

Computer Support for Collaboration in Medical Education

Jim Greer and Susan Bull

ARIES Laboratory, Department of Computer Science, University of Saskatchewan,
Saskatoon, Saskatchewan, S7N 5A9, Canada.

Abstract: This paper introduces I-Help, an intelligent learning environment to facilitate peer help exchanges and collaborative learning in university education. I-Help's private and public discussion areas are presented, and the agent-based pairing of suitable partners, based on student models, is illustrated.

1 Introduction

A recent development in intelligent computational learning environments involves the use of agents. An agent is an autonomous program that makes its own decisions in reaction to stimuli from its environment. For example, Shaw et al. introduce a system which uses an animated pedagogical agent to provide a more authentic learning experience in distance education, where the student is guided through clinical cases by the agent which adapts its recommendations according to the student's actions [1].

Other environments are designed to support collaboration between students. Cameron et al. describe a system comprising conferencing software and accompanying web page, to facilitate synchronous distributed problem-based learning involving first and second year medical students and a tutor [2]. Kamin et al. introduce an environment aimed at supporting asynchronous collaborative interaction for third year medical students and a tutor, based on a Web/CD-ROM program with a video patient case [3]. An advantage of collaborative interaction is that students may experience alternative viewpoints from their peers, thus encouraging them to reflect and resolve any conflicts, thereby enriching the learning experience.

Combining these approaches, Supnithi et al. suggest an agent-motivated method of opportunistic group formation [4]. In this situation students work individually on a task, watched by an agent. If this agent observes an opportunity for the student to gain from collaboration, it will negotiate with the agents of other students, to form a collaborative group. Thus learners may work alone where this is productive, but may collaborate when this would be more effective. All agents attempt to maximise the benefits both to their own learner, and to the group as a whole.

Although the potential for agents to facilitate learning is great, systems employing such agents will often be expensive to construct and have limited applicability. One of the reasons is that, in addition to specific domain knowledge, the agent must have access to a student model in order to react appropriately to student actions. A student model is a representation (in the computer system) of the individual user's continually evolving knowledge (including misconceptions). The model is usually updated dynamically by the system, depending on the actions of the learner. It is used as a basis for system decisions for adaptation to the individual. The pedagogical agent of Shaw et al. uses this information to make tutorial decisions; the agents of Supnithi et al. use student models to form effective collaborative groups.

It would be useful to find a cost-effective method of combining the power of agent-based software and the intensity of collaboration. The I-Help (Intelligent Help) system is a step towards this goal.

2 I-Help

I-Help is an intelligent learning environment integrating information and help resources [5]. We describe two aspects of I-Help which involve collaborative interaction amongst students: the public and the private discussion areas. These are intended to facilitate student interaction at times when learners are not co-present, and not necessarily working at the same time. Figure 1 shows some of the I-Help components.

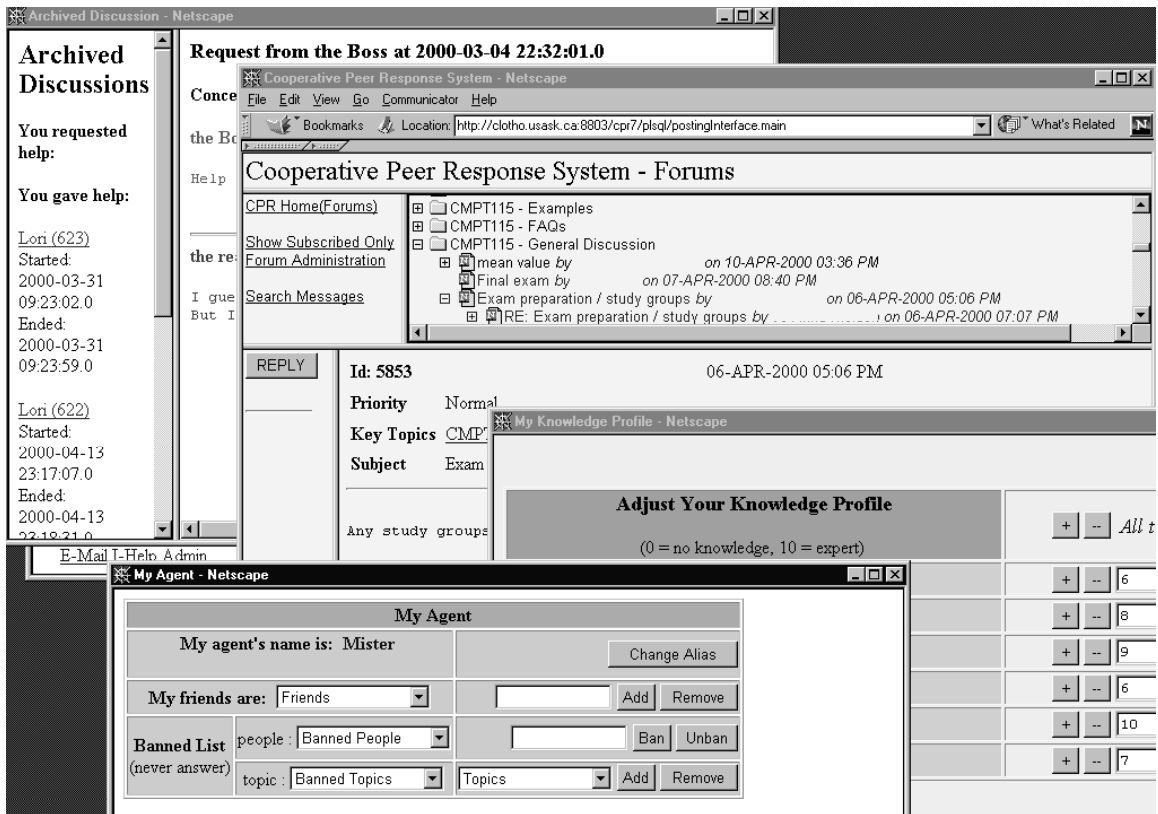


Figure 1: I-Help

2.1 The I-Help Public Discussion Area

For each course students are enrolled in, they are subscribed to a set of relevant discussion forums. All students may read and post messages to such forums. These may be general questions or information, or discussions about specific issues arising in a lecture, assignment, etc. Any number of peers (and tutors) may respond to a message. The public discussion area is most appropriate for questions that require a quick answer, as postings will be seen by many individuals; for questions where the widest readership is most useful; or for questions that are likely to elicit different viewpoints, since multiple user discussion may be initiated.

2.2 The I-Help Private Discussion Area

The private discussion area is a one-on-one dialogue facility, which may be used synchronously or asynchronously. It combines the educational benefits of collaboration with the power of autonomous agents. Each user has a personal agent that negotiates peer help on the learner's behalf, according to their stated needs, and the representations in their student model [6].

A dialogue session unfolds as follows:

1. A student contacts their agent to issue a request for peer help or collaboration;
2. The student's agent negotiates with the agents of other learners, to find appropriate partners;
3. The top five user matches are notified that there is an interaction request waiting for them in I-Help (less than five if fewer acceptable matches are found);
4. The first helper to accept the request answers it, initiating a one-on-one dialogue. This cancels the requests to the other potential helpers or collaborators;
5. Upon completion of discussion, each learner receives an evaluation form through which they evaluate their partner, for student modelling purposes.

Unlike many other systems, the student model in I-Help is easily maintained since it requires no detailed domain-based information, as domain content will be provided by, or negotiated with, the selected peer helper or collaborator. Thus the system itself does not need to make inferences about such information. It simply maintains a record of students' knowledge levels in each of the subject areas. This occurs through self- and peer-assessment, therefore necessitating less complicated system reasoning. This makes the system easily portable across domains—all that is required is a list of course topics to be provided by the tutor.

As shown in Figure 1, students may add people to their 'friends' list, to indicate that these are people with whom they would particularly like to interact. These may be 'real friends', or people with whom they have previously had fruitful interactions. Students may also ban people with whom they wish to have no contact, and they may ban topics on which they do not wish to give help, or enter into a collaborative interaction. Learners may also alter their knowledge profile, making it more likely that they will be asked to help on topics where their self-assessment is high, and less likely to receive help requests for topics about which they know less.

At the end of a discussion, each of the learners receives an evaluation form through which they evaluate their partner's knowledge, to provide an additional perspective in each learner's student model. Helpers also rate the helpfulness of their helpers to provide further information for future matching of individuals.

Figure 2 illustrates student-student, student-agent and agent-agent interactions in I-Help.

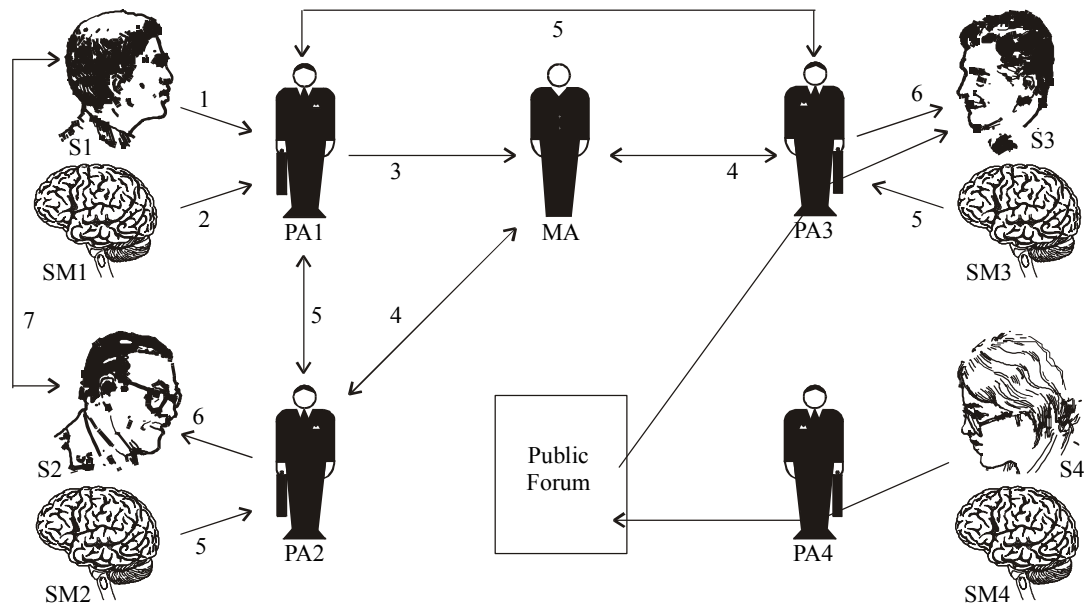


Figure 2: Interactions in I-Help

All students (S) interact with the environment through their personal agent (PA). These agents act upon their owner's requests, supported by information in the student model (SM). The matchmaker agent (MA) is a general agent which matches learners according to information received from their personal agents. Also shown in Figure 2 is the public forum.

Student 1 (S1—top left of Figure 2) has informed their agent that they would like to seek a peer helper or collaborator. PA1 checks SM1 for relevant information, and then forwards this information to MA. MA consults the other PAs, also using information from their owners' SMs. MA finds two acceptable matches, and initiates negotiations between PA1 and PA2, and PA1 and PA3. PA2 and PA3 then send the requests on to their owners. S2 accepts the request first, and a session begins between S1 and S2. At this stage S1 and S2's PAs are no longer directly involved, but simply observe. S3 is reading postings in the public forum, mediated by PA3. S4 has submitted a posting to the public forum, accessed via PA4.

The private dialogue component of I-Help is useful when students need more intensive interaction, for example: tutoring on some course component that they do not fully understand. The matchmaker ensures that sufficiently knowledgeable helpers are contacted, and also that these helpers are willing to help on the topic. This is useful when cohorts are large, as typically occurs in medical education, since learners themselves will often not know who is the most suitable person to contact for their particular problem. In the case of collaboration, the matchmaker will locate people with similar knowledge levels in the specific area, but possibly complementary knowledge in related areas, to that of the requester. With collaborative learning, each member of the pair is expected to benefit. In the helper-helpee context it is also intended that both partners gain: the helpee from receiving help on a specific problem; the helper from the need to reflect on their knowledge in order to give help. Students may interact completely through I-Help, or arrange face-to-face interaction once contact is made.

2.3 I-Help in Medical Education

There are a range of uses for I-Help in medical education. For example, in the traditional classroom setting for basic science courses both I-Help components may be used as described above, enabling students to help one another and to collaborate on problem-solving activities. I-Help might also be used as a forum to discuss medical simulations. Web-based interactive simulations can be delivered with I-Help tools deeply integrated. In a distance learning (tele-learning) context, I-Help can be even more useful, as it lessens the feeling of isolation experienced by many students. In problem-based learning, the public discussion forum is a useful way to support small-group interaction outside scheduled meeting times, whereas the private dialogue area can be used to gain advice or support from outside their group, if individuals are having difficulty with some aspect of the problem-based learning approach itself (e.g. understanding how best to fulfil their particular role). The public discussion forum is also likely to be useful for learners during clinical rotations to encourage students to share experiences and problems.

3 Conclusion

I-Help, a peer help network which includes public and private discussion areas, is easily transportable across courses and is particularly suitable for large group settings. A major strength of I-Help is the use of agent technology to match learners for educational human-human interaction, where these individuals are separated by distance and/or time, using a non-domain-intensive student modelling technique. I-Help, which has been used in a range of courses at the University of Saskatchewan, has become well accepted by instructors and students.

References

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