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**An Interactive Computer-Based
Conferencing System to Accommodate
Students' Learning Process**

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AN INTERACTIVE COMPUTER-BASED CONFERENCING SYSTEM TO ACCOMMODATE STUDENTS' LEARNING PROCESS*

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ABSTRACT

We describe an integrated computer-based conferencing and mailing system as a tool to encourage students to more actively participate in class discussions. The system is called ICMS (Integrated Conferencing and Mail System). It provides a *bulletin board* that serves as a communication medium for the students and the instructor. An analysis of why students do not actively engage in class discussions is given. We then proceed to explain how the ICMS system can successfully alleviate this problem. Furthermore, we discuss how the ICMS system can serve as a tool to improve a student's critical thinking and as a guide to self-evaluation. Other unintended but positive consequences of the ICMS system are described. We conclude that the ICMS system can play an effective role in students' learning process.

INTRODUCTION

There is a continuing need to revitalize the conduct of undergraduate education in computer and information sciences. The educator's challenges are to increase students' participation in course topics and encourage their active participation in the learning process. Furthermore, students should be effectively guided in self-assessment. These are crucial in promoting the interest and enthusiasm of students who have career aspirations in the computing and information sciences.

Computers have been widely discussed as having the potential to radically change students' learning process. One of our areas of research has been in

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well as the content of the course for which it was used. Its primary purposes have been to:

- Encourage students to be more actively involved in topics related to the course they are taking.
- Provide a self-assessment environment for students.
- Provide an environment in which students are encouraged to cooperate with each other.
- Provide a better means of communication between students and between a student and an instructor.
- Facilitate a forum for team-oriented, project-intensive courses so that students who are in a project team can better manage their activities.

We elaborate on the above and other impacts of the conferencing system in the next several sections.

THE ICMS SYSTEM

The system is called Integrated Conferencing and Mail System (ICMS). It provides an effective environment for students to contribute to a discussion topic related to the course. The system has a rather simple interface. We realized that for students to actively use the ICMS system, the interface had to be simple. Software based on the concept of "stepwise learnability" [5] decomposes the amount of information the user must assimilate into a set of unthreatening steps. We kept that in mind through the interface design process. The interface consists of series of menu-driven screens with simple instructions.

In addition to the conferencing facility, the ICMS system provides an electronic mail facility. This facility is similar to traditional mail systems and allows students to send private mail messages to each other and to the instructor. The effectiveness of this facility as a teaching instrument is the same as those discussed by [6].

The Bulletin Board

The ICMS system has a *bulletin board* which serves a common area for the participants of the conference. Students and the instructor "post" (i.e., attach) their "articles" (a generic term for replies, questions, solutions, ideas, etc.) to the bulletin board.¹ These articles remain on the bulletin board until their time expires. Students are able to post an article, read an article, reply to one, etc. Students are initially asked to log on to the system at least once a day; however, as the semester

¹ Throughout this article, the words "message" and "article" are used interchangeably.

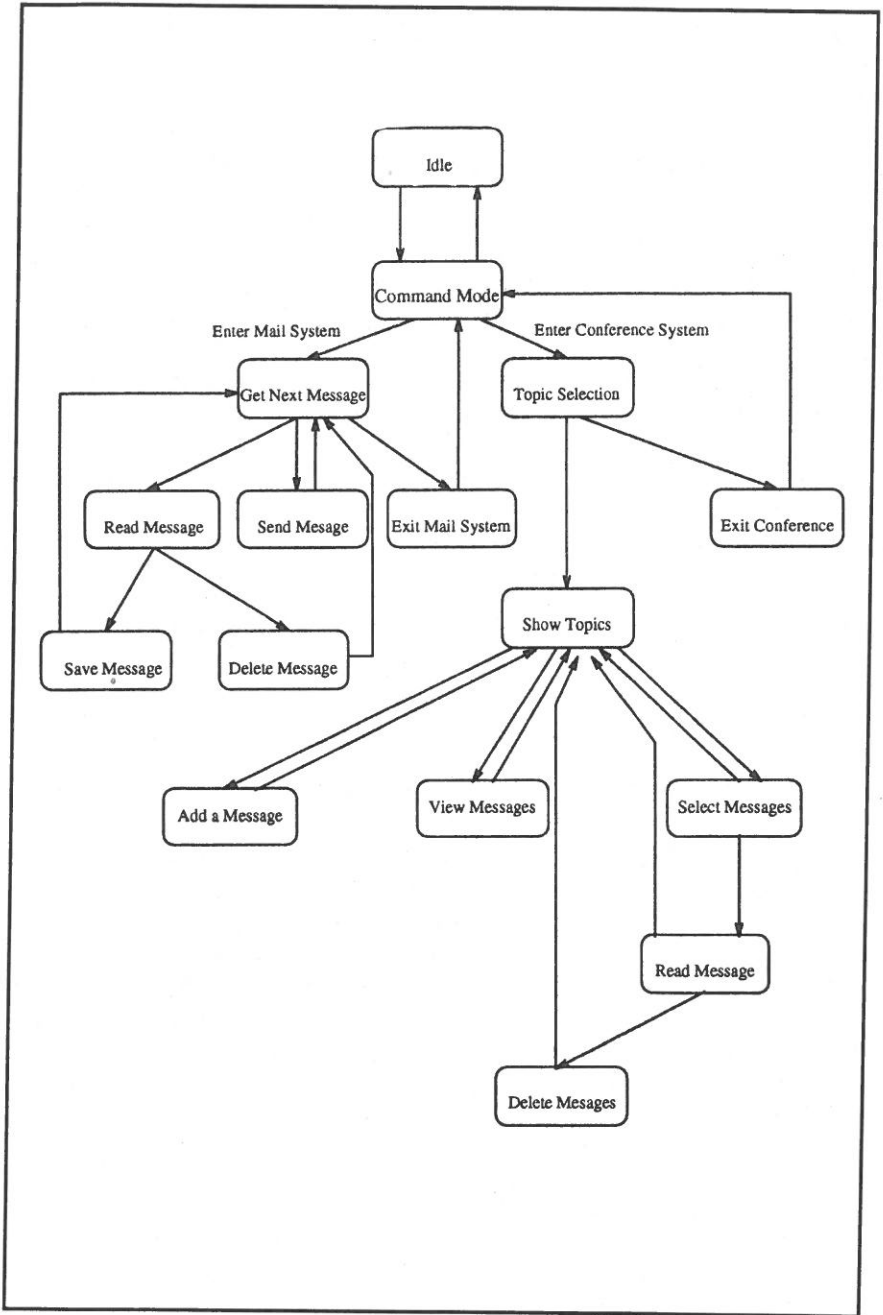


Figure 1. State diagram of the ICMS system.

- The ICMS system provides a structured environment in which one can state his/her views, comments, responses, and so forth, without fear of interruption. In other words, no one is going to leap into a student's editor and cut him/her off or render one of his/her statements incomplete and therefore not representative of the student's true thought to the classroom audience.
- It is hard to be ignored on the ICMS system especially if you have a technical question. The conferencing system is a less threatening atmosphere than an open classroom. It provides a "security" blanket to those who like to express themselves but would be hesitant to do so in class.⁴ Text-based communication (as opposed to verbal communication) overcomes a lot of fears some "tight-lipped" students may have about their own voices.
- Students can compose their messages, questions, and comments at their leisure and make sure that they are saying what they want to say in a clear manner, without mistakes. The students can fully edit their message/reply.
- As mentioned earlier, students are allowed to post questions. Some students feel very positive about providing answers to questions that fellow students have raised. This encourages positive collaboration among the students. This kind of collaboration leads to another reason why students engage more, and that is *reciprocity*. That is, if a student gains from the conference forum, he/she feels obligated to return the favor by sharing information, a concept, or a perspective with someone else.⁵
- Convenience associated with being able to compose a well thought out question or answer in advance appeals to the "shy" people. The conferencing system lends itself to the interaction that is not available in all classes, unless the instructor put the class in a circle and operated as an "open forum." (We do have open forums in upper-level, graduate courses.)
- Finally, because of the openness of the conferencing system, a student can argue confidently. For example, if a student thinks that his/her idea is correct then he/she can "prove" it (for example, by giving citation to literature work). In other words, the student need no longer fear the instructor's unfounded "superiority" attitude.

Before ending the above discussion, two important points must be remembered:

⁴ We were recommended by a student to provide an "anonymous" account so that if a student does not want his/her name revealed they can still use the ICMS system. We are considering this suggestion; however an anonymous account invites misuses of the ICMS system.

⁵ Throughout the semester, we noticed that some students asked questions that were not directly related to the course. For example, some asked for a citation/reference to a certain topic; others asked how to use a certain editor or document preparation package, and so forth. This kind of interaction led to yet another positive side effect: students formed studying teams and similar activities.

this approach is the improvement in students' critical thinking. The solutions as well as comments that are provided by students will reflect their critical thinking and self-assessment, and provide a different perspective of learning and understanding of the course material. To complement the students' understanding and self-evaluation, the instructor will normally select the best solution(s) to a problem and dissect other solutions to point out their weaknesses.⁶

This kind of critical thinking and self-evaluation is particularly important for undergraduate courses (both upper- and lower-level courses). This approach, which has been very effectively accomplished by the ICMS system,⁷ can be viewed as a *cognitive engineering* effort which incorporates the current achievements in machine learning [8] with student learning.

ADDITIONAL BENEFITS

The ICMS project has had a number of unintended but interesting and valuable consequences that we like to share with our audience in this section.⁸

Students Write Publicly. Throughout the semester, students' responses grew in length. Students showed interest in engaging in serious and intellectual discussions with each other and with the instructor. Also, because students wrote publicly, they took their writing more seriously. This led to great improvement in their writing skills. The increased quantity of writings also improved the quality of their writing.

Stimulation in Thinking. Students showed great care in forming their opinions and positive speculations, resulting in more rational discussions.

Diligent Probing. In ICMS's group discussions, "hidden" aspects of a problem were revealed because of the diligent probing of group opinions. This probing added to students' understanding of the materials and improved student cognition.

Resources are Saved. As mentioned earlier, most of course materials (e.g., course outline, test dates, problems, assignments, etc.) are posted to the bulletin board of the ICMS system. This saves resources. No more paper copying is needed (students can make computer printout copies of the material posted to ICMS system).

Informality. It is easy to make revisions, for example, to semester schedules by modifying and re-posting a message. An instructor no longer needs to create

⁶ Since this kind of activity can be very time consuming, normally small problems are chosen.

⁷ Of course one can argue that a similar approach can be taken during regular class periods. However, our experience shows that the bulletin-board is more effective because traditionally students are not very vocal and active in the classroom. The traditional approach of homework or tests is not as effective either because it is impractical to use the classroom time to distribute each student's solution and ask others to comment on it.

⁸ The above list is based on our informal/intuitive observation and not necessarily the result of an empirical study.

```

***** Main Menu *****
|
|
|           C Conferencing Subsystem
|
|           E E-Mail Subsystem
|
|           X Exit
|
|Option:
*****
|H Help Screen                               10:09 |
*****

```

Figure 2. ICMS's main menu.

```

***** Conference Menu *****
|
|   Conf      Conf
|No  Id       Topic
|-----|
| 1  C1       Software Project
| 2  C2       Test Schedule
| 3  C3       Test Schedule -- Revised (12/10)
| 4  C4       Formal Spec of Rotate Problem
|
|Option:
*****
|H Help Screen                               10:12 |
|D Move Down the Selection
|U Move Up the Selection
|X Exit
*****

```

Figure 3. Conference selection menu.

```

***** Add A Message *****
|
|
| Enter Message Subject:
|
| Enter File Specification:
|
|
|Option:
*****
|H Help Screen                               10:33 |
|X Exit
*****

```

Figure 5. Menu for adding a message.

code. The client program contained about 1,050 lines of C and Pascal code. (Pascal was for most of the code. Language C was for the communication routines and some miscellaneous support routines.) The purpose of the server program was to collect different messages and post them to the bulletin board at each client's local memory thus simulating a single bulletin board.

Both server and client were written using the BSD socket interface to TCP/IP network services. We designed a protocol for exchanging information between the server and client. All messages in the conferences are stored with the server. The client is just an interface that allows the user to access the server.

CONCLUSION

We have identified reasons and circumstances that discourage the students from actively participating in the course discussions. To alleviate the problems, we have built an integrated conferencing and mail system called ICMS. In particular, our goals in developing the ICMS have been to:

- Provide a facility for the students to actively participate in course topics, and hence contribute to the discussion topics,
- Provide the students with a means for self-assessment and critical-thinking,

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