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Online Chemistry Modules: Interaction and Effective Faculty Facilitation

College educators in chemistry and engineering are using computer-mediated communication and computer supported collaborative learning in a variety of ways. Many institutions support electronic communication technologies such as WebCT or Blackboard. Combining cooperative learning techniques and electronic communication has lead to a new area of educational research known as computer supported collaborative learning (CSCL) (1). CSCL is built on a firm foundation of educational research that emphasizes the importance of social interaction in learning and the work of Johnson and Johnson in cooperative learning (2, 3). Physical Chemistry Online (4) modules which use electronic communication technologies to allow students to form a collaborative on-line learning community have been developed and implemented by faculty at geographically dispersed institutions. These modules help students learn physical chemistry concepts and to investigate such subjects as the thermodynamics of inclusion complexes, ozone kinetics, and molecular modeling. The evaluation of the modules over time shifted to understanding how students collaborated in the online environment and the role of the faculty facilitator.

In this project, our goals were to develop analysis tools that would allow us to describe and analyze the types of student collaboration taking place via computer-mediated communication. Simultaneously, we sought to develop guidelines or recommendations for faculty facilitation in an on-line environment. The work presented in this article focused on 1) describing how students and faculty interact during an online module, and 2) developing research-based guidelines for effective faculty facilitation in an online environment. The module we chose for study was one of the largest conducted by our consortium.

The participants included 101 students from seven different colleges and universities, and three faculty facilitators—one experienced online facilitator and two novices. The students and faculty were divided into 10 cohort groups that were composed of a faculty facilitator, project facilitator (the experienced online facilitator), and three student groups from different institutions. Each cohort communicated via a discussion board during the five weeks in which the module took place.

The archived discussion boards were analyzed using two methods. First, using transcripts of the discussion boards each posting was coded by message type: original, first follow-up, second follow-up, or third and higher follow-up. The posts were also categorized by author—student group, cohort facilitator, or project facilitator—and whether or not the post contained a question. Questions were defined as utterances that usually ended in a question mark. Student's, as well as facilitator's, questions were usually asking for additional information or requesting feedback. Each discussion board was then diagramed using Inspiration software as shown in Figure 1 (5). The diagrams allowed for better visualization and subsequent description of the student-students and facilitator-student interaction. It allowed researchers to take pages of transcripts and represent them on a single page, much like a single IR spectrum or NMR spectrum can tell chemists about molecular structure. Figure 1: An example of discussion board diagrammed created with Inspiration software. The second method of analyzing the transcripts focused on coding each posting using a scheme that identified behaviors associated with collaboration such

as giving feedback or challenging one’s reasoning from the work of Johnson and Johnson (2, 3). The scheme was similar to that developed by Curtis and Lawson (6).
The methods developed in this project for analyzing communication may help engineering educators examine electronic interactions in a more meaningful manner. For example, by looking at the message type distribution in a CSCL project, it can determined if a pattern of sustained discussion and collaboration emerged (that would be indicated by a balance of original and third or higher following up postings which would indicate that discussion did take place). We also found analyzing long threads of discussion via the discussion board diagrams to be particularly informative. Within these threads we found evidence of ""feedback sought-feedback given"" or ""challenge-explain"" cycles of interaction among cohort members. These types of interaction patterns are documented in the cooperative learning literature and promote a number of beneficial results including greater insight into the problem under consideration (5). Finally, from our analysis we found that the students rarely engaged in ""monitoring"" activity that would have helped them recognize group progress and achievements. Students rarely considered what actions to continue doing, stop doing, and start doing in order to sustain and increase their efforts to reach a goal.

Beyond the development of new CMC analysis techniques and discussion board diagrams, the most important findings emerging from this study are those pertaining to effective online faculty facilitation. We present the following recommendations to foster effective online facilitation by faculty. 1. Maintain an active online presence by regularly posting messages 2. Monitor students’ progress and acknowledge their achievements. Encourage students to generate postings tracking their progress through the module. 3. Summarize previous posts, weave them together and point out discrepancies or unanswered questions. 4. Challenge the students’ reasoning. Ask questions that require the students to resolve discrepancies or address differences of position or approach. 5. Request responses from students and provide students with feedback. 6. Offer students support and encouragement.
Based upon our research findings, we believe that these recommendations will help faculty and students to collaborate more effectively in an online environment. However, previous work in cooperative learning has definitively shown that students need to be prepared to work in groups. Our research also showed that students need significant training in the art of communication and collaboration. This training is accomplished with strong faculty presence in each collaborating class. Faculty who just sit back and watch will find failure among their students because students are not used to delivering information in a conversational context and they may be inhibited by thinking that they have nothing to contribute.

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