>Week</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<td>Notes</td>
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<td>11</td>
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<tr>
<td>SOLO</td>
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</tbody>
</table>

Posting pattern

Paula typically logged on twice per week. As noted in section 6.2.3.2, she posted an average of 7.1 notes per week which was within the parameters of the course requirements. While there was not the anticipated drop in the number of postings at the time of the mid-term test, she did not participate during the final week, immediately before the final examination. She handed in her final essay on the day of the final exam. This can explain her failure to participate during that week.

Posting patterns are consistent with the outcome of her Study Process Questionnaire in that she performed up to, but not beyond, expectations. Notes generally focused exclusively on a single issue or piece under consideration, rarely noting relationships between pieces or looking beyond the defined scope of the course.

SOLO patterns

Paula performed consistently throughout the course, and her SOLO scores demonstrate little change. During the first half of the course, her mean SOLO score was 3.7 and this dropped to 3.6 in the second half of the course. This consistency is reinforced by the fact that her weekly evaluations averaged B-. Together, this suggests that Paula had established an acceptable pattern and level for her postings and did not seek to move to a higher level. This is consistent with the outcome of her Study Process Questionnaire.
CT patterns

Critical thinking scores dropped over the semester from 0.55 for the first half of the course to 0.48 for the second half; however, there is an anomaly in these figures corresponding to week 9. While other external influences cannot be documented, at that time, the CAIRS system had been introduced and students were being challenged to think differently about their learning and cognitive structure. It is reasonable that a superficial learner would resist this challenge; that the introduction of the system would impact upon their tried and true approach, and subsequently that they may perform less acceptably at that time. It should be noted that there was a corresponding drop in Paula’s SOLO score at the same time.

When this anomaly is removed from the calculation. Paula’s CT score increased marginally, to 0.59. In the second half of the course. This supports the assertion that she had established an acceptable method for approaching the learning task and did not deviate from that method.

6.4.4.4. Query postings and analysis

Paula posted three queries to the CAIRS system:

1. In "The World is Too Much With Us", W. Wordsworth says that we don’t spend enough time to actually see and appreciate the beauty and power of nature. How is this attitude reflected in "God's Grandeur"? (8 information bearing terms)

2. In the poems "The World is Too Much With Us" and "God's Grandeur", both of the poets try to show an image of God; his power, strength, and mercy. What is the similarity and difference between those two images? (11 information bearing terms, one repeated - image)

3. In the literature of the Romantic period as well as the Victorian period there were other methods of showing reality to the reader. How do the authors in those two periods describe their truth to the reader? What did they use to achieve the purpose? How is truth related to
reality in the poems of the Romantic period, and how in the Victorian period? (11 information bearing terms. five repeated - Romantic, Victorian, period, truth, real)

Each of these queries was vague, given the content of the database. There were few notes which directly related to them. The first query returned three notes which focused on the poetic identification with the power of nature but did not address either poem specified directly. The third query is unfocused, asking for methods for showing reality, methods for describing truth, and the relationship between truth and reality as it is presented in two different literary periods. The system returned three, weakly loading notes which addressed realism in Victorian novels, the use of dramatic monologue to convey the inner workings of a mind, and the relationship between the sound of poetry and meaning. These are as close as the database could come to fulfilling the information need.

The second query returned seven notes, with weightings ranging from 0.73 to 0.34. While these notes did not directly answer the query, they suggested that imagery is representative of something in poetry and it is used to unify and epitomize reality; that imagery is used to create sensuous reality in the mind of the reader by connoting implications, and by doing so, that it presents a kind of personal truth.

Notes to Paula from the researcher highlighted the CAIRS responses:

The system has interpreted your question as asking about alternative methods of showing reality. Hence, the three responses focus around that. You may want to try to rephrase the question.

and
As in your first question. CAIRS here has focused upon the conceptual content of your query. In other words, it thinks you are looking for ideas on images of God....This is what it has returned to you.

Although Paula was asked to rephrase her queries, she did not do so.

Given that terms in the database were unweighted except additively, and multiple appearances of terms were treated as cumulative using a simple additive function, the focus of the contrast in these questions (two poems or two periods) would not be given additional loading strength; hence, the retrieved notes were more general than expected, focusing on the more dominant terms in the queries. This suggests a potential modification to the CAIRS procedure.

6.4.4.5. Follow-up interview

During the follow-up interview. Paula provided only short answers which directly addressed the question posed by the interviewer. She rarely elaborated upon her answers. Nevertheless, she did comment on both the FIND command and on the CAIRS responses.

Paula reported that she used the FIND command often and found the notes which it retrieved to be useful and appropriate.

I used the FIND command quite a lot. Quite a lot because sometimes ...like when I was reading the notes first, I didn't really read through them in depth so I just saw some points and I wanted to come back to it. So [when] I wanted to find specific poem so I used this.

The following transcription of the interview indicated Paula's attitudes towards the on-line search techniques in general, and CAIRS in particular:

Interviewer: What were the best and worst aspects of the search techniques?
Paula: They took some time. I mean the FIND technique was fine because it was possibly five minutes or something. It wasn't like answering your specific questions. It was just in general. And CAIRS, well it took a long time.

Interviewer: [Was] the information which CAIRS provided useful to you?

Paula: Oh yes. It was very good....You can have something to think about.

6.4.4.6. Conclusion

While concerned about the turn around time for a CAIRS response, and quite probably influenced by the CAIRS examples which were posted by the instructor, Paula's interview suggests additional features that could be built into the CAIRS system and into its use. These include more sophisticated term-weighting systems and additional instruction on query formulation.

Nevertheless, she was positive about the potential of the system and it is reasonable to assume that if its turn-around time was faster, she would have used it more, as she had with the FIND command.

6.4.5. Student 5, Cheryl

6.4.5.1. Background

Cheryl was an excellent student, studying towards an Executive Office Administration diploma. She had completed thirteen of the twenty required credits and had been granted advanced standing in two courses. Her cumulative grade point average was 3.9 on a four point scale, and this cumulative average held throughout her studies at the college. While she completed all required subjects and took additional credits, she never applied to graduate from the program. While working forty hours per week as an Administrative Assistant, she took up to five courses per semester through continuing education during her college career. During the semester of this study, she was taking six credits through continuing education. While she started this course two weeks
late, she reported that one reason for enrolling in it was that the description of computer conferencing in the Continuing Education calendar suggested that this teaching methodology would ease up the time constraints for taking courses. This is not surprising given both her professional and academic work loads.

6.4.5.2. Study Process Questionnaire

Analysis of the Study Process Questionnaire shows an interesting learner profile for Cheryl. Her motive balanced evenly between deep and achieving, but the result was only marginally different from that for a surface motive. Her approach to learning balanced between all three outcomes and provides little to differentiate between them. Her strategy was predominantly surface but the figures were all above the reported class means. Collectively, the outcome of her Study Process Questionnaire, coupled with her grade point average, suggests that Cheryl had developed a successful learning strategy. While she recognized that there was greater depth possible in her learning, and that she was capable of achieving it, her approach to the task guaranteed her above average results. Clearly, this was a student who was capable of advanced studies; one can only speculate as to why she had not sought a higher level of education which would challenge her to a greater degree, or why she had not applied to graduate.

6.4.5.3. Quantitative Analysis

Table 6.11 summarizes the number of weekly entries, SOLO scores, and CT scores for Cheryl's entries.
Table 6.11. Scores for Student 5

<table>
<thead>
<tr>
<th>Week</th>
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<td></td>
<td>8</td>
<td>5</td>
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<td>10</td>
</tr>
<tr>
<td>SOLO</td>
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</table>

Posting patterns

Cheryl displayed no consistent posting pattern. During seven of eleven weeks, she posted notes in at least two blocks; during weeks in which she only posted notes once, she also posted fewer notes. Over her eleven weeks of participation, she averaged 6.8 notes per week which was well within the guidelines specified in the outline to the course. Unlike some other subjects who used conferencing more as a self-directed learning medium, Cheryl actively engaged in dialogue with classmates through the conferencing system. Weekly assessments of her entries were consistently high.

SOLO patterns

The SOLO pattern for Cheryl's entries was relatively stable throughout the course, rising from 3.8 for the first half to 4.0 following the introduction of the CAIRS system and the emphasis on deeper critical thought. This pattern suggests that she consistently operated at a relational level in her notes, with occasional instances which demonstrated extended abstract thought.
CT scores

Critical thinking scores showed a marked improvement over the course, rising from 0.80 to 0.95 between the first and second halves. This improved performance coincided with the introduction of the CAIRS system, the presentation of CAIRS examples, and Cheryl's own queries.

6.4.5.4. Query posting and analysis

Cheryl posted three queries to the CAIRS system. These were posted in three separate notes but within three minutes on the same day:

1. By using various different literary techniques to get the meaning of a poem across, is truth distorted by the different interpretations one could make because of the variety of techniques? (9 information bearing terms, 3 repeated)

2. What are the basic attitudes Hopkins has towards God and nature in "God's Grandeur"? Are the same attitudes evident in Wordsworth's "The World is too much with us"? If not, how do they differ. (8 information bearing terms, 2 repeated)

3. If the attitudes and thoughts on the same subject, being God and nature, are different in Hopkins' "God's Grandeur" and Wordsworth's "The World Is Too Much With Us", is there a basic underlying similarity that would support the concept that literature is truth? (13 information bearing terms. 7 coincide with query number 2)

In response to the first query, CAIRS returned only two notes that merit consideration, and even these are dubious. The notes loaded at 0.53, and -0.29 respectively. The strongly loading note focuses on the paradox of the nonsense poem, "Jabberwocky" by Lewis Carroll. It suggests that poetry is a linguistic artifice, and meaning should simply exist within the artifact regardless of technique. The second, negatively loading note suggests that life's lessons have been always been contained through literature, and a given instance is a representation of specific lesson. A third note, although loading at only 0.22, suggested that, even in connection with nonsense poetry, meaning exists and is related to sound. While these responses do not directly address the crux of
the query: they do pick up on the idea of whether truth is distorted through technique, or whether it exists as an absolute within literary artifacts.

The other two queries, because of the coincidence of terminology, factored into the same component. This component was returned to Cheryl with the explanation that the system treated the two as a single query. Only two notes were returned, loading at 0.39 and 0.25 respectively. The first, a note of over 300 words, directly compared and contrasted the attitudes which the Victorian and Romantic poets held about God and nature, and made specific reference to the poems specified in the queries as illustrations. The second note discussed the rhyme scheme of "God's Grandeur" and suggested a human reaction to the God of the poem. While this second note can be discounted, it is noteworthy that although the first note did not factor strongly, it is the only note in the database that is directly related to the two queries. The database at the time of the query contained eight notes which directly addressed "The World is Too Much With Us", and eleven notes which addressed "God's Grandeur". Only the one note returned that factored above 0.3 addressed both poems, and specifically the attitudes towards God and nature.

6.4.5.5. Follow-up interview

Cheryl gave an extensive follow-up interview, elaborating on a number of germane ideas.

She reported that she used the FIND command extensively during the course, but for particular purposes:

If I wanted to just find [out] about the whole -- something about a particular poem or author -- then FIND was very simple because I could just pull off everything and then wade through it.
This comment suggests a limitation of the FIND command by highlighting the fact that it retrieved everything about a particular search parameter, and left the student to provide the information filter. It also focused on narrowly defined search parameters, returning either too much unfocused material, or insufficient conceptual material. Cheryl elaborated upon this:

It doesn’t pull off ideas...same ideas that may have been in different poems. It couldn’t do that. It would pull off everything -- a lot of things saying the same things.

Unless you were doing something on a specific poem, FIND is useless....Like, for instance, for essays...We didn’t need stuff for one specific poem. We get ideas from everything.

Her general evaluation of CAIRS was positive. When asked if she found the information which CAIRS retrieved to be useful and relevant, she responded

I got a lot out [of it]....I was really surprised...because I probably would not have thought it. Those being answers to questions, but when you see them you think oh, gee, yah....I wouldn’t have really thought in that way at first....I found out a lot when we did our own questions...For me. I found it just interesting that it would come up with these thoughts and it probably made me think more for my essay.

CAIRS produced useful and relevant answers for Cheryl, but also provided her with unanticipated results which stimulated thinking. She reported too that the factor loadings of responses was a useful feature for her:

You would assume that the higher load, this poem is going to have more in it.

Note loadings appeared to be a useful feature for Cheryl, although she did not use it as a rigid guideline for relevance. When asked to compare a high loading note to a lower load, she responded,

I’d read it because maybe it’s just the way it’s worded that it didn’t pick it up as high, but it could still give you something to think about....I would assume [that] it wouldn’t have had that much relevance to the topic, but maybe it actually does.

Cheryl’s recommendation for the developers of the CAIRS system did not focus on technical aspects including either interface and output appearances or database seeding; rather, it focused on
teaching users to formulate successful queries. She noted that the CAIRS samples which were posted by the researcher were useful examples, but that users needed additional instruction and practice in query formulation:

I had problems constructing a sentence that would be appropriate for what I was looking for. I think if people had time, maybe they can play with it and try and get different questions put together and more kinds of ideas. And also if they had more time they could start with one. and then get some more ideas from that. and then you can broaden it and ask more questions. Elaborate on it as you go.

6.4.5.6. Conclusion

Like the other key informants, Cheryl provided a positive review for the CAIRS system, finding it useful as a tool to stimulate critical and analytical thinking.

6.5. General conclusion for case studies

Of the five students in the class, four of them reported that the CAIRS procedure was a positive and acceptable addition to their learning experience, using the FIND command as a point of comparison. They reported that CAIRS provided them with appropriate responses to their self-defined knowledge needs and stimulated deeper levels of critical thinking. But their reports, while expressing some reservation, particularly focused around the problem of query formulation and turn-around time, also offered constructive suggestions for subsequent developments and applications.

Students recognized that they had problems with query formulation, and accepted the fact that CAIRS was unable to respond effectively to an information-sparse query. They also recognized that some of the limitations of the system were based solely upon the fact that the database contained limited information. They suggested specifically that users needed to be given additional
training on query formulation, and that the database should be seeded with information from external sources.
Chapter 7.

GENERAL DISCUSSION

7.1. Introduction

The information highway presents education with both opportunities and problems. It holds the potential of dramatically increasing both the population and the knowledge base for education. But at the same time, it presents educators and institutions with the problems of information overload and scattered information. As the use of the highway increases, information filters which can bring the best information forward based upon self-identified knowledge needs, and which can function not only within a class of students but can also filter general information from outside of the group, become essential. Effective information tools can potentially make a difference in education by helping to facilitate the progressive reconsideration of course-based ideas, and the inclusion of other school resources including applications such as CD-ROM, Web and Internet sources, or external databases.

Computer conferencing, as a flexible, Internet-based educational delivery system, holds promise for post-secondary institutions. Since it does not restrict the institution or the learner to a commitment of time or place, it can be an effective tool for self-motivated adults or distributed learners who are involved with life-long learning and other, external commitments. Because of the expectation of participation, computer conferencing can help to stimulate active participation and engagement with the educational process, thereby moving learners away from the empty vessel model of education to a more collaborative model based upon verbalization and discussion.
An ideal computer conferencing system needs to support learners as they attempt to make sense of information and build knowledge structures. But even the most current systems, while encouraging the divergent process of idea generation, provide only limited tools for idea structuring and linking, especially when the goal of structuring is weakly defined or is in the process of developing. Structuring information in existing systems is largely dependent upon extant, intentional linking of information, based upon a decision of applicability made at the time that information is entered. But this kind of knowledge structuring can create limited groupings. It supposes that information items are useful within limited scopes, whereas the reality is that information can be brought to bear on many different areas of inquiry to a greater or lesser extent, and so it requires successive re-juxtaposition, re-examination and reinterpretation of ideas.

Because educational computer conferences can become very large, with ideas introduced sequentially or incorporated from external sources, it is possible for information to become lost or ignored even though it may be appropriate for an area of inquiry. While existing linking mechanisms involving keyword attachments, text string matching, or other hypertextual methods are meant to address this problem, they present a number of limitations. Keywords are based upon the assumption that the scope of an entry can be fully summarized at the time of its creation, and that this summary will remain constant as inquiry progresses. But learners in the process of moving from relative novice to more expert states cannot be expected to understand all of the potential applications of an item of information. Further, effective summarization skills cannot be assumed of all learners. Text matching assumes equal importance for all instances of a text string, whether it be the focus of an entry or a secondary issue. Hypertext linking assumes that all links can be defined, either on the fly or algorithmically, but it does not measure any degree of relevance and the number of links can be overwhelming if all possible paths are followed.
There is need for an alternative, but complementary, linking mechanism in computer conferencing as part of the tool box for learning. This alternative must allow for the successive reexamination of material based upon the immediate needs defined by the learners. It should be as free as possible of the requirement that all knowledge is represented at the time of note creation, and should provide a level of direction on the degree of relevance of any given entry. Further, it should be very simple to use. If the goal of the user is to locate appropriate information for critical and analytical thinking, an effective information retrieval system should be able to respond to these demands, even though they may not be fully identified at the point that the information retrieval system is created. This will allow an item of information to be turned into scaffolded knowledge in a variety of ways.

Statistically-based information retrieval systems use associations and dependencies between vocabulary controlled terms within documents as the variables in computation. They allow a retrieval system to look beyond the actual terms contained in a single document, to the relationships between terms both within a document and across a database. Since they are statistically based, the information retrieved can be based upon a probability estimate of the relevance of any given document.

While these systems have typically been applied to library and information research fields using established information banks, the investigations presented in this dissertation have shown that automated information retrieval techniques will work with unstructured and developing student databases, and that their retrieval and precision measures can be superior to those associated with traditional text string matching or keyword applications. In initial explorations, algorithmic information retrieval methods were capable of both clustering conceptually related notes and
addressing the needs of learners for self-defined conceptual information. Retrieval did not depend upon exact text string matching, and was able to accommodate the changing dynamics and conceptual clusters of developing databases.

7.2. Overview of the studies

Initial explorations suggested that the procedure used in the main study for this dissertation would cluster free-formed information around conceptual hubs which could be specified through student-generated queries, and these indications led directly to the questions which the fuller study addressed.

In a longer, more carefully designed investigation, a group of five community college students studied the history of literature from the Romantic to the Modern period for one semester using computer conferencing as the main instructional delivery medium. Half-way through the course, students were introduced to automated information retrieval and the use of the CAIRS system, and they were encouraged to use it as part of their course work. Learning, as demonstrated in the notes which subjects posted to the conferencing system, was measured using the SOLO taxonomy and Critical Thinking indicators. These scores were compared to themselves before and after the introduction of the CAIRS system in order to identify possible changes in the complexity of student thinking. Analysis of both SOLO and CT scores suggested a neutral or positive change in learning. Follow-up interviews showed that students found CAIRS to be a positive and useful addition to their learning experience.

While students were introduced to a tool box approach to literary criticism based upon a combination of reader response and practical criticism, the operation of CAIRS was consistent
with deconstructionism, a contemporary philosophy that advocates the postponement of conceptual closure in favour of ongoing discussion and textual reconsideration. By optimizing the retrieval of developing concepts around user-defined areas of inquiry, CAIRS encouraged the progressive reconsideration of ideas, regardless of sequential placing of information within the database or the literary text to which it was attached. and it provided a guideline for the degree of relevance of each information item. The seemingly irrelevant or tangential note, that is relevant and central but may not be retrieved through other methods, was brought back to learners as they progressed through the course. thereby preventing valid concepts from being subjected to premature closure or rigid incorporation into developing knowledge scaffolds.

7.3. General conclusions

Lynch (1997), in discussing searching procedures for Internet-based information, argues that the classification and selection skills of librarians must be complemented by the computer scientists' ability to automate information retrieval. Results of the extended study, which incorporated a network-based information system, suggests that this statement is limited in its educational applicability. To classification and technically mediated approaches to information retrieval, we must add the insights of the educator and, particularly in the case of literary study -- a domain of inquiry which has actively resisted computer applications -- a theoretical, literary foundation that vindicates the application of both computer-based and statistical approaches.

The primary purpose of this series of explorations was to develop and apply an automated information retrieval system, to consider its effect on learning, and to examine its acceptability as a learning tool. Results from initial explorations suggested that the CAIRS procedure could cluster free-formed notes around conceptual hubs, and that these hubs could be centred in free-formed
queries. Groups involved in both the graduate level exploration and the fuller study stated that they found CAIRS to be a positive addition to their learning, and both groups encouraged further development and application. It is noteworthy that the acceptability of peer entries to students was never an issue. While CAIRS was never intended to be the perfect, algorithmic information retrieval system, these results suggest that automated IR can be a useful aid that addresses the needs of learners across domains of inquiry in a computer conferencing learning environment.

SOLO and Critical Thinking scores drawn from the fuller study, while inconclusive, suggest that there was a neutral to positive effect on learning which can be associated with the introduction of the CAIRS system. Because of the uncontrollable variables involved in this study, including the small sample size, the self-selection of participants, and the lack of comparative groups, statistical proof of the effect of CAIRS cannot be established. But the statistics drawn from these two scores can be used as indicators that suggest change.

While the secondary purpose behind the fuller study, to consider whether computer conferencing would be an acceptable educational delivery system for Ontario colleges, occupied little of the documented results of this research, this study represented the first application of conferencing in the Ontario College system. Follow-up explorations have confirmed the applicability and acceptability of this mode of educational delivery, and computer conferencing has experienced a steady growth since this study was undertaken. At the time of the writing of this dissertation, the college that hosted the extended study reported that over 600 students and faculty were using computer conferencing, and the college was actively involved with a consortium of Ontario colleges using computer conferencing and pooled student populations for the delivery of credit subjects.
7.4. Problems of query formulation

Providing students with direct training on query formulation for information retrieval within electronic environments became a crucial issue in this study and with this audience. As Fedderson (1993) points out, college students are prepared to be docile workers, ready to follow the directions of their teachers, and they approach the learning task on a 'need to know' basis, where the need has been narrowly defined by potential employers. This attitude can hinder students from becoming engaged in the process of knowledge creation. Habits formed through years of traditional, teacher-centred education had led subjects to expect that a query system would behave more like a human interpreter, intuitively elaborating upon a query and supplying information based upon the elaboration. This suggests that while subjects were working within a collaborative environment, they continued to operate under an empty vessel model, expecting the query-response system to fulfill the role of the dispensing and interpretive teacher and to provide fairly explicit responses.

The accuracy of retrieval is a function of the information contained in a query. The problem of query formulation had been highlighted in the study with graduate students, and attempts had been made to addressed it in the fuller study through hand-outs and conference postings. Actual queries posted by the students indicate that these measures were insufficient to change their approach to the learning task. Further, although subjects had been taught a process for formulating research questions in the prerequisite course, even this had been taught within a teacher-centred environment and evidence from student queries suggests that this skill did not transfer. The subjects in this study went through school systems which supported dependent, rather than self-directed, learning and so they approached the task of query formulation as an interpretive activity on the part of the information dispenser, rather than as an active construction and definition of information needs for the development of new knowledge. While instructor summarization of CAIRS output was
perceived as a positive addition to learning, active construction of knowledge based upon self-defined need was, in at least three of five cases, resisted.

As we move into electronic environments we need to teach learners how to become self-directed in their search for knowledge, and how to address cognitive conflict. The act of knowledge-based query formulation as a focus of inquiry must become second-nature to students if they are to thrive in electronic educational environments, and the acquisition of these abilities must be encouraged and supported from early ages. This is a necessity if the information highway is to become a delivery mechanism for lifelong, self-directed learning.

7.5. System development

The development and application of the CAIRS model provided evidence that an algorithmic information retrieval system is capable of supporting the convergent process of thread management and idea linking and conceptual structuring. But at the same time, CAIRS also appeared to promote divergent thinking through the introduction of cognitive conflict contained in the notes in the clusters which it identified. It was a tool that pointed students in directions, without imposing closure, and it supported them in reflective learning. While initial explorations indicated that CAIRS could help to lead learners to information which would assist them in considering and formulating responses, it was up to the learner, finally, to construct their responses as authentic activities within a defined universe of discourse.

Because any note could load into multiple components, and components were subject to change as each new note was introduced into the database, the system supported successive interpretations of ideas which were focused around user-defined conceptual hubs. In essence, it was intended to
act as a thread organizing aid for students which acted over the long term, and which could show students how ideas related to each other. Further, because of the factor loading weights, those individuals who made use of this information could be given an indication of the degree of relatedness of entries.

Because of the algorithmic approach to conceptual clustering, it was unnecessary for the researcher to anticipate all possible information needs of learners or the potential juxtaposition of related entries. Because of vocabulary control processes, CAIRS was able to provide conceptual threading, ignoring the sequential nature of computer conferencing, and without placing any specific requirements upon the learners, other than the direction-based expectation of being able to ask knowledge-based questions. Subjects were not forced to guess at text strings for their search parameters; rather, they could define their knowledge needs using natural language.

CAIRS was never intended to be the perfect automated information retrieval tool for computer conferencing applications. While its development was based on theories drawn from the probabilistic IR literature, more sophisticated systems, using different statistical procedures, have subsequently been developed and tested with static databases. Nevertheless, CAIRS was a sufficient model for this exploration. CAIRS was a brute-force procedure involving human intervention and a number of different software applications including statistical and word processing packages, and Pascal programming.

Since speed, beyond the requirement of a twenty-four hour turn around time from query posting to output posting, was not considered to be an issue by either the students or the researcher, the procedure was never fully automated. Decisions about literary warrants were made for each run,
based upon the intention of keeping as many terms active as possible while still allowing for the maximum resolving power of the statistical process. These routines could be defined algorithmically and programmed into a fully automated, conceptual information retrieval system.

In a fully programmed system, a full, domain dependent entry vocabulary would be specified before the study was undertaken. This would be a bare list of words and control processes which would not be subjected to literary warrant decisions. Once this base vocabulary existed, literary warrant could be established algorithmically and updated regularly, and notes could be fully processed into controlled vocabulary matrix entries as they were input into the conferencing system. The statistical procedures could be reduced to only those calculations which are necessary for the IR process, thereby reducing the computational overhead of large statistical packages. Finally, an expert manager which could assemble output for users could be programmed. These additions would substantially reduce the turn around time.

Follow up trials have already shown that, using a full statistical package, the calculation time for a matrix in excess of 500,000 elements can be reduced from over four hours on an 80486 DX2/66 to two minutes on a 200MHZ Pentium Pro\(^1\) dual processor machine with 128 Mb of RAM. This suggests that processing time for this brute force system could approximate a reasonable turn-around time, and for more sophisticated and integrated systems, turn-around time could be fairly transparent.

\(^1\) Intel Corporation
7.6. Further research

Results of these explorative studies suggest that statistically-based information retrieval, based upon the algorithmic control of full text, can make a positive and acceptable contribution to education using computer conferencing. But these studies in the development and application of the tool were intended to explore the potential of these systems and the results are not offered as final proof. Results do indicate that there is a neutral or positive, and acceptable, effect which can be associated with learner use of automated information retrieval, and based upon this, further research and development is warranted.

7.6.1. Incorporating external information sources

The content of the computer conferencing database presents limitations to the application of IR procedures. While facilitating and making concrete the opinions and ideas of learners, educators know that a wealth of information will continue to exist outside the scope of a closed system. In the electronic world, these sources include CD-ROM applications, Internet and intranet sources, and other multimedia applications. Subjects in this study identified the need to bring external sources into the electronic classroom.

Researchers at the AT&T labs are examining the viability of applying standard labels to Internet resources as information filtering mechanisms (Resnick, 1997). Since a text-based label attached to a discrete information item can be processed into one, vocabulary controlled line in the term by document matrix and subject to literary warrant decisions, just as the controlled vocabulary of a note becomes input into the matrix, then external information items can be brought into the analysis for clustering. While full text can still be used as the matrix input for text-only information items, labels can allow for the inclusion of other multimedia materials.
7.6.2. On thesaurus creation

The creation of the thesaurus for this study was an inexact process, based largely upon the examination of word lists as they grew, and the reduction of words to common linguistic roots. This meant that the thesaurus was unstable for the duration of the study and was subject to change based upon the ongoing interpretation of word lists by the primary researcher.

But thesauri, especially for entry vocabulary, can be pre-defined by small teams of curriculum experts and applied to a broad range of information sources if the natural evolution of word lists has been monitored. These people, as a committee, can be asked to specify the terms which will be exempt from literary warrant decisions, and the bases for term expansion and reduction. If entry level vocabulary lists are reasonably exhaustive and based upon the domain vocabulary anticipated for the full unit of study, this can make vocabulary control procedures more automatic and leave decisions about literary warrant to algorithmic procedures. Pre-set entry vocabularies would negate the possibility of important terminology being rejected by the algorithm because it did not achieve the necessary warrant level.

Presetting vocabulary also allows curriculum developers to manipulate the weighting, or degree of importance, of terms on a gross level, and to anticipate the potential for overlapping meanings between terms. Based upon knowledge of the field of inquiry, the curriculum committee could, for example in the case of the larger study, rank main authors as more important than secondary authors, and rank them and the elements of their statements appropriately.

In the CAIRS algorithm, the semantic function of a word or word grouping was disregarded. Adjectives and adverbs were controlled to become nouns, and this level of control has had an
unidentified effect upon the term by document matrix. Lancaster (1986) indicated that verbal form can be a consideration in the development of vocabulary control procedures. Other experimental systems have examined semantic relationships as indicators of importance within term by document matrices, but these have focused upon pre-existing databases. In static databases, greater levels of vocabulary control can be exercised than in developing databases with an expected change in the use or introduction of vocabulary. Further applications of this level of vocabulary control needs to be examined within developing databases.

7.6.3. Controlled studies

While this dissertation documents a series of explorations in the development and application of a model information retrieval system, and the results of each investigation led to the research questions which framed the next study, there was never provision for a clean, comparative study between methods. Even in the more carefully designed investigation, exploratory data was collected and interpreted using a variety of methods with differing degrees of reliability.

In order to establish empirical proof of the effectiveness of automated information retrieval, the next step in the exploration is a series of controlled studies. Given equal instruction levels and identified information retrieval techniques presented and taught, the main variables which need to be defined through random assignments are classroom-based learning, computer-conferencing-based learning, computer-based learning with text string or hypertext retrieval systems, and computer-conferencing with text-string, hypertext, and probabilistic information retrieval systems. Reliability of results will depend on the extent to which the variables can be controlled. Essentially, this study is an indication of the direction for an empirically testable hypothesis.
7.7. General discussion

If we argue that education is a progressive, dialectic process involving interaction between peers, collaborating teachers, and external knowledge sources, then computer conferencing, as the communications hub of this process, holds promise for future learning environments. But while facilitating communication, computer conferencing presents problems of information overload and lost information, especially when the system is linked to extensive, external resources. Computer conferencing needs a filtering system that not only brings the best ideas forward, but will also provide direction on the interpretation and assimilation of potentially conflicting items of information.

For computer conferencing, the results from this series of explorations suggest that the output of a vocabulary controlled and statistically-based information retrieval system can challenge students to delve deeper into self-identified, wide-ranging knowledge areas as they engage in the process of collaborative knowledge creation. Vocabulary controls can address issues of language polysemy and synonymy by contextualizing terms within an extended term by document matrix. This decreases the influence of any single term and increases conceptual retrieval through the juxtaposition of a large set of variables, related both within a single note, and between all entries in the possible information set, which can be subject to continuous change when any new entry is added to the data set. Statistically-based information retrieval can function as an automated computational device that can help to support, guide, and extend the thinking processes of students who are willing and able.
REFERENCES


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Appendix A.

SUBJECT OUTLINE

ENG 200

Literature from the Romantic to Modern Period

Students will be presented with and will discuss the diversity of English Literature, including the history and development of the novel, from the birth of the Romantic period to the modern day. Topics will be presented in a setting which encourages discussion, interpretation and critical thinking.

By presenting major literary works and encouraging discussion, the goals of this course are.

1.) to develop the student's ability to read effectively and precisely
2.) to develop creative and critical thinking
3.) to help students to develop the discipline and detachment required for participation in lively, unbiased discussion
4.) to provide models for educating and stimulating the imagination
5.) to develop effective critical skills
6.) to develop effective writing skills when dealing with literature.

Topic Highlights:
1) Introduction to Literature
2) Introduction literary criticism
3) The Romantic period: Blake, Wordsworth, Coleridge, Keats, Shelley, Bronte
4) The Victorian Period: Tennyson, Browning, Carroll, Dickens, Hopkins, Hardy
5) The Modern Period: Yeats, Auden, Eliot, Orwell, Joyce, Larkin, Hughes, Thomas, Forster

Textbook:
English Literature by Craig, von Schmidt, and Bennet. Toronto: Ginn and Company, 1984. Course materials not included in the text will be provided by the instructor.
Method of Evaluation:

- Written Conference Entries ........................................... 20%
- Conference Participation ............................................. 10%
- Lead discussant conference presentation ....................... 10%
- Major essay .............................................................. 20%
- Mid-term test ............................................................ 15%
- Final exam ............................................................... 30%

The students of the mixed mode class will be required to contribute a minimum of seven notes per week to the conferences. All of an individual's contributions will be evaluated by the instructor and the best five in terms of their application of the principles specified in the "Guide for Understanding Literature and Poetry" will be selected for grading. These will be commented upon and returned to the student privately on a weekly basis through the conferencing system; thus these will parallel the weekly written assignments of a regular class.

Grading for weekly participation in the conferences will use the following general guidelines:

- 0 - 54 - you have made less than three contributions.
- 55 - 59 - you have made at least four acceptable (relevant and readable) contributions.
- 60 - 69 - you have made at least seven acceptable (relevant, readable, clear and concise) contributions which make direct reference to either the reading materials or the contributions of your classmates.
- 70 - 79 - your contributions help further the discussion. They provide new, relevant information or perspectives. They address the questions raised by others and/or they pose thought-provoking questions for the group.
- 80 - 100 - your contributions provide a "netweaving" effect by integrating the ideas, concepts, issues, and problems raised throughout the discussion and the course as a whole.

The lead discussant assignments will require students, as part of their final grade assessment, to post into the conference a 500 to 700 word written presentation on a specific work. Discussants must also be prepared to direct an on-line discussion on that work. Where students have not selected works, or there are too few students for all works, the instructor will assume this role.

Conference structure

The following conferences will be opened for the mixed-mode class:
1. "INSTRUCTOR" Read-only. This will be used for the posting of any background information for the course such as general lectures or specific instructions.

2. LARRY HOPPERTON This is a private conference. It will be for students to privately contact the instructor for assistance or other communication.

3. Student private conferences (by name)
   There will be one private conference for each student which can be read only by the student. Private messages from the instructor, CAIRS responses, or other private correspondence can be posted here.

4. "HELP!" This public conference is for posting requests for, and receiving answers to technical questions.

5. "CAIRS" In this public conference on information retrieval, the instructor will post a general introduction to CAIRS, instructions on query formulation, and sample queries and results from the course conference. Students will be able to ask questions about CAIRS and receive answers.

6. "PARTY TIME" This public conference is for general discussions about non-course related activities.

7. "INTRODUCTIONS" This public conference will be used on the first night of class. Students will be asked to post a brief, biographical message for their fellow students.

8. "LITERATURE" This is the main, public conference for the discussion of course materials. All participants may post to and read messages from this conference. This conference and the ESSAYS conference will be the basis for CAIRS searches.

9. "SUMMARIES" This read-only conference will contain the posted course summaries.

10. "ESSAY" This public conference will be used for discussion of the opposing literary theories which students must consider and reconcile as part of their major essay. It is anticipated that this conference will be a focus of CAIRS searches.
APPENDIX B.

ADDENDUM TO THE COURSE OUTLINE
FOR THE MIXED-MODE COURSE

LITERATURE: ROMANCE TO MODERN

SEMINAR LIST/COURSE SYLLABUS

The following is a course syllabus and list of seminars. Seminars should be 15 to 20 minutes in length. Students should present the work which they select in detail with specific reference to form and content (what is being said, how is it being said, what literary devices are used etc.) Further, students should discuss the type of the work (ie novel, short story, sonnet, ode etc) and the features of the work which make it typical of its literary period. The main question is what do you think this work is all about and why do you think that. Please see your instructor for further direction.

Items marked ** will be presented by the instructor.

Romantic Period (weeks 2-6)

**
1. Wordsworth " The Prelude"
2. Wordsworth: "Composed Upon Westminster Bridge" and "The World is Too Much With Us"
**
3. Coleridge: " Apologia Pro Vita Sua" and " Incription for a Fountain on a Heath"
4. Coleridge: "Frost at Midnight"
5. Wollstonecraft: A Vindication of the Rights of Women
6. Shelley: "Ode to the West Wind"
7. Shelley: "To a Skylark"
8. Keats: "Ode on a Grecian Urn"
9. Keats: " La Belle Dame Sans Merci"
10. Bronte: from Jane Eyre

Victorian Period (weeks 7-10)

11. Tennyson: "Ulysses"
12. Browning: "My Last Duchess"
13. Browning: "Home Thoughts from Abroad" and "Home Thoughts from Sea"
14. Arnold: "Dover Beach"
15. Carroll: A Mad Tea Party from *Alice in Wonderland*
16. Hopkins: "God's Grandeur" and "Spring and Fall"
17. Hopkins: "The Windhover"
18. Dickens: from *Great Expectations*
19. Hardy: "The Darkling Thrush" and "Channel Firing"

Modern Period (weeks 11-13)

20. Yeats: "The Lake Isle of Innisfree"
21. Yeats: "Sailing to Byzantium"
22. Brook: "The Soldier" and Owen: "Strange Meeting"
23. Auden: "In Memory of W. B. Yeats"
24. Auden: "Musée des Beaux Arts"
25. Forster: The Machine Stops
26. Eliot: "Preludes"
27. Eliot: "Journey of the Magi"
28. Orwell: Politics and the English Language
29. Joyce: from *Portrait of the Artist as a Young Man*
30. Thomas: "Do Not Go Gentle into That Good Night"
31. Thomas: "Fern Hill"
32. Larkin: "The Whitsun Weddings"
33. Larkin: "Mr Bleaney"
34. Hughes: "The Horses" and "Hawk Roosting"

**Weekly Activities Outline**

The basic idea behind this course is that we must become very interactive. Our main classroom is the discussions which we will have online. Here are a few guidelines:

1. Check in frequently. Three or more times per week is a good idea. You are required to post at least seven entries per week.
2. Help to make the conversations flow. Do not just dump a bunch of notes in once a week.
3. Do not think of your messages as formal, written assignments. Think of them as natural conversations that you could have with your classmates.

**Week 1**

- 2 hour lecture/discussion class
- distribution of course outlines
- discussion of course requirements
distribution and discussion of essay assignment
- distribution of "lead discussant" assignment
- introduction to literature lecture
- distribution of written "Guide for Understanding Literature and Poetry", the basis for all assignments and on-line postings
- 2 hour introduction to computer conferencing.

TO DO THIS WEEK:
1. Get online and get comfortable
2. Send an introduction note to "?????
3. Send a personal perspective note to "?????
4. Use PROFILE "EAC269" BRANCHES to see what's there.
5. Respond to each other.

Week 2
- face to face class
- discussion of pre-test
- Introduction to the Romantic Period
- Computer Conferencing review
- directions on conference structures
- participation guidelines.

Week 3
- CMC participation
- first lead discussant postings

Week 4
- 1 hour lecture
- discussion of any CMC problems
- CMC participation with lead discussant postings
- first summary posted on CMC

Week 5
- CMC participation with lead discussants
- opening of Essay conference
- on-line introduction to PARTI search procedures

**Week 6**
- CMC participation with lead discussants
- second summary posted

**Week 7**
- 3 hour face-to-face class
- Introduction to information retrieval
- 2 hour mid-term test
- CMC participation is still expected throughout the week
- opening of "Introduction to CAIRS" conference

**Week 8**
- 1 1/2 hour lecture/discussion
- take-up mid-term test
- assignment that requires the use of CAIRS
- CMC participation with lead discussant

**Week 9**
- CMC participation with lead discussant presentations
- third summary posted

**Week 10**
- CMC participation with lead discussant presentations

**Week 11**
- CMC participation with lead discussant presentations
- fourth summary posted

**Week 12**
- CMC participation with lead discussant presentations

**Week 13**
- 3 hour lecture/discussion
- course review
- essays due
- further CMC participation optional

**Week 14**
- face to face final examination

**Week 15 - 17**
- individual follow-up interviews.
Appendix C.

NOTES TOWARDS AN UNDERSTANDING OF POETRY AND LITERATURE

The following notes and questions are intended as a supplement to the questions which appear at the end of each selection which we consider. They are a guideline only and are not intended to be an exhaustive approach to the careful study of literature and poetry. You should also consult the glossary of literary terms at the back of your textbook and any handbook to literature for further discussion of literary features and terminology.

There are two essential aspects to the study of literature. These are attention to the details contained in the work under consideration (the form and content), and the ability to question your own reactions. In constructing any discussion about a piece of literature, the fundamental questions which you should be asking yourself are.

Based upon what is being said here, and the way in which it is being said, why do I think what I think?
What details of the piece support my reaction?
What details contradict my reaction?
Given all the details of the piece, is my reaction cohesive?

A General Guide to Understanding Poetry

Poetry: This is writing which is intended to give a concentrated and imaginative awareness of experience and is arranged to give a specific emotional response through meaning, sound, and rhythm. This term has been applied to the many forms in which humans have given a rhythmic expression to their most imaginative and intense perceptions of the world, themselves, and the interrelationships of the two. Poetry will demand that the reader attempts to participate in the situation of the poem, and is willing to attempt to understand and identify with (to consider one's reactions as the same as) the poetic statement. Unlike the reading of a newspaper, the reading of poetry will demand intellectual and emotional commitment from the reader, for which the reward

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will be more than factual information; it will be a greater realization of those aspects of ourselves which make us truly human.

1. Who is the speaker? What kind of a person is the speaker?
   While the speaker will often be the poet, it is also possible that the speaker is alternative personality which the poet has adopted. In a play or movie, for example, an actress or actor will play a role that is appropriate for the story. A poet, similarly, may adopt a persona (an alternative personality) in order to make a statement.

2. To whom is the poet speaking? What kind of person is the listener?
   While a poet may be addressing a general audience (just anyone who happens to be reading or hearing the poem), a poem may also be addressed to a specific, identifiable individual or group of people. These may include a friend, a child, God, nature, an inanimate object or a group of fellow travellers. Where the listener is an identifiable person, the personality and reactions of the listener can influence the way in which a speaker makes a statement.

3. What is the occasion of the poem?
   Is there a specific event which has led to the writing of the piece? Or does the poem arise out of the imagination of the poet independent of a specific event?

4. What is the setting of the poem?
   Setting is the physical and sometimes spiritual background in which the poem takes place. Is there a specific time of day or a specific time of year? Is there a specific place in which the poem is set? What influence does the setting have on the poem?

5. What is the central purpose of the poem?
   Why do you think the poet wrote this? What do you think the poet's intention was?

6. What is the theme of the work?
   Theme is the central or dominant idea presented in a literary work; it is the message which the writer is trying to convey. It is usually an abstract or philosophical concept which is made concrete through its representation in the poem. Do not confuse this with subject which is the concrete topic which the poet uses in order to present the theme.
7. Discuss the tone of the poem. How is it achieved?

Tone indicates the speaker's attitude towards the subject or audience, and sometimes towards himself. This attitude becomes clear through the author's choice of words and details. A poem may be playful, somber, informal, intimate, ironic, condescending, or even sarcastic. In this way, the tone will contribute in a major way to the effect and effectiveness of a work. In another sense, the tone may be thought of as the mood of the work and the various literary devices which are used to create that mood. It is the emotional colouring or emotional meaning of a work. Whereas in speech we have the inflection of the speaker's voice to guide us in identifying tone, in poetry almost all the elements of literary technique go into indicating tone.

8. Summarize the events of the poem. Paraphrase the piece.

A paraphrase is a general restatement and often an amplification of the original for the purpose of clarity. This is a good indication of your understanding of a poem. First, put it into your own words and then compare your statements to the poem. Is your paraphrase consistent with the poem? Are there extra elements which you have included but which the poem does not contain? Are there aspects of the poem which you have not included in your paraphrase?

9. Discuss the diction and style of the poem.

Diction refers to the choice of words which the poet uses. We can assume that the poets work from inspiration to revision of poem before they consider them to be complete. Hence, every word has been selected because it conveys precise meaning, either for its denotative purpose (to signify or specific) or connotative purpose (to imply or involve something other than what it specifically refers to, to suggest to the reader's mind more than what the word simply says. For example, the word "home" suggests more than just a dwelling place. It also connotes love, security, and comfort.).

Style refers to the arrangement of the words in a manner which expresses the ideas and intentions of the author. It is the adaptation of language to suite the ideas which are being expressed. There is a great range in styles which an author may use (forceful, ornamental, factual, logical, evocative, didactic, to name a few). It is made up of the idea which is being expressed in combination with the personality and intention of the author.

10. Discuss the imagery of the poem. What kinds of images are being used?
Imagery is word pictures. It is the representation of sense experiences through language. Images represent the pictures, smells, sounds, tastes and other tactile experiences which the author brings into the mind of the reader through language. A poet will select impressions (images) in order to evoke emotions associated with the images form the reader. Through the use of tangible images to which the reader can relate the poet helps the reader to recreate the experience which the poem discusses.

11. Discuss the figures of speech which the poet has used.

No poem will use every figure of speech or musical device, just as not every song will use a full orchestra. Figures of speech are the various uses of language which depart from ordinary usage in order to achieve special effects or meanings. The following are only some of the major figures of speech and musical devices which you will encounter in a consideration of poetry.

**Metaphor:** This is an implied analogy which imaginatively identifies one object with another and ascribes to the first, one or more characteristics of the second. It is the most common literary device. It is a comparison which is made between two things so that the qualities of the second are associated with the first. For example, in "To a Skylark" Shelley makes the statement.

"Hail to thee, blithe spirit!"

which makes an implied comparison between the bird and a spirit, ascribing to the bird the qualities of a spirit.

**Simile:** Like a metaphor, a simile is a way of comparing two things that are essentially unlike. But unlike the implied analogy of the metaphor, in a simile the comparison is more specific. For example, Wordsworth states.

"The city now doth, like a garment, wear
The beauty of the morning..."

which makes a direct comparison between the colours of the light of morning reflecting on the city and the wearing of a garment.

You will find similes easy to identify. The author will use words such as like, as, seems, appears or resembles in order to make the comparison obvious.

**Personification:** Through the use of this metaphor, a poet will give abstract or inanimate object human characteristics. For example, T. S. Eliot says,

"The morning comes to consciousness."
which ascribes to morning the human ability of achieving consciousness.

Symbol: In making use of a symbol, an author uses an object or event which represents something besides itself. For example, the pledge of allegiance in the United States begins, "We pledge allegiance to the flag...." Here, the pledge is not only to the physical flag but also "...to the country for which it stands...." Similarly, the maple leaf is a symbol for Canada, along with being an actual leaf. Through symbolism, an object not only stands for itself but also evokes something else. Another example is the three leaf clover which St. Patrick used to symbolize the trinity of God the Father, God the Son and God the Holy Spirit as three individuals in one.

Hyperbole or overstatement: This is simply an intended exaggeration which is used to heighten an effect or for humour. For example, Shelley states.

"The earth and air
With one voice is loud..."

or we can talk of an eagle flying close to the sun. Neither of these is possible but both are effective ways of conveying an idea.

Understatement: This is generally used for an ironic (an effect which is produced by saying one thing but meaning the opposite) effect. For example, in Tale of a Tub Jonathan Swift makes the statement.

"I saw a woman flayed (whipped) today. I cannot tell you how it altered her person for the worse."

Allusion: Because literature has grown from common, human experience, it is assumed that all readers have a basic knowledge of human events and writers will make use of this common human background. An allusion, then, is a reference to something in history -a person, an event- with which they assume the reader is familiar. Hence, an allusion is a richly connotative word or symbol and is used to suggest far more than the words alone say.

12. Discuss the musical devices which the poet has used.

As with figures of speech, a poem may use some or all of the following devices. Just as the common aspect of all songs is that they incorporate sound patterns but some may be fast or slow, happy or sad, all poems will incorporate some aspect of sound patterning although they may be more or less formal. The following are some of the sound patterns to consider in examining a
poem. Like figures of speech, or the tempo of a song, they are tools which artists will use in order to convey their ideas.

Music and poetry share a similar origin and so the ways you enjoy music will also apply to poetry. While you can look at the score of a Bach cantata and understand the intricacies of the theory of music, the way to enjoy Bach is to hear his music. The same is true of poetry. While you can look at a poem on the page and understand the methods which the poet has used, the way to enjoy poetry is to hear it. Hence, it is always recommended that you READ POETRY OUT LOUD and let your ears and tongue do your work for you.

**Meter:** This is the recurrence in poetry of a rhythmic pattern, or the rhythm established by the regular occurrence of similar units of sound patterns. In music, this would be the beat of the song. The way to hear the rhythm of a poem (and to detect other sound devices which the poet has used) is to listen to the poem and follow the natural intonation of the language. Meter is one of the most fundamental ordering techniques which an author will use. It results from the juxtaposition of stressed and unstressed syllables which make up the English (or, for that matter, any) language.

**Rhyme:** This is the similarity or identity of sound which exists between accented syllables which occupy corresponding positions within lines of verse (a metrical composition). This correspondence of sounds is usually based upon the vowel and succeeding consonants of the accented syllable. For example, "fan" and "tan" are perfect rhymes since the vowel sound (a) and the succeeding consonant (n) are identical, and the preceding consonants (f and r) are different. Through rhyme, the ear will recognize sounds and so will give the reader a sensuous gratification. The recurrence of rhyme at regular intervals helps to establish the stanza (a recurring pattern of lines in terms of length, metrical form, and often rhyme scheme. A stanza will always contain a regular number of lines.) pattern of a poem. Rhyme is relatively new to poetry, having been introduced only around the middle ages (900-1200 A.D.).

**Rhyme Scheme:** This refers specifically to the pattern or sequence in which the rhyme occurs in a stanza or poem. The rhyme scheme is usually denoted by the assigning of a letter to each rhyme. Hence, in Houseman's "Loveliest of Trees, The Cherry Now",

- Loveliest of trees, the cherry now a
- Is hung with bloom along the bough, a
- And stands about the woodland ride b
Wearing white for Eastertide.

'now' and 'bough' are labelled as 'a'. and 'ride' and 'Eastertide' are labelled as 'b'. This continues for as long as the rhyme changes.

**Alliteration:** This is the repetition of identical consonant sounds, or the repetition of any vowel sounds in closely associated words or syllables. Hence, in Coleridge's lines:

"The fair breeze blew, the white foam flew.
The furrows followed free..."

the repetition of the 'f' sound is an obvious example of alliteration. A second example here is the repetition of the 'b' sound in the first line and the repetition of the 't' in fair, breeze, furrows, and free.

**Assonance:** This is a resemblance or similarity in sound between vowels followed by different consonants (compare to rhyme). While rhyme uses a similarity of both vowel and consonant ('lakc' and 'fakc'), assonance uses only the vowel ('lakc' and 'fate'). In a sense, assonance is a half-rhyme rather than a perfect rhyme.

**Consonance:** This is a repetition of the final consonant without the repetition of the vowel sound in the stressed syllable. For example, 'bill/ball', 'add/read', 'born/burn' all repeat the final consonants but not the vowels. This too is an example of half-rhyme.

When words rhyme within a line (rather than at the end) it is called internal rhyme. When the rhymed words are at the end of the line, they are called end-rhyme.

When you criticize (a term which means to analyze, to describe, to justify one's opinion, and to pass a considered judgement), always remember to focus upon what authors are saying and how they are saying it. While your own opinion is the most important aspect of criticism, you can form an opinion based only upon what the author has said, and not upon ideas or opinions which are outside the piece. Hence, to say you disagree with a poetic statement because the author had an asparagus farm, followed a particular political party, or believed in a different God is irrelevant. Similarly, to disagree because you don't like farms, or blueberries or anything which does not relate directly to the work is irrelevant.

In a court of law, a judge makes a decision based upon the evidence which is presented. In literary criticism, you are the judge and the evidence presented to you is the piece of literature under
consideration. Just as the judge can only consider the evidence presented, and not include outside information or personal opinions, in rendering your judgement you can consider only the work under consideration and you must disregard outside details such as personal prejudices. The piece is the totality of the evidence. You are the judge.

In order to judge a piece, we need to begin by asking the following:

1. What is the purpose of the piece?
2. How fully was this purpose accomplished?

This must always be followed with a personal question: Why do I think what I am thinking? Am I right and just? Why?
Appendix D.

PARTICIPATE MANUAL

ENG 200

The Tradition of Literature

THE PARTICIPATE CONFERENCING SYSTEM

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Please Note: You will be using computer equipment of both the College and The Ontario Institute for Studies in Education. The Computer Centres of both institutions ask that you respect this privilege and do not abuse it.
1. COMPUTER CONFERENCING

1.1 Introduction to PARTICIPATE
PARTICIPATE is a computer conferencing system, designed to facilitate educational activities. It provides both electronic mail and group communication (conferencing) facilities. Users can communicate with the instructor and with one another, even though they may be separated by time and distance, by accessing the PARTI system, housed on the central VAX computer at the Ontario Institute for Studies in Education. This electronic delivery medium has proven itself to be popular with students who appreciate the ability to log on to the class from home, work, or the college, 24 hours per day.

1.2 What is Computer Conferencing?
Computer conferencing can be thought of as a group meeting to discuss a specific subject. But unlike a meeting of people, in which all must be physically present in the same time and same place, computer conferencing allows for geographical diversity and a personally convenient time frame. Conferencing is for many to many communication activities, and it maintains an on-going transcript of the interactions among the people discussing a topic. The dispersed group of conference participants can still share messages and ideas and, because of the archiving ability of the computer, can also generate a common record of their discussion.

1.3 Features and Benefits
No time constraints: Members of an electronic meeting or class can read the notes and respond at any hour of the day or night, whenever is most convenient for them.

Location flexibility: Each member can communicate from wherever a telecommunications connection can be made. For many students, this will be either of the campuses of the College which have numerous terminals in the computer rooms. Others may access the class from home, using a personal computer and modem.

Easy to Learn: The conferencing system is flexible and easy to use. Computer skills are not required, and use of the system can contribute to increased motivation and confidence in using computers for other purposes.

Topic Oriented: Computer conferencing allows groups of people to discuss topics of mutual interest and to maintain a complete transcript of the discussion.
Contributors to educational effectiveness:

* telephone tag and office hours problems are overcome;
* scheduling problems, travel time and expenses to attend classes or meetings are eliminated;
* users can participate in many ongoing conferences using less time than for just one face to face meeting;
* users can tailor their information environment and thereby focus their energies, skipping messages or conferences of less interest and using the computer to select or search for particular items.

Permanent record: Each conference maintains a permanent record of all transactions. Class discussions are always available for student reference or for printing.

Participation: All participants have an equal opportunity to 'voice' their opinions or ideas, and to immediately read the replies of others. In a sense, the class will stop so everybody can have their say.

2. THE ELECTRONIC CAMPUS

This section of the manual is designed to introduce you to the commands you will need in order to access and use PARTI from either the College or your home computers.

2.1 PARTI and Internet

While we will be connecting to PARTI through MARS, the main computer at the College, PARTI exists on the main computer at the Ontario Institute for Studies in Education. The computers at the college and OISE are physically connected through Internet, an international network of educational institutions. To join into the class will mean that you are logged in at the college or at your home, working on a computer in downtown Toronto. While this sounds technical and complicated, it's really quite easy.

If you were coming to the classroom, you would first enter the college. Then, you would walk to the right phase and find the classroom. Finally, you would enter the classroom and be ready to participate. Joining the PARTI class is similar. The connections which you make are like walking through sets of doorways.

2.2 Calling MARS

Your first step is to log onto the central computer, MARS, at the college. There are terminals at the main campuses, or you can use your home computer and modem. These instructions will assume that you are logging on from the main campuses.
Here are the steps for logging onto MARS:

1. Find the computer room. Choose a terminal, sit down and **turn it on**.
   That was easy. In a few seconds, the screen will show:
   
   A220 OK

2. **Press ENTER twice.** The screen will show:
   
   College VAX 8530

   **Username:**
   Enter this and press ENTER. The computer will then prompt you for your password:

   **Password:**
   Type in your password. You will never see your password on the screen. If you do see it, it means then you have typed your password in the wrong place.

When your username and password have been entered correctly, the screen will show:

   **COLLEGE, WELCOME TO MARS**

   20-JAN-1993 15:26:27

   ***********************************************
   **College Bulletin Message System**
   **Valid Responses Are:**
   Down arrow - Move cursor down
   Up arrow - Move cursor up
   <CR> - Display bulletin messages as marked
   <DEL> - Unmark a bulletin message
   N/n - Mark a bulletin message as NEVER SHOW (reject)
   X/x - Select a bulletin message to be displayed
   Ctrl-W - Refresh screen
   Ctrl-Z - Exit
   ? - Display this text (HELP)

   Press return to continue ...
   ***********************************************
At this point, **PRESS RETURN** and the screen will change to the college bulletins which are available to you:

Command: Down arrow, Up arrow, <CR>, <DEL>, N, X, Ctrl-W, Ctrl-Z,

Oracle Daily Backup Time 14-jan-1993
Newnham Lab Hours 11-jan-1993
IBM.PC.INFO.Digest 11-jan-1993
DIALUP.INFO.
Mars down Fridays 10:pm till 12:pm. 24-jul-1992
Job Listings On-Line may-1992
NetNorth Replaced by ONet feb-1992
Network Guide. nov-1991
FINGER vs. TOE 17-sep-1991
Some New Utilities Added 20-sep-1989
Microcomputer Virus Protection Program Available
Internetworking discussion 25-apr-1991
Vax ID - Name Program feb-1991
College Telephone Directory On-Line nov-1988
Laser Printing Commands

Press **ENTER** to continue and the screen will show you:

Charges to date: 42.00
Budget remaining: 9,957.00
As of: 93/01/18.

$ 

And congratulations! You have reached MARS. The $ prompt means that MARS is now waiting for your command. Now on to OISE and PARTI.

The first time that you log on to Mars, you will be asked to enter your full name. This is the only time that you will be asked for this. and it is just a way for the Computing Centre to add a name to that long string of characters that is your VAX username.
2.3 From MARS to OISE
To make the link from MARS to OISE, we will be using the Internet connection. This link will allow you to use the VAX computer at OISE from MARS at the college.

To make the connection:
At the $ prompt, type
$ TELNET OISE1.OISE.ON.CA and press ENTER. The computer will respond.

Trying... Connected to OISE1.OISE.ON.CA.

When you press the ENTER key, the screen will show you:

VAX node OISE1. Authorized users only.

Username:
The username for this course is ENG200. Type ENG200 and press ENTER.
Password:
Type the password and press ENTER.

The OISE VAX usually has a log-in message for the professors and students of the Ontario Institute for Studies in Education. For the most part, you can disregard this.

Last interactive login on Wednesday, 20-JAN-1993 15:22
Last non-interactive login on Wednesday, 20-JAN-1993 15:20

Now you have successfully logged into the OISE computer. All that you need to do now is join the PARTI.

2.4 Joining the PARTI
The OISE computer has been programmed to take you into PARTI automatically. This means that it will now ask you for your PARTI name and password:

Please enter your PARTICIPATE name: ENTER YOUR FIRST AND LAST NAME
Please enter your Participate Password: ENTER YOUR FIRST NAME

My PARTICI username is LARRY HOPPERTON: yours should be similar.

When you enter PARTICI for the first time, you will be asked to verify your password by typing it a second time. Then you will be invited to take a tour of PARTICI. This is a good idea for your first time.

You have now joined the class. PARTICI will show you one or two introductory screens of information, each of which can be passed by pressing ENTER, and then places you into our literature conferences.

2.5 A sample PARTICI session

Your opening class screen will look something like the following:

Please type MODIFY PROFILE to enter your address, description and phone number.

SEGMENT NAME (# OF NOTES)
1 Urgent Notes (0)
2 Personal Notes (0)
3 "CLASS BULLETINS" (4)
4 "TRADITIONS" (2)
5 "HELP 151s93" (2)
6 "THE CAFETERIA" (2)
7 "CLASSMATES" (1)
8 "THE ESSAY" (21)
9 "GUIDES" (3)
10 Kept notes (1)

ACTION on 45 Inbox Notes==> READ, WRITE, PROFILE, ACTION, MODIFY PROMPT, HELP

Enter a command or press <RETURN> for: (Read)

The last line is the ACTION prompt. It indicates that PARTICI is waiting for your command.
Above the ACTION prompt is a listing of the conferences which you have joined, and the number of notes in each conference which you have not yet read. The is the PARTI Inbox. These notes, the contributions of fellow students or the instructor are available for you to read and comment upon. After this listing, PARTI waits for you to decide what you want to do. You can return to the PARTI inbox by issuing the command INBOX at the action prompt:

Enter a command or press <Return> for: (read) INBOX

This will return you to your listing of unread notes. It's like going back to the beginning again.

2.5.1 Writing a note to a conference or person

To write a note for the conferences, at the ACTION prompt,

Enter a command or press <RETURN> for: (Read) WRITE

The computer will respond with:

Enter your text.
Then enter one of the following on a new line:

.DISPLAY, .OPEN, .SEND, .CLEAR, .QUIT, .HELP

Enter text:

this is a sample

.send

The computer will then prompt you:

Enter addressee list:
The computer is asking you where you want your note sent. Type, in quotation marks, the conference to which you want this note sent:

Enter addressee list: "THE CAFETERIA"

The computer will respond,

Sending to "THE CAFETERIA" as note 736.

ACTION on 42 Inbox Notes==> READ, WRITE, PROFILE, ACTION, MODIFY PROMPT, HELP
Enter a command or press <RETURN> for: (Read)
When I told PARTI that I wanted to write a note, it took me to a blank scratchpad. I can type anything I want into the scratchpad, in ordinary English. When I was finished typing, I told PARTI to send the note by typing the 'send' command on a new line. ANY TIME YOU USE A . COMMAND, IT MUST BE ON A NEW LINE.

The computer then asked me for an addressee list. My addressee was a conference, "THE CAFETERIA". IN SENDING A NOTE TO A CONFERENCE, THE CONFERENCE NAME MUST BE IN QUOTATION MARKS. If I had wanted to send the note to a classmate or the instructor, I would have typed the individual's first and last name WITHOUT QUOTATIONS in the addressee list.

When you pressed ENTER, the computer told you that the note is being sent to the conference.

2.5.2 Reading notes
You have a few options for reading notes. If you are at your inbox, you can simply press ENTER at the prompt. This will give you a sequential view of the notes, starting with those in the early conferences and ending with notes in the later conference. After reading each note, you will be given the option of continuing to read, or writing a response.

Alternatively, when you reach the prompt in your inbox, you can specify which notes you want to read.

<table>
<thead>
<tr>
<th>SEGMENT NAME</th>
<th>(# OF NOTES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Urgent Notes</td>
<td>0</td>
</tr>
<tr>
<td>2 Personal Notes</td>
<td>0</td>
</tr>
<tr>
<td>3 &quot;EAC151S93&quot;</td>
<td>4</td>
</tr>
<tr>
<td>4 &quot;TRADITIONS&quot;</td>
<td>2</td>
</tr>
<tr>
<td>5 &quot;HELP 151s93&quot;</td>
<td>2</td>
</tr>
<tr>
<td>6 &quot;CLASS BULLETINS&quot;</td>
<td>2</td>
</tr>
<tr>
<td>7 &quot;CLASSMATES&quot;</td>
<td>1</td>
</tr>
<tr>
<td>8 &quot;INSTRUCTION&quot;</td>
<td>4</td>
</tr>
<tr>
<td>9 &quot;THE ESSAY&quot;</td>
<td>21</td>
</tr>
<tr>
<td>10 &quot;GUIDES&quot;</td>
<td>2</td>
</tr>
<tr>
<td>11 Kept notes</td>
<td>1</td>
</tr>
</tbody>
</table>

-----press <RETURN> for next prompt-----
ACTION on 43 Inbox Notes==> READ, WRITE, PROFILE, ACTION, MODIFY PROMPT, HELP
Enter a command or press <RETURN> for: (Read) 5

At the prompt, instead of pressing ENTER and seeing my notes sequentially, I typed the number of a conference. In this case the "HELP 151s93" conference, number 5. The computer takes me to that conference and shows me the first of the notes which I have not read:

"HELP 151s93" by LARRY HOPPERTON, May. 07, 1993 at 13:08 about A CONFERENCE FOR TECHNICAL ASSISTANCE (344 notes)

341 (of 344) ANNE STUDENT Jan. 12, 1993 at 18:15 (307 characters)

I, too, would like to retrieve my course dialogue. Any suggestions?
Anne Student

This is a note from a student. Everyone can read it and everybody is invited to respond. The computer shows you:

ACTION on "HELP 151s93" 34 (of 43) ==> READ, KEEP, WRITE, JOIN, LEAVE, PROFILE MEMBERS, PROFILE BRANCHES, FIND "text", OTHER
Enter a command or press <RETURN> for: (Next) ENTER

Here I have pressed ENTER to read the next note:

37 (of 43) ANNE ANSWER Jan. 12, 1993 at 18:40 (212 characters)

Use file command. Let us assume that there were 100 notes in your conference. You can send the conference to a vax file called temp by using the following command.
I have now seen two notes, and again been returned to the prompt. I can respond to one or both, change the topic, continue with my reading, or return to my INBOX.

2.5.3 Getting a print-out of the notes
Getting a print out of notes will take about a day because of Internet computer administration, but, for you, it will be easy. When you have finished reading a note, and you decide that you want to save it, the computer will give you the following prompt:

Enter a command or press <RETURN> for: (Next) FILE
What file? YOURNAME
Filed.

At the prompt, I typed the command FILE. The computer then prompted me for a file name by asking, "What file?" I named the file my own name. ALWAYS NAME FILES AFTER YOURSELF and follow each file name with a number (for example, LARRY1 LARRY2 LARRY3). This creates a file of the note on the OISE computer which will be forwarded to MARS on the next day. You then print the file at the college by typing the print command at the dollar prompt:

$print filename

To get a list of the files which are available in your VAX account for printing, type DIR at the dollar prompt.

$dir

2.5.4 Leaving PARTI
Whether you are reading notes or writing them, PARTI always returns you to the action prompt:
ACTION on "HELP 151s93" 37 (of 43) =>
READ, KEEP, WRITE, JOIN, LEAVE, PROFILE MEMBERS, PROFILE BRANCHES,
FIND "text", OTHER

Enter a command or press <RETURN> for: (Next) LO (short for logout)

When you are finished with PARTI on OISE's VAX, you will need to issue the command EXIT at the TELNET prompt. The connection to OISE will be broken and you will be returned to MARS. The computer will show you:

TELNET> EXIT
Connection closed by Foreign Host: You are now back on MARS.

$ 

To turn off the college computer, now, the command at the $ prompt is lo (short for logout):
$lo

Then, turn the power off on the terminal.

3.0 NETIQUETTE

3.1 Introduction
Every communication method, including electronic communication, has its strengths and weaknesses. Because of the speed, convenience, and informality of electronic communication, we tend to equate it with verbal communication. However, since it is a form of writing, its advantages and restrictions are more like those of memos. Electronic communication does not incorporate any elements of body language. You cannot tell by the tone of voice that the sender is joking. You cannot see by the furrowed brow that the receiver is confused. And you cannot see ones' skin colour, age, appearance, or dress. Only words convey the message. Another difference between electronic and oral communication is speaker-listener interaction. Electronic communiques are sent as lumps of complete thought to be read at the receiver's leisure. You lose the instant interaction that often clarifies oral communication, but you gain the ability to make complete statements without interruption and give the listener time to decide a thoughtful response.
A key to successful communication is to have consideration for your readers. With the amount of information pushed upon individuals continually increasing, you can save them time by being clear and concise. A well-organized, to-the-point message is more inviting than five screens full of long, single-spaced text.

Below are some guidelines to help you to use the strengths of electronic communication and avoid problems.

3.2 General guidelines
1. Length of message
Brevity is a definite virtue. Try to restrict a message, if possible, to a screen; two screen pages are still tolerable. Brevity is recommended if only because reading long text on the screen can be tiresome for both the eye and mind. As always, think about your reader.

2. Writing style
Use short sentences and simple English. Avoid rambling running prose with complex syntax and a multitude of co-ordinate and subordinate clauses. While the nature of online discussion means that some inconsistent grammar will slip through, keep your writing clear. This is essential in written discussion. Notes should still be written using normal sentence and paragraphing structures since this is what we are accustomed to when we read.

3. Spacing
Neat, meaningful spacing can ease mental processing. For example:
- a. Have short paragraphs separated by a blank line rather than long paragraphs with a tab indent for the first line.
- b. Put questions on separate lines rather than stringing them altogether in one paragraph. This makes it easier for people to annotate or answer them.

4. Numbered items
Ideas, arguments, etc. are clearer if they are numbered. It will make it easier for your classmates to cross reference.

5. Annotation
When you want to refer to a previous note, make direct reference to it in the first line of your note (for example, " re: #51 in "INSTRUCTION"). This will make it easier for classmates to find. It's also a good
idea to paraphrase or summarize the original so that readers can understand the background of your entry and follow the argument.

6. Upper case
The upper case is often used among networkers to denote emphasis, but using too much of it can produce what is know as the "BANG" effect. Words in upper case shout at you and generate a "noisy" reading environment. THIS SENTENCE SEEMS TO STICK OUT AS IF SOMEONE WERE SHOUTING AT YOU. AND THIS CAN MAKE THE SENTENCE MORE DIFFICULT TO READ.

7. Subject line
PARTI will allow you to add a subject line to your note when you send it. This will indicate to other readers the general content of your note. But it is a good idea to include subject headings in your note itself to help others to follow your thoughts. These internal subject lines will also help classmates to retrieve and select messages of interest to them.

8. Wit and humour
A small and occasional dose of wit and humour does wonders for a stuffy conference that is beginning to take itself too seriously, and it can also break the ice for a conference with a hesitant start. But too much clowning around and too many flippant jokes or remarks can be irritating and offensive to people.

9. Spontaneous or considered response
Much can be said in praise of spontaneity. It adds a lively spark to a discussion. But if you are dealing with a sensitive or controversial topic, it would be better if you could give yourself a little more time to reflect on the arguments and counter arguments, than compose a considered response that you will not regret or feel embarrassed about afterwards.

10. Etiquette and protocols
a. Acknowledge and thank people for their comments on your views. (You should do that privately rather than publicly.)
b. Avoid digressing in a conference. If a side issue is of interest to a number of participants, we can open a special sub-conference for discussions that stray away from the original intent of the class.

11. Identification
Be sure that you identify the topic area to which you are responding. Everybody else wants to know what you are thinking so tell us the topic.
3.3 Quick summary
* Be concise
* Organize your thoughts.
* Never forget a human being is on the other end, reading your message.
* Ask for clarification before jumping to conclusions. Perhaps that seemingly outrageous message was meant to be funny or to convey a completely different idea.
* For the main body of your text, use lines less than 65 characters long because they are easier for the eye to follow.
* Use uppercase text sparingly because it is more difficult to read and is needed for emphasis.
* Use subheadings (all caps is fine) and lists to break up the text.
* If you are attempting sarcasm or other humour, clearly indicate so. A common convention is to place a smiley face icon at the end of non-serious passages. For example, tilt your head to the left to view the following examples
  :-)  I'm happy, or making a joke
  :-(  I'm sad
  :-|  Say no more! A nod is as good as a wink.
  >:|  I'm wrestling with this problem
* Post a different note for each topic of discussion.
* When responding to a posting, summarize the original posting so that your readers understand the context. If you choose to include the original itself, delete all but the passages relevant to your point. Keep it as short as possible.

3.4 Conclusion
Remember that type-written conversation is the glue that binds us together as a learning group. Let these notes on style and etiquette guide you, but don't let anything inhibit you. We are all interested in what YOU think.

When you are reading the notes which the group has entered, be ready to jot down your thoughts, just as you would in any lecture-style class. On a piece of paper and to use these, along with the notes you made while reading the course materials, to compose your contributions to the group. We are not looking for perfect thinking and understanding in these discussions. There are no wrong answers or bad ideas. We are looking to build our group and individual knowledge.
4.0 DIALING INTO MARS FROM YOUR HOME COMPUTER AND MODEM

To log into MARS from a remote location like your home will require that you have a microcomputer, modem, and communications software. MARS at the college will accept transmissions at 300, 1200, or 2400 baud. You will have to configure your software to accept the following:

Telephone: 999-9999
no parity
8 data bits
1 stop bit

You will have to type CON MARS at the Local> prompt.

5.0 A PARTI MANUAL

The following pages provide you with a more detailed PARTI manual. These sections are reprinted from A User's Guide to PARTICIPATE: OISE's Computer Conferencing System by Linda Harasim and Marcia Williamson (1988).

(Pages not provided in Appendix)
SEARCHING IN PARTI, PART 1:
TEXT STRING AND DATE SEARCHES

LITERATURE: Romantic to Modern Periods
Searching in PARTI

Part 1: Text String and Date Searches

At this point in time, there are over 300 notes in our conferences, and these notes refer to a variety of pieces which we have considered. As I'm sure you have notices, the notes have been organized by conference name, not by subject. For the purposes of studying specific works, we need a way to locate subsets of notes in the conferences.

PARTI provides us with the FIND command for locating notes in the database. There are several different types of notes that you can FIND. You can locate notes that have appeared in your inbox since a certain date or between one date and another. You can limit the search to finding notes from a specific user, or notes that you sent to a specific user. Or you can find notes that contain a specific word or group of words.

1. To find notes that appeared around a specific date, at the action prompt type

**FIND BETWEEN 11/20/84 AND 11/26/84**
This will return all the notes that appeared in your inbox between those two dates. The order of the dates in month/day/year (mm/dd/yy)

2. If you know the name of the author of the notes that you are trying to find, you can specify that information. At the action prompt, type
FIND SINCE 11/20/84 FROM ANNE STUDENT
This will return all notes that Anne Student has posted since the specified date. You will find this to be useful if you want to see the sample seminar on Blake which was posted.

3. A particularly useful search technique will help you to locate all notes that contain a specific word or set of words. This is the FIND /string/ command, in which the specific set of letters that you want found is enclosed in slashes. For example,

FIND /Blake/ in "INSTRUCTOR"
Will return all notes from the "Instructor" conference that mention Blake. This will be useful if you want to see all the notes on a specific poem as part of your studying. But you are not restricted to a specific conference with this command. In the conference structure, all sub-conferences are branching off the main "EAC 269" conference. At the action prompt, type

FIND /west wind/ in "EAC 269" BRANCHES
PARTI will search though all of our conferences for mention of 'west wind' and return these to your inbox:

<table>
<thead>
<tr>
<th>SEGMENT</th>
<th>NAME (# OF NOTES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Urgent Notes (0)</td>
</tr>
<tr>
<td>2</td>
<td>Personal Notes (0)</td>
</tr>
<tr>
<td>3</td>
<td>&quot;EAC 269&quot; (1)</td>
</tr>
<tr>
<td>4</td>
<td>&quot;LITERATURE&quot; (16)</td>
</tr>
<tr>
<td>5</td>
<td>&quot;Help Please&quot; (1)</td>
</tr>
<tr>
<td>6</td>
<td>&quot;Instructor&quot; (6)</td>
</tr>
</tbody>
</table>

Action on 24 Found Notes=>>

These are all the notes that mention 'west wind'. They have been returned to your inbox. To read them sequentially, simply press RETURN as you would to read any other notes. When you are finished reading, type INBOX to return to your regular inbox.

For more information on the searching procedures in PARTI, at the action prompt type

HELP FIND
Appendix F.

SEARCHING IN PARTI, PART 2:

CAIRS SEARCHES

EAC 269 FM

LITERATURE: Romantic to Modern Periods

Searching in PARTI

Part 2: CAIRS Searches

At this point in time, there are over 300 notes in our conferences, and these notes refer to a variety of pieces which we have considered. As I'm sure you have noticed, the notes have been organized by conference name, not by subject, and even less so, by ideas or concepts. As you work on your essays, and other course assignments, you will find it useful to be able to search for ideas, rather than just specific words as with other PARTI search techniques. For the purposes of considering the relationship between ideas, we need a way to locate subsets of notes in the conferences, and to decide upon their relative importance to ideas.

Let me give you an example. If you want to investigate the effect of rhythm in modern poetry, existing PARTI search techniques will limit you to searching on each of these words individually. But there are many synonyms for these words in the English language. Synonyms are words which are closely associated in meaning. Consider the following:
If you are looking for notes which discuss rhythm in modern poetry, wouldn't notes that discuss tempos in contemporary verse be useful? Further, if you are searching for the effect of rhythm in modern poetry, wouldn't information on the use of meters in Romantic or Victorian poetry also be of some use to you? We need a way to search for all of these simultaneously, and to show us that while information on rhythm in Romantic or Victorian poetry is somewhat helpful, it is less useful than other information.

CAIRS (Computer-based automatic information retrieval system) will perform searches like these and return notes to you in a hierarchical order from most to least important. CAIRS will look for the synonyms of all terms and rank the retrieved notes for you. There is no special computer code to learn or special syntax to use. All you need to do is ask CAIRS an ordinary question.

What Will CAIRS Give You?
CAIRS is based upon a statistical procedure. While it will not give you a direct answer, it will cluster the notes which have been put into our conferences around conceptual hubs, and the conceptual hub will be your question. It will examine everything in the database, select those notes which match or closely match the ideas in your question, and return these notes to you in the order of most to least important. So you will be receiving back actual notes that have been contributed.

When you get a CAIRS response, you should read through the notes, and formulate your own answer based upon the ideas that the notes contain. Remember that something ranked at 92% is more closely related to your question than something ranked at 40%, so you should pay more attention to the 92% than the 42%. Nonetheless, every note which CAIRS retrieves should be considered in relation to your question.

How Do I Use CAIRS?
Using CAIRS is easy. All you have to do is ask a question and send it to the CAIRS conference. Use separate notes for each question since CAIRS considers a full note as one question. CAIRS will then go to work for you, and return the responses to your private conference.
But you should think about asking questions for a minute. CAIRS works on ideas, not specific words. As a result, if you want to search for everything that has been said about COLERIDGE, CAIRS won't work very well. Other PARTI search techniques will be much better for a search for "COLERIDGE". But if you want to see how the ideas of truth appear in Romantic poetry, CAIRS will search for these ideas, and also provide you with ideas on how the concept of honesty appears in literature.

The point is that the better you can ask your question, the better CAIRS will respond to you. The more information you can provide in your question, the more precise CAIRS will be. For example, if your question is:

What's all this rhythm stuff?

CAIRS doesn't know where to go looking. If your question is:

The Romantic poets wanted to approximate the language which people really speak and so they used iambic pentameter. What is the effect of using this rhythm in their poetry?

then CAIRS can do a really good job for you. The more you can tell CAIRS about what you want, the better it can do for you.

Limitations of CAIRS

CAIRS has to understand what you are asking, and then it has to compare this to all the entries in the conferences. This will take a bit of time. In earlier tests of the system, it took about a day to answer a question. A lot can happen simultaneously, so feel free to ask as many questions as you like at one time. If everyone in the class asked 10 questions at once (50 questions in total), CAIRS would take one day to respond to all.

When asking a question, you should tell CAIRS how many notes you want returned to you. If you don't specify a number, CAIRS will return notes in multiples of 5 until it reaches notes which only have a 30% likelihood of helping you. After this, it will stop.

A Statistical Example

CAIRS will be creating a massive note by term matrix. I expect that by the end of class, we will be looking at 800 notes by 1200 terms. CAIRS uses the following, oversimplified procedure to look at the relationship between notes:
The ? in the first column represents a question. T1..T7 are the terms or words in the database. D1 and D2 are fairly obvious matches to the query since they contain many terms in common with the query.

Interestingly, though, although D6 shares no common terms with the original query, it does share terms with D2, D3, and D5. Hence, we would want to associate D6 with D2, D3, and D5, and since D2 is strongly associated with the query, D6 should also share some association with the query, albeit much less. In the response to the query, then, a student would be returned D6 although it would be weighted - in terms of satisfying that query - much lower than D1 or D2. If you expand this matrix out to one with 960000 entries (the number of words times the number of notes), you can get an idea of the job which CAIRS will do.
Appendix G.

GENERAL BIOGRAPHICAL QUESTIONNAIRE

You are being asked to fill out this survey as part of a study about the use of computer conferencing and information retrieval in continuing education courses. Although names are needed for matching purposes, these will be physically removed as soon as a code is assigned, and before any person other than your instructor sees the questionnaire. No individual will be identified in any report and no information will count towards course evaluation. Thank you for your cooperation.

Background Information

Name ___________________________ Today's date ________________
Age _______ Gender (M/F) ___ Phone Number ______________________
High School Grade Completed ______
Have you completed a college diploma? (yes/no) ________________
   If yes, what program? ________________________________
Have you completed a university degree? (yes/no) _____________
   If yes, in what field? _________________________________
   If no, have you completed any university courses (yes/no) __
      If yes, please list them.
In which diploma program are you currently registered?
Which college credit courses have you completed? (please list)
Which college credit courses are you taking this semester? (please list)
Are you employed this semester? (yes/no) ______________________
   If yes, how many hours per week on average do you work? ______
   Please state your job title and give a brief description of your duties.

Computer Experience

Do you own a computer? (yes/no) ________________________________
   If yes, what type? ________________________________

Do you own a modem? (yes/no) ________________________________
   If yes, what uses have you found for your modem? (please list)
If you do not own a computer, have you ever used a computer? (yes/no) ______
If yes, what kind of computer have you used?

If you have ever used a computer, how comfortable and familiar are you with using a computer? (select one of the following)

very comfortable ____________

somewhat comfortable ____________

not very comfortable ____________

What software packages do you know how to use?

How many words per minute can you type on a typewriter or a computer keyboard?

___________ words per minute

Have you had any experience learning with computer based instruction? (yes/no) __

If yes, please describe the course or courses.

Did you enjoy learning with the computer? (yes/no) __

Please comment upon aspects which you did or did not like.

Have you had any experience with computer conferencing? (yes/no)

INSTRUCTIONAL PREFERENCES

Have you ever taken a course which formally involved extensive discussions with your fellow students? (yes/no) __________

If yes, please describe the course.

Do you enjoy talking about course materials and assignments with your classmates? (yes/no) __

If you had the opportunity, would you like to discuss course materials and assignments with your classmates? (yes/no) __

Would you like to work with one or more partners on your assignments? (yes/no) __

When you registered for this course, were you aware that one section of the course would be using computers as part of the instruction? (yes/no) __
Would you prefer a course (please rank from 1-highest to 5-lowest)

- taught by lecture only
- taught by lecture and class discussions
- taught by lecture and small group discussions
- taught entirely through discussion
- taught by lecture with computer based assignments

Outside of regular classroom hours, how much time per week, on average, do you expect to spend on the following?

1. Reading and studying course materials? ________ hours
2. Preparing and writing weekly assignments, essays and seminars? _______ hours

In other classes which you have taken, when you have encountered problems, where have you gone to find help?

In other classes which you have taken, when you have needed additional information in order to answer questions, where have you gone to find the information?

Do you think that the computer will help to tailor instruction to your needs and interests?

Do you think that computer conferencing will make you more actively involved in your learning?

Do you think that computer conferencing will provide an impersonal learning experience?

Do you think that the mechanics of the computer will distract you from learning?

Do you foresee any problems?

Do you think that computer conferencing will prevent you from setting a pace that is right for your ability level?
Appendix H.

INTERVIEW SCRIPT

Questions to be given verbally and tape recorded. Order of questions is subject to change by the interviewer.

Name__________________________ Today's date____________

REASONS FOR TAKING THIS COURSE AND MODE

Why did you take this course?

Did you know that the course was offered using an alternative mode, that is face to face?

Did you consider taking the other mode?

Did you consider transferring to the other mode?

Why did you choose this mode?

How comfortable and familiar are you with using a computer?

Did you enjoy learning with the computer? (yes/no)________

Please comment upon aspects which you did or did not like.

TIME ON COURSE

Outside of regular classroom hours, how much time per week, on average, did you spend on the following?

1. Reading and studying course materials? ________ hours
2. Reading and responding to conferences? ________ hours
3. Other preparation for conference participation

What were the best aspects of the class?

What were the worst aspects of the class?
Were course expectations clearly defined at the start of the course?

Did you have enough opportunity to participate in class?

Did you have enough interaction with the instructor?
   Was there enough instructor support and feedback?
   Was this helpful?

How well do you know your classmates?
   Did you know any of them before the class?
   Please compare this to a regular class.

Would you have liked the more opportunity to discuss course materials with your classmates or instructor?

Were the reading guides to Plato, Shelley and Eliot which the instructor handed out useful to you?
   How did you use them?

THE COMPUTER CONFERENCING COURSE
Did you enjoy learning with computer conferencing?
   What specific things did you like?
   What did you not like?

CMC SYSTEM
Did you find the system easy to learn?

How long did it take before you felt comfortable with it?

Did computer conferencing help to tailor instruction to your specific needs?

Did CMC make you more active in your learning?

Did the mechanics of the terminals provide you with any problems?

Did you ever use the system to send private notes to classmates?
LEAD DISCUSSANT PRESENTATION
Were the lead discussant presentations useful to you?
    The one you did?
    The ones presented by other students?

GETTING HELP
When you needed help with essays or assignments, where did you go?
    Did you go to classmates?
    Did you contact the instructor by phone or conferencing?
    Did you go to people not connected with the course?

When you needed to find information (for example, course readings, outside information, research information), where did you go?
    Did you have any difficulties finding useful information? Explain.

THE INSTRUCTOR
Please evaluate the instructor. What were the best and worst aspects?

Please comment on the instructor's postings in conferences.
    Were there enough? too much?
    Please comment on the teaching style.

Did you have sufficient interaction with the instructor?

Did the instructor provide you with sufficient feedback?
    Was it useful?

COMPARISON TO FACE-TO-FACE CLASSES
How would you compare the learning experience through computer conferencing and face-to-face classes?
    Please compare and contrast.
    What are the strengths and weaknesses of each?
    Computer interaction vs classroom interaction?

Do you think that you learned more or less through computer conferencing?
Would you recommend this kind of course to a friend?

Would you take another course offered through computer conferencing?

RECOMMENDATIONS FOR THE COLLEGE
What kind of basic skills (language ability, computer, typing etc.) do you think a person should have if they are going to take a computer conferencing course?

What kind of person/student do you think would do well in a computer conferencing course?

What kind of person/student do you think would do terribly in a computer conferencing course?

What kind of courses do you think would be appropriate for computer conferencing courses?

If the college were to offer more courses through computer conferencing, what suggestions would you make to the college, the instructors, and the students?

CAIRS AND COMPUTER CONFERENCING
Information retrieval
When you needed further information about some aspect of the course, where did you look for it?

Did you consult the other students through the conferences?

Did you use the search techniques (other than CAIRS) available through the conferencing system?
  How often did you use the FIND command?

  Was the information that you retrieved useful and appropriate for your needs? Did it answer your question?

  What were the best/worst aspects of the search techniques?

Did you consult classmates outside of the conferences or classroom?

CAIRS
Did you use the CAIRS retrieval system?
Was the information which CAIRS provided useful to you. Did it satisfy your query? Did the response make sense? How relevant was it?

Did CAIRS provide you with unanticipated but still useful ideas?

Was CAIRS able to provide you with information or directions for thinking which you could not find in other ways?

Did the information which CAIRS provided help you in the completion of your assignments? How?

CAIRS SAMPLE
As you know, there are two studies going on right now. First, the College is looking at the usefulness of computer conferencing, and second, Larry is looking at how people use the information that can be generated from a computer conference. In connection with this, I would like to ask you a question about poetry. After you have answered, I will give you a sample of notes from the computer conference section of the course and ask you if you want to add anything to your answer.

1) Give the student a written copy of the CAIRS question and read the question to them. They may need some prompting in formulating their answer. While they will probably talk generally, ask if they can refer to specific poems which would support or counter their statements.

2) When they have completed their answer, ask students the following:
   Given all the class resources that you had at your disposal last semester, if this were the topic for your major essay, how would you go about researching the topic? (libraries, classmates, parents, conferences, etc.)

3) Give the student the sample CAIRS response. Explain that these are notes taken from the computer conferencing section of the course. The system which Larry has built has selected these notes as being the most related to the question, placed them in order, and given a loading which says how well the computer thinks the notes address the question. Ask student to read through this.
   Do they have any comments on the notes while they are reading?

4) When the student has finished reading, give them the CAIRS question again and ask if they would like to change their answer in any way.
5) Questions

Given the question, does the response make sense? Is it relevant?
Does the CAIRS response provide you with information that helps you to formulate ideas?
Does this kind of response provide you with any unanticipated but still useful ideas?
Does this kind of response prompt you to think about the question in different ways? Elaborate.

How would you have used it?

6) Suggestions for the CAIRS development team

SAMPLE CAIRS QUESTION

While many poems make use of the time we have left for life, poets express a sense of fear, particularly through the undertone of death that we see in some references. There seems to be a sense of urgency and helplessness in that the inevitable - death - is going to catch up. Do you think this statement is correct? Elaborate.
Appendix I.

SOLO TAXONOMY REFERENCE TOOL

1. Description
The SOLO (Structure of Learning Outcomes) taxonomy is an evaluation tool which focuses on the qualitative aspects of open-ended responses. Unlike quantitative measures of learning (how much), SOLO is concerned with the meaningful learning and integration of existing knowledge (how well) and the application of that learning in tasks such as making judgements, resolving conflicts, interpreting or deciding. It is used to discriminate between responses of different quality and describe a particular performance at a particular time by considering the conceptual levels of student responses. SOLO provides a method for the measurement of levels of information processing which can vary between students and between the responses of an individual.

Judgement can be made based on the assumption that assessment can be made in terms of the structural levels of complexity of a response. The levels in SOLO which range from concrete to abstract. Each of these levels entail an increasing number of organizing dimensions, increasing consistency, and an increasing use of organizing and relating principles.

2. SOLO Dimensions
There are five levels to the SOLO taxonomy, and three response descriptors for each of these. Table 1.0 presents the dimensions of the SOLO taxonomy. This will be followed by a description of each descriptor and the indications of that descriptor for each SOLO level.

2.1 Capacity
Capacity describes the working memory or attention span of the student. In simpler terms, it considers how much someone must think about in order to develop a response.

PRESTRUCTURAL: At this level, you will see little evidence of demands placed upon the memory. An response will show confusion of the question with the answer, or no attempt to reach an answer. A typical kind of response would be 'dunno' or 'Vancouver is the wettest city because it has lots of water'. There is no connection between information or no attempt to make any connection.
UNISTRUCTURAL: For the unistructural response, there will be at least one logical operation involved in relating a question to an answer. Generally, one piece of data will be used in order to establish a response. An example of this would be 'Vancouver is the wettest city because it rains a lot there'.

MULTISTRUCTURAL: A multistructural response will incorporate two or more concepts or data in the response: for example, 'Vancouver is the wettest city because the wind off the ocean makes it rain a lot there'.

RELATIONAL: In a relational response, most of the concepts available will be interrelated and focused at the specific question. All or most of the available data will be used in formulating a conclusion. In the relational response, an individual might consider the influence of the mountains in causing the rainfall in Vancouver specifically but it would not generalize to places other than Vancouver.

EXTENDED ABSTRACT: At this level, responses will use all information and relate it to an abstract principle. The response will be based upon a hypothesis which can apply in situations not given in the cue. It would, for example, consider the influence of geography upon rainfall and apply this generalization, making reference to Vancouver as an example.

2.2 Relating operation
The relating operation describes the way a cue (question) and a response interrelate. With the exception of the prestructural response, each level is dependent upon the level of induction which it uses. This involves correctly drawing general conclusions from the instances. It considers the way the data is related to the conclusion.

PRESTRUCTURAL: A prestructural response will show no logical interrelationship between the query and the answer. There are three types of prestructural responses to consider:

1. Denial. The learner refuses to become engaged in the task at all. Responses will include denial (dunno) and rejection (this is shit) to a random guess.
2. Tautology. A tautology is a repetition of the same idea in different words. This takes the form of a restatement of the question.
3. Transduction or guesstimate. There is some attempt at a logical response but the response has an inadequate logical basis. The individual has jumped to a conclusion.
UNISTRUCTURAL: The response uses one relevant feature in order to reach its conclusion or generalization.

MULTISTRUCTURAL: In this response, several relevant features will be used in generalizing but these will not be linked up well. Rather, they will seem like a series of independent ideas fastened together with grammatical connectives (...and...and...and also).

RELATIONAL: Relational responses will provide an overall principle that accounts for the various, isolated data. While drawing information into a framework, it will stick to the data and the information already taught.

EXTENDED ABSTRACT: The extended abstract moves beyond induction on the basis of the data alone to a logical, generalized deduction. Aspects to watch for are:

- the introduction of abstract principles not in the data at hand.
- deductions based upon principles that certain events will follow and testing that deduction against the data.
- the introduction of a compatible analogy which was not present in the existing data, and
- acceptance that the outcome may be indeterminant. in other words, the events may be different under different circumstances.

2.3 Consistency and closure

This dimension considers the needs of the learner to reach a conclusion of some kind as opposed to the need to reach a consistent conclusion that accounts for the information. The greater the need that a student feels to reach a conclusion, the fewer items of information will be used thereby increasing the likelihood of inconsistency in the answer. If a response shows a need for high consistency, it will use more pieces of information, thereby increasing the likelihood of a more open decision.

PRESTRUCTURAL: This response shows a high need for closure at the expense of consistency. This is the 'dunno', restatement of the question, or irrelevant answer type of response.

UNISTRUCTURAL: This response will use the first relevant piece of information that comes to mind in order to reach a conclusion. As with blind men describing an elephant (a rope, a wall, a hose), there are many possible right answers, but the answers are inconsistent with each other.
MULTISTRUCTURAL: In a multistructural response, closure is based upon multiple aspects, but these aspects are not well interrelated and therefore inconsistency can be the result.

RELATIONAL: Closure, in a relational response, will be based upon all aspects of the data but the closure is restricted to the context of the information. This kind of response can leave room for inconsistency across contexts and may over-generalize.

EXTENDED ABSTRACT: The extended abstract subsumes all data and interrelationships under a hypothetical structure that leads logically to a conclusion. It entertains alternative outcomes so it is not forced to come to a conclusion.
Appendix J.

CONSENT FORM

I __________________________ hereby consent to assist Lawrence Hopperton in the completion of his doctoral dissertation on facilitating learning through the application of information retrieval techniques in computer conferences, in the Department of Measurement, Evaluation, and Computer Applications at the Ontario Institute for Studies in Education. In connection with his main study as part of the course EAC 269, Literature from Romantic to Modern Periods at Seneca College of Applied Arts and Technology, during the period of January through April 1992, I agree to allow him to print my input into the computer conferences, to photocopy any assignments I do in connection with EAC 269, to present general questionnaires, and to examine any college records generally available to a continuing education instructor.

I understand that I am part of the main study, the sole purpose of which is to examine the utility of computer conferencing in continuing education subjects, and the usefulness of information retrieval methods in educational computer conferencing. I understand that Mr. Hopperton may ask me to participate in a personal interview following the course during which I will be asked my opinion on conferencing and information retrieval methods.

I understand that I may withdraw from this study at any time and for any reason without fear of repercussion, and that if I withdraw, all of my records pertaining to this study will be destroyed and the data collected from those records will be disregarded. Participation, refusal to participate, or withdrawal from the study will have no effect on my grades for this course.

I understand that all information will be kept confidential and that my name will be removed from all materials prior to their use. Further, I realize that the data collected will be used as part of a doctoral dissertation and may be included, anonymously, in academic publications in the future. For the purpose of this study, only Mr. Hopperton will have access to the data in a form which will allow the identification of individuals. He will keep all such records in locked storage or in password-controlled computer files. All data will be destroyed five years after the completion of the dissertation study. Mr. Hopperton has further agreed, should I request it, to provide a summary of his findings to me.

Signed: __________________________

Date: __________________________
Appendix K.
ANNOTATED CAIRS RESPONSE

I thought you would be interested in seeing a CAIRS run on a broad question that we have considered during the course. I took a note from early in the "LITERATURE" conference and made it into a question:

CAIRS QUESTION:
Many poems are about making use of the time that we have. But I get a sense of fear from the poets, particularly through the undertone of death that we see in some references, like easter and snow. There seems to be a sense of urgency and helplessness in that the inevitable - death - is going to catch up. Is this right in poetry?

The question is basically asking about how the attitude towards death is presented in poetry as a whole. After each of the 10 notes returned, I have included a comment on what it might suggest in relation to this question.

At the end of this note, I will ask you to summarize the CAIRS response in a note that you post to "LITERATURE".

CAIRS RESPONSE:

||notei384|| LOAD .75
re: "Do Not Go Gentle into that Good Night" To continue the Paraphrase, lines 7-9 are as follows: "Good men, the last wave by, crying how bright. Their frail deeds might have danced in a green bay. Rage, Rage against the dying of the light" Could line 7 be a comment on how "nice guys finish last"? Good men, are questioning what the effects of their good deeds were. Were their good deeds done in vain? As they are described as "frail" Wild men, too late they realize how close death is. Grave men, on their death bed can see how near death is, but still must fight against it. He then speaks of his father who is close to death. He wishes for, if not his blessing, for his
He is looking for some form of emotion to be shown towards him. He does not want his father to give up fighting.

*** This is certainly putting forward the argument that people do fight against the inevitability of death, and this is appropriate. But what is the attitude of the father?

***

Thomas: Do Not Go Gentle into That Good Night

This poem originated as an address to the poet’s dying father. Thomas’ poems elicited a marked response in readers caught in a fierce economic depression. In any immediate sense, the poems were not optimistic: they sang of no golden age in the offing. Instead, mildly outrageous in subject matter and language, defiant of the ugly processes of life and death, and apparently even more defiant of conventional poetic forms, they seemed to project a knowledge of the inner workings of the universe denied to other mortals but toughly shared. In this poem, a strong sense of defiant of the processes of life and death. He talks about "Old age" men, "wise men", "good man", "wild men", "grave men". what their last deeds should be like. He keeps on repeating: "Do not go gentle into that Good Night". "Rage. rage against the dying of the light". It seems that he is begging and encouraging his father. "keep on going. do not surrender. do not give up. you should use all your power to fight against death"

*** Here we are given the idea that the defiance of death is an attitude that is common to all mankind. But once again there is the issue of the attitude of the father. This can lead one to think that maybe fear and defiance is not the only attitude that poets present towards death. ***

Re: "Do Not Go Gentle Into That Good Night"

There are a few interesting techniques that Thomas has used in this poem. The first is a very simple rhyming scheme of aba, aba etc. The second is his repetition of "Rage. rage against the dying of the light" as the last line in every other stanza. The alternating stanza’s last line of "Do not go gentle into that good night" is also repeated. These two lines show a conflict in thought as we are told to fight against death but death in turn is described as "that good night". He has heightened the emphasis on the fight against death by repeating these two lines as the last lines in the poem. Beginning the last line "Rage, Rage" breaks the rhythmic pattern and emphasizes the feelings he wishes to generate. This is
also true as this line is repeated throughout the poem. It heightens our awareness of the strength of feeling the author has. I feel he thinks his father has given up and is just waiting die. He seems to put all his emotion in this one line.

*** This note looks at poetic techniques. But notice the contrasts that are mentioned. First, there is the contrast between "Rage. rage" and "that good night", and second, there is the contrasted attitude of the father and son. It seems that fear and defiance are only type of attitude that poets put forward. ***

"phantom"

This poem is about death & its occurrence. The poet in my belief is sending the message that how the life that we treasure reaches it's end so sudden and we die without a trace. The tone of this poem is sad , somber and intimated.

*** Seems like the undertone of fear is very strong. The urgency of life is clear. ***

"ode to the west wind" the end.

The destruction. the sweeping away of the old must occur. before any new life can come about. Dead thoughts. dead words can take on new shape if possessed by wind. Those dead things are not in fact dead. They contain the ashes and sparks of the new life. The poem ends as it began. with the cycle of seasons: "if winter comes. can spring be far behind?" This structure of this poem is very different to typical 17th century lyrics. which may have a logical structure like that of a syllogism. There is no close linkage between images. there is no marked use of sounds effects. no alliterations. The logic here is one of emotion. feeling. The poem is not really able to be split up. It can only be felt and understood just like the wind itself...

*** Hmmmm... Death seems to be a necessary, and positive, part of life. This is expressed through feeling. How fearful does this sound? ***

tennyson- "ulysses"

there is an interesting change in scene that occurs in line #44. The narrator, ulysses, has changed from talking about the past to speculating about the future. He seems to be talking to those aged and seasoned sailors with whom he wants to set sail. I assume
that from these lines to the end are tennyson's way of symbolically describing death and the process of dying. "'Tis not too late to seek a newer world." (line #57)

*** This sounds a little bit like "Rage, rage against the dying of the light" mentioned in the first few notes. ***

As we know, this poem takes place when ulysses is an old man. So, he is much too old to depart for adventures as he did when he was much younger. The quote above is ulysses' way of looking at death as a conquest rather than the end of his life. The newer world is possibly the hereafter or whatever you want to call heaven. He refuses to acknowledge the fact that he will die soon, so he looks forward to this "departure". "To sail beyond the sunset, and the baths" "of all the western stars, until I die." (lines #60,61) Although the wording of the poem strongly suggests that he is going to set sail to new lands and conquests, much of the feeling is that of it being his final voyage. A voyage from which there may be no return. He'll see achilles, who was slain, and this could only be done in the after-life. "And see the great achilles, whom we knew." (line #64) So, as we see, ulysses is predicting his own eventual death and hoping it would be much like the adventures he enjoyed as a young warrior.

*** No, this is different to "Rage, rage...." This is openly welcoming death as an adventure. The idea of fear is absent. This is more a heroic acceptance. ***

re: shelley "ode to the west wind" in the first six lines, shelley makes use of a traditional epic simile through his reference to the dead leaves. In the major epic poets such as homer, virgil, dante, and milton, the souls of the dead are compared to fallen leaves driven by the wind. This explains not only the choices of colours in line 4, but also the reference to the ghosts in line 3 and the pestilence stricken multitude in line 5. If you notice in the final sonnet, this idea appears again as shelly asks the wind to "drive my dead thoughts over the universe / like withered leaves to quicken a new birth!" (l.64-65). Hence the same simile has shifted from an image of death to an image of birth. What do you think shelley is suggesting through his use of this epic simile?

*** This note seems to address the issue of the poetic references to death. It's showing how an image can have a double meaning, and a double use in one poem. ***
rc: "crossing the bar" I agree with Jim that the "pilot" means god. The author wants to see the person who has guided him through life. I also agree that the "bar" is the boundary separating life and death. The bar symbolizing the end of his life is mentioned at the beginning of the poem as he requests "no moaning of the bar". This reflects his feelings for there to be "... no sadness of farewell" when he dies. He also seems to know that there will be no uncertainty when he dies as to whether this is the right time or not. "one clear call for me" Line 2

*** Another image of death. But there is no fear or doubt. Instead, we have the sense of death as the appropriate, or correct thing. It also makes me think of the attitude of the dying father in "Do Not Go Gentle into That Good Night." Is this the kind of attitude that you see in the father? ***

"Jabberwocky" Imagery: Several images are described in this poem. In the second stanza the image that reader capture from the poem is that the old man or the story teller is standing before the hero and is warning him. The words describe fear that the old man has of the wicked creature (Jabberwocky).

*** This is a poetic image of fear. The story teller seems to be afraid of the monsters of this world. Then there is the hero who is going out to face the monsters. Sounds a bit like Ulysses. How does this response relate to a question about the poetic portrayal of death? ***

Houseman does a little more with his time of year than just set up associations of beauty in the reader's mind, and use the time as the a metaphor. He has specifically mentioned easter. Why do you think he would do this? In christianity, easter is the time of the death and resurrection of christ. It is the time when christ redeemed the human race. Does this fit with the poem? The redemption of the world is certainly in keeping with the ideas of new life that spring suggests. But easter is also a time of death since christ was executed by crucifixion. Does this idea of death fit with the poem in any way? Remember the theme of time passing? Now look at the second and third stanza. Do you get a feeling of urgency? Houseman says that 50 years is not very much time to look at things that are blooming. What is going to happen after the fifty years? Is this in keeping with the suggestion of death that the word easter suggests?
And what about the image of snow on the last line. What does this suggest? Is it in keeping with the hint of death?

** This note certainly mentions the urgency of life. Easter, and snow but it didn't rank as highly as other notes. What it does do is show us traditional images being used for opposite purposes. Easter, the time of spring, is here discussed as a time of death. ***
Appendix L.

LAST NOTE POSTED TO THE CAIRS2 CONFERENCE:
HOW DETAILS CONTRIBUTE TO MEANING

10 Notes which show how superficial details contain implications relating to meaning.

|||Noteli24|| LOAD .78
1. I like the poem "lovelies of tree" for the following reason:

1. The theme of it - author warning us with his message about how life is passing by and we have to take advantage of every moment of our lives, not wasting it.

2. The tone of the poem.
The "lovelies of tree" is about the life and beautiful things that we have to live for. It's about and joy, happiness and hope. But it's also the warning, warning that beauty would never be forever!

well this is only what I think about the houseman's poem but I'm sure everyone has different opinion :)

|||Noteli77|| LOAD .77
re: "the world is too much with us"

This poem gives me such a feeling that humans have put up a wall, never exposing ourselves, not caring and greedy. Wordsworth's personification of the sea as he writes she "bares her bosom to the moon", seems to contrast nature and human nature. The sea appears to expose herself, and it seems to imply that as humans we are so concerned about ourselves that we would never expose ourselves. If we were more in tune with nature, we would not feel threatened. Before you get worried about me when I write exposing I mean in regards to our feelings.

In the first eight lines wordsworth uses the first person plural. I believe this is because he sees it as our problem. It is all our problem not just one person's problem. In the last 6 lines, his solution or way to get around this problem is written in first person singular. This is his suggestion for himself. He knows
what he would rather be but he knows he can only speak for himself. This sharp change from "we" to "i" also clearly divides the poem in two sections.

Wordsworth also brings the elements of nature to life with more personification. The howling winds and the sleeping flowers gives life and animation to nature. Setting the stage for "it moves us not". You ask yourself how can we not be moved by these vivid pictures.

The abrupt change in rhythm at, "it moves us not." Great god" adds emphasis to these statements making them stand out. I can almost feel the disdain the author feels for the direction human nature has taken.

This poem seems to show us the internal battle of this old king.  

By the way. we can see the difference here from Romantic poetry: the poet himself is not the persona of the poem. there is another made up character.

The King is sitting and meditating about his life: the past, the moments he has now, and what he would wish to happen still in his life. He doesn't express too much feeling about any of the situations or people around him except when he talks about his adventures or the mariners which he seems to be very close to.

It was a little depressing while he discussed all he did in his life and he is still looking for something more. for some extra challenge. extra goal in his life while he is already very old.

stanza 3 is the focus for the contrast between life and art in the poem. Keats continues the joyful exclamations of the life on the urn: "boughs" that "cannot shed leaves", eternal "spring", "happy melodist", "forever piping songs" and "more happy love", "forever warm", "forever panting", "forever young". He declares that the life on the urn never alters or decays. But as he continues his praise of the joys of the immortal life of art. he becomes aware of its distance from the life and passion he finds in the real world. In the real life. we have a "heart" that is "high-sorrowful and cloyed", a "forehead" that is "burning" and a "tongue" that is "parching". The picture of life in the real world is unsatisfying and sorrowful.
re: Ulysses

Let's continue talking about as the king sees and feels about his life.

There are a few mentions of people who live in his kingdom; however, it is clearly underlined that he doesn't care about them at all. They are not worth his time. Seems like he leaves that up to his son. He doesn't want to be bothered by such an unimportant thing. He has so much more to look forward too.

The one paradox in his feelings towards his people is that about how he talks about the mariners. As we know they are exactly the same people as all others living in his kingdom. They are not always mariners. He seems to have some weakness for them and he treats them almost like his companions. They sailed with him and only they can understand how he feels. "Free hearts, free foreheads - you and I are old."

re: frost at midnight

The third verse brings together Coleridge's thoughts on his life while pointing out how different his son's life will be. He seems to scorn his life. He looks with tenderness at his child who will learn things in places quite different from his own upbringing. His repetition of the word far gives the sense of distance in the type of upbringing he wishes for his son. I almost get a feeling he feels sorry for himself as he says the only thing he saw that was lovely was the sky and stars.

"But thou, my babe." shall have all the beauty surrounding him.

This comment aids strongly in the contrasting of the two lifestyles the strong emotion felt by this statement also shows how much he wants his son's life to be different from his.

Is A.E. Houseman in "Loveliest of Trees" speaking as a metaphor for his value of life and his appreciation of it? He spends so much time dwelling on the calculation of years that the cherry trees seem to be secondary. Is it his own way of showing appreciation for life and "stopping to smell the flowers"(my words, not his).

Exactly which season does the poem take place in? It tells of blooms and spring and then of snow. Is it a way of talking about the seasons of life or am I going "nuts"?

Blake: "The Lamb"

From the description of the lamb, a number of associations come to mind. First, although the colour of the lamb is never mentioned, there seems to be an underlying assumption that it is white, a colour commonly associated with purity and innocence.
While also being a particularly tasty animal, especially with mint sauce or gravy. :-) the description gives us an image of very young animal, unaware of the dangers of the world and in need of love and protection. Every aspect of the lamb reinforces the fact that it is a symbolic representation of innocence and purity.

Do you see other aspects of the poem that support the idea of the lamb as a symbol of innocence?

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**Note:**

"crossing the bar"

I agree with Jim that the "pilot" means god. The author wants to see the person who has guided him through life. I also agree that the "bar" is the boundary separating life and death.

The bar symbolizing the end of his life is mentioned at the beginning of the poem as he requests "no moaning of the bar". This reflects his feelings for there to be "... no sadness of farewell" when he dies.

He also seems to know that there will be no uncertainty when he dies as to whether this is the right time or not. "one clear call for me" Line 2

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**Note:**

Ulysses

The poem is about great desire of the king to go and look for knowledge, adventure. There is a picture drawn for us of old bored king who doesn't want to die but wants to continue his life in seeking new.

There are lots of contrasts and paradoxes in this poem about the kings feeling towards the kingdom and his closest family as well as to himself. He doesn't want to die and be forgotten. And for him the only way to live is by adventure. Life as being a king is boring for him, doesn't give him satisfaction.

The king himself is talking about his desires about his life, his wife and his son. He talks also about his kingdom and his people but there is not much feeling noticeable towards them.

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Post a note to "Literature". What do you think is the relationship between details and meaning in literature?