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Copies of the laboratories described here are available from the author upon request.

COMPUTER CONFERENCING AND THE COMPUTER CONFERENCE ON APPLICATIONS OF TECHNOLOGY IN TEACHING CHEMISTRY

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INTRODUCTION

An announcement of the Computer Conference on Applications of Technology in Teaching Chemistry appears elsewhere in this issue. This is the first such conference sponsored by the Division of Chemical Education's Committee on Computers in Chemical Education.

Computer conferencing has been used in education, business, industry, government and the military. Many of the applications in education are directed towards course work and degree programs. A few references are presented at the end of this article. Some of these references contain extensive bibliographies. SELECTION OF CONFERENCING SOFTWARE

The authors are interested in conferencing software which is available at little or no cost and is accessible to a wide variety of chemistry educators. It was decided to use LISTSERV since it can serve those having BITNET or INTERNET addresses.

LISTSERV is used by the Chemistry Education Discussion

List (CHEMED-L). Many chemists are already familiar with some of the features of LISTSERV. In the configuration we are using anyone can establish a CHEMCONF LISTSERV account and can remove himself from CHEMCONF. When mail is sent to CHEMCONF it is automatically distributed to all those on CHEMCONF. Each piece of mail is indexed and filed in a "notebook." Users can obtain the index (or part of the index). A file can be retrieved from the "notebook" and printed. Also, it is possible to obtain the names and electronic mail addresses of all those who are signed on to the LISTSERV account. Under favorable conditions messages are distributed within a few minutes, but in some cases longer delays may be observed. Thus, it is not possible to carry on a "real-time" (synchronous) conversation in the usual sense. However, this may have the advantage of encouraging more thoughtful replies.

LISTSERV is almost strictly a text oriented facility. Graphics mostly in the form of slides and transparencies are important to most presentations at meetings. The authors have identified the software which will convert a graphic image to an ASCII character file and additional software which will produce the original graphic image from the ASCII file. Much of this software is either in the public domain or available at a small cost. We have developed simple instructions to assist authors and participants in using the software. Graphics, chemical structures, spreadsheets, executable binaries, HyperCard stacks and digitized photographs can be handled. In addition to these instructions, individual help will be available through the conference manager (Tom O'Haver).

FORMAT OF THE MEETING

The meeting will be divided into two sessions. Each session

will consist of five papers and will extend over a period of three weeks. On the first day (a Monday) all five papers will be distributed to all participants. Each paper will consist of an ASCII text file which may contain tables. Each graphic will be transmitted as a separate ASCII file which will have to be converted by each participant. Participants will have the remainder of the first week to read the papers. Authors are encouraged to stimulate discussion by including questions for the participants in their papers. Participants will have an opportunity to send short (less than 100 word questions) to the author or other participants on a designated day during the first week.

The second and third weeks will be devoted to asynchronous discussion and questions. Two days will be devoted to discussion of each paper. This format has some distinct advantages over a conventional on-site conference.

- Each participant will have a week or more to read the paper and prepare any comments, suggestions or detailed questions. The participant will be able to research and carefully word his comments and questions. Relevant references can be located and cited to reinforce a point of view.
- Authors will have time to consider responses to questions.
- Since discussion will occur over two days, there will be time for an extended dialog and considerable discussion.
- All papers and discussion will be saved in files until the end of the conference. Participants and authors will be able to access these files at any time.
- Authors planning to submit their papers for publication subsequent to the conference may receive de-

tailed comments and suggestions which will improve the quality of a revised version of the manuscript.

This conference is to be regarded as an experiment. Its success depends upon the quality of the papers submitted, the ingenuity of authors to adapt to a format which has different characteristics from that of a traditional meeting, and the quality of discussion generated by participants and authors. Authors are encouraged to submit non-traditional as well as traditional papers. The questions and discussion generated by a paper may be even more important than the paper itself.

A brief description of the scenarios we expect for authors and participants is presented below.

Authors must submit a title and abstract of not more than 150 words by February 1, 1993. The deadline for submission of the paper is May 1, 1993. Instructions concerning the format of the paper are available from Tom O'Haver (TO2@UMAIL.UMD.EDU). Authors are expected to review first-week short questions received from the participants on the day following the receipt of such questions and to prepare responses to appropriate questions. Responses should be sent to CHEMCONF early on the day that discussion begins. For example, short questions for the first paper in a session would be received on Tuesday and examined by the author by early Wednesday of the first week. Responses would be

sent early on Monday of the following week when discussion of the first paper begins. (Not all short questions are necessarily directed to the author.) Authors would be expected to examine the discussion in the middle and towards the end of the first day (Monday for paper one) and respond in a timely manner.

Participants are expected to retrieve the papers on Monday of the first week. We suggest that each paper be printed and that graphics be viewed on the monitor or printed. The first paper will be read on Monday. Short questions will be sent on Tuesday (for paper one). Longer questions and comments will be prepared and sent (on Monday of the second week of the session for paper one). Participants will examine the discussion several times during day one and day two of the discussion (Monday and Tuesday of the second week of the session for paper one). Participants might add additional comments or respond to comments made by others. While it is not essential that every participant read and discuss every paper, it is expected that everyone on CHEMCONF will participate significantly in the conference.

At the end of the conference participants will be asked to evaluate the conference and to make suggestions regarding changes which might be made to improve future conferences.

TRIAL SESSIONS IN FEBRUARY

We will conduct a trial

of this conferencing technique during the first week in February. On Monday, February 1 two papers will be distributed to everyone signed on to CHEMCONF. Short questions will be submitted on Tuesday, February 2 for paper one and on February 3 for paper two. Discussion of paper one will occur on Monday and Tuesday, February 8 and 9, and paper two would be discussed on February 10 and 11. February 12 will be used for evaluation of the trial sessions and for obtaining suggestions on how to improve the June sessions. Not everyone signed on to CHEMCONF may elect to participate in these trial sessions. However, authors and participants will have this opportunity to obtain a better understanding of computer conferencing before June. If participants have difficulties, they may wish either to seek local assistance or to contact Tom O'Haver. We may revise some of the instructions and suggestions to participants as a result of these trial sessions.

ADVANTAGES OF COMPUTER CONFERENCING

1. Time and expense of travel are eliminated.
2. A permanent record of the papers and discussion is available.
3. Participants can select the dates and times for reading papers and for participating in discussion.
4. In conventional meetings, discussion is limited and those participating must respond within a very short time period. In this "meeting" discussion is possible between speaker and participant, and between partici-

part and participant. Participants and speakers need not respond immediately; they can think about a question, even research a topic before responding. Responses may occur within a few minutes or a few weeks. Ample time is provided for discussion. Collaborative problem solving and polling may occur.

5. The sharing of data, computer programs, images, graphics and other digital forms of information are facilitated.
6. Authors can submit more detailed presentations than are possible at an ordinary meeting.
7. Authors of papers can ask questions of participants with the expectation of receiving well thought out answers. Participants can let authors know where their papers are unclear or may make suggestions. Authors can learn from participants about relevant work or publications.
8. Conference expenses and preparations are minimal compared to what is involved in a conventional meeting.
9. Participants and authors from all over the world can interact.
10. Hearing and speaking disabilities, as well as many other physical handicaps, do not prevent or hinder participation. Those from abroad who can read and write English but have difficulty in speaking or understanding the spoken language are not at a disadvantage.
11. Participants can ignore papers in which they have little interest and can examine the papers in each session in any order they wish.

DISADVANTAGES OF COMPUTER CONFERENCING

1. The pleasure of socializing at a physical meeting are absent, as is the valuable communication "back channel" of body language and inflection.
2. Computer conferencing would be limited to those who have some form of computer connectivity — at least an electronic mail address.
3. We are already familiar with the mechanics of physical meetings (traveling, making slides and transparencies, public speaking, socializing) and of print publication (using libraries, subscribing to journals, preparing manuscripts). Computer conferencing requires skills that are not necessarily more complex but are generally less familiar.
4. A physical conference occurs in real-time, and discussion is synchronous and consecutive. In computer conferencing discussion of a particular aspect of a paper may occur over several days with other discussion being intertwined. Participants and authors will need to sort out the different threads of the discussion.
5. Computer conferencing does not yet have recognition in the scientific community - one of the reasons scientists go to meetings and publish papers is that it enhances their prestige and reputations.

CONCLUSION

This conference is different. We need to discover how best to exploit the technology and format of the conference. Its success depends upon the ingenuity of the authors and participants. Won't you help by participating.

CHEMCONF will be made available for other Chemistry

Conferences to be held after September 1, 1993. If you are interested in organizing such a conference, please contact Tom O'Haver at the address given above.

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