Motivating Participation in Virtual Learning Communities

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ABSTRACT

Computer networks have a great potential to facilitate community-supported life-long learning. Virtual learning communities are environments that provide learning materials as well as a shared medium for communication and collaboration for a group of learners, for example via private conversations, public discussion forums and chat-rooms or shared workspaces. Learners can benefit not only from getting access to multimedia instructional materials, but also by the possibility to communicate with teachers and with each other. They can contribute new materials, discuss and collaborate with other learners. They can help others, and learn by teaching or explaining, by taking the role of teachers themselves. This paper discusses methods for motivating learners to participate in virtual learning communities using examples from a virtual learning community system called I-Help.

KEYWORDS: virtual learning communities, motivation, personal agents, modelling emotion

INTRODUCTION

Creating a successful and productive virtual learning community is a difficult task. Just providing a pool of resources or e-mail addresses to a learner does not work; creating an open discussion forum will most likely result in a few "just testing" postings. It is necessary to provide a software infrastructure facilitating the access to learning resources, teachers and peers. This infrastructure needs to take into account the specific learner's needs, goals, preferences, i.e. to be adaptive to the learner, to the context and to the social factors influencing the group of learners. It needs to provide a seamless and natural interface for the user. It has to ensure effective motivation mechanisms to stimulate participation. Finally, it is necessary to ensure some means of control of the emerging behaviour of the community, and to steer it towards worthwhile goals and productive interactions.

THE I-HELP SYSTEM

For a number of years, at the University of Saskatchewan we have been exploring how to integrate learning technology more naturally into a learner's own environment, for example, in workplace training situation (Greer et al., 1998). More recently, we have focussed on a problem that we have in our own work: how or to support large classes with over 100-120 students with various levels of knowledge where there is no possibility for individualized feedback. A virtual learning community would allow students to help each other. The I-Help system was designed to support peer help in university classes (Vassileva et al., 1999), and has been deployed for 3 years with over 1000 students. I-Help supports the learners in a constructivist way, providing a shared medium, both asynchronous (a newsgroup like public discussion forum) and a synchronous individual help facility (a two way chat line or chat-room).

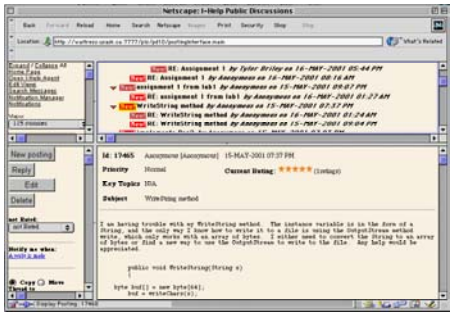

Figure 1: The I-Help public discussion forum.

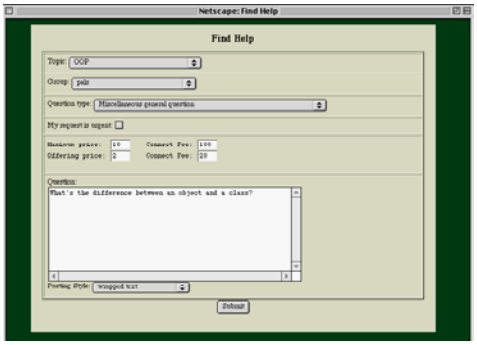

Figure 2: Requesting individual help through the personal agent.

To illustrate the functionality of individual synchronous help tool in I-Help we will use an example scenario. Imagine that a student working on a programming assignment has a question. The personal agent of the student asks one of several matchmaker agents to find an appropriate other student to help her, for example one who is currently on line and is competent on the topic of the question. The matchmaker maintains profiles of the knowledge and some other characteristics of all the users. The matchmaker creates an ordered list of the users who qualify and sends it to the personal agent of student who asked for help. The agent of the potential helper notifies its user and asks her if she would be willing to help or not. If the helper is willing to help, a communication channel is opened between the two users (a simple chat tool), and a help session starts. After one of the parties closes the chat window, an evaluation form pops up in which each student has to evaluate the other one. This information is used to update the user profiles maintained by the matchmaker agent.

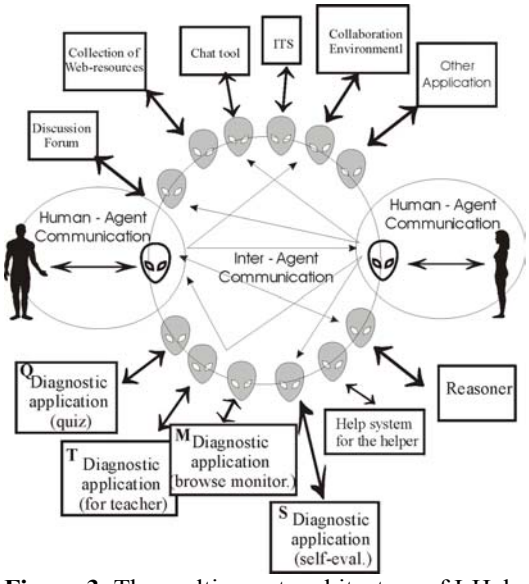

Figure 3: The multi-agent architecture of I-Help

I-Help is based on a multi-agent architecture, consisting of personal agents and application agents (see Figure 3). These agents use a common ontology and communication language. Each agent has a model of the resources of the user or application it represents. Personal agents keep a model of the knowledge level of the learner about domain topics, as well as some individual features, like eagerness, helpfulness, class ranking. Application agents keep model of the topics addressed by the instructional materials belonging to an application (e.g. an educational web-site).

Individualization in I-Help is achieved though matching people with appropriate helpers depending on various criteria, for example, their knowledge, cognitive style, eagerness, helpfulness, star-sign, their social ranking in the class, relationships with other people (e.g. give preference to friends). These features are modeled by the personal agents of the users together with preferences of how to do the peer matching.

I-Help provides an authentic learning environment: in the context of student's problem solving, working on projects and assignments and allows applying the cognitive apprenticeship method. The instructor supports the community with a lot of help in the beginning, both by answering questions on the public discussion forum and serving as a private helper when students request individual synchronous help through their agents. Afterwards, the instructor slowly withdraws and lets the students help each other, thus creating a community of practice.

We have deployed I-Help for 2 years in most of our undergraduate classes, with more than 2000 users. It has also been applied in classes of law at our university as well as universities in the UK, France and Colombia. We can summarize the lessons learned in these deployments as follows:

- Usage and student participation varies greatly from class to class;
- An important factor affecting the usage is that the system should be perceived from the beginning as adding value, therefore
- Initial knowledge and time investment from instructor is crucial for the success of the system;
- After reaching a "critical mass" the system becomes self-feeding since students tend to be on-line most of the time and they get used answering each other's questions.

Furthermore, we discovered that even the most exiting technology is worthless, if not embraced by a large user community. On the contrary, a very simple technology, like for example ICQ or MOO can be invaluable, if supported by an active user community. All collaborative environments rely on active and motivated users participation. This refers in general to

technologies depending on user resources, e.g. Napster, Kazaa, Gnutella.

HOW TO MOTIVATE PARTICIPATION?

Thus the great lesson we learned is that it is not enough to *push* exiting new technologies – there needs to be a *pull* on the side of the learners, a need, a perception of usefulness, motivation, a culture around the new tool. A wonderful technology, without being embraced by the people is worthless. For example, if just one person has a telephone, it would be useless for him. The usefulness of the phone emerges only when there are many people who own phones and whom one can call.

NAPSTER and Kazaa function even though the majority of their users are "free riders", i.e. people who only consume, but do not contribute new resources. However, they are examples or entertainment communities, which achieve their purpose even with passive participants (imagine readers of a book or people watching TV. In teaching people the goal is to pull the passive spectators out of their shells and make them active participants. One learns by asking questions, by helping others and being helped, i.e. by being an *active* learner. One of the reasons that large classes are considered not so beneficial for learning is that they are environments where passive watchers thrive. So the question arises, how to motivate users in a virtual learning community to participate, to ask questions and moreover, to help others?

Why do busy people offer their time and resources to help others? Obviously, different people have different motivations. Some are compassionate altruists. Some are socially oriented; they would help their friends or hope to make new friends through helping. Some seek glory (being the "guru" of the community). Some seek attention and will feel rewarded when they know that many other people will read what they have written on the pubic discussion forum. Some seek high marks. Some would prefer to earn money… We have designed different mechanisms in I-Help to motivate people differently depending on their individual motivation mechanisms.

APPEALING TO THE COMPASSIONATE

There has been a lot of research on creating believable animated interface agents (like the MS paper clip), exhibiting emotion and distinct personalities. The ability of such an agent to change or adapt the beliefs or attitudes of a user and/or move them towards a desired state or action is undoubtedly essential in designing an effective agent-based learning tool. We designed a pedagogical agent to support an interactive learning environment, using the Cognitive structure of emotion model (Ortony at al., 1988) and the five-factor model of personality (McCrae & John, 1992), which we used in a small-scale case study. Our goal was to see if the agent has an impact on the users and especially, if by displaying emotions, it can invoke a response emotion (for example, compassion or desire to please, or not to disappoint the agent,) in the user.

An introductory interactive course on C++ programming was delivered by an animated persona. The material was presented by human voice. The students had to answer test questions on the fly and the persona responded to their test performance with facial expressions corresponding to its current emotional state (see Figure 4).

Figure 4: Agent's facial expressions: Pleased, Sad, Happy, Surprised, Neutral, Angry.

We ran an experiment under two conditions: with the emotional engine "**on**" and with the emotional engine "**off**" with two groups of randomly chosen 6 student volunteers; 12 participants in total, 6 females and 6 males, equally represented in each of the two groups. The average age of the subjects was 25 years. There were two phases in the test, one where each group worked under one condition and then we swapped the groups, so each group could experience both the system with the emotional persona, and also with a non-emotional persona. After the session, the students had to answer questionnaires to evaluate their experience with the system. The results (Okonkwo and Vassileva, 2001) showed that there was no significant effect of the emotions displayed by the persona on the actual scores of the test items (i.e. on the student's learning), there was a significant effect of their perception of learning. All students enjoyed more learning from the emotional persona and the girls even felt a

pressure to perform better in order to please the persona! Boys, in contrast did not feel such pressure, and some were annoyed when the persona showed an angry face after the student did a sequence of errors.

This study was very small (with 12 people altogether, 6 female and 6 male) and of course, we can not conclude from it that women can be influenced more easily by an emotional agent to feel compassion or to meet the agent's expectations. However, the study shows that certain individuals can be influenced in this way. So if we know (i.e. are able to model the user's level of "politeness" to an artificial agent) we can most try to influence the more compassionate users to help others through providing them with an agent displaying emotional reactions to their actions.

APPEALING TO THE MATERIALISTIC

We hope motivate the more materialistic users to help by creating a marketplace for learning resources, i.e. an e-commerce environment for trading with intangible goods (advice, help, tutoring or on-line learning resources). The marketplace provides for help and information exchange, which happens both asynchronously and synchronously. The basic assumption in the design of a learning economy model is that resources like effort and time spent to provide help or to create teaching materials have inherent costs. To take these costs into account, the resources should be made tradable. Thus the payment may motivate a user to get online and help another user. We decided to focus primarily on the synchronous information exchange (individual help sessions through a chat tool) since it is related with more immediate motivational need.

Maes et al. (1995) proposed to help consumers in e-commerce applications in the search of goods, price comparison, negotiation or bidding by providing them with personal agents / assistants. This idea has important implications in trading with knowledge resources, since users have to be able to concentrate on their work or learning rather than thinking about how to get a better deal. I-Help through its multi-agent architecture of personal agents representing the uses, provides an ideal application for Maes's idea and naturally supports a free market for learning resources. The agents help connect students with questions with students who are knowledgeable and negotiate for their behalf payment in cyber currency.

We developed a negotiation mechanism (Mudgal & Vassileva, 2000) on board of each personal agent, which allows it to negotiate with other agents on behalf of its user. Each agent decides to counter-offer or accept an offer by calculating a utility function with the following factors:

- money importance (the greediness, stinginess of user)
- importance of the current goal of the user (to get help or to do her current task)
- importance of the relationship between the users (friends get discount)
- risk attitude (how much the user is willing to gamble in negotiation)
- perceived utility function and factors of the other agent (agents model each other to optimize their negotiation strategies).

The virtual currency ICU (I-Help Currency Unit) is like Sun java's Duke Dollars. The helpees must pay and the helpers earn. When someone runs out of currency, s/he has to help somebody to earn some money, to answer a question posted in the public discussion forum (the student who posted a good answer to a question gets ICUs depending on how many people voted for the answer) or to find some valuable class resources (evaluated by how many people visit the resource and vote for it positively) and to put it on line. In our experiments, the actively accumulated currency was redeemable for souvenir-prizes in the end of the term, which turned to be not particularly motivating, according to the evaluation student questionnaires. Students suggested that the prices have to be more relevant, e.g. bonus marks in the class.

So, the question arises how to redeem the accumulated currency? There are many possible ways. One of them, the marks / grades is a reward that has been used for centuries in the school system and though often criticized, it is still the most generally accepted way of rewarding learning performance.

There are other possible real word rewards though, e.g. the accumulated currency could be "cashed" in real money. Though this is obviously inappropriate measure for educational institutions surviving on tight budgets, it may be well acceptable in a workplace or in a life-long learning environment. The system of paid tutors

or private instructors has been around for ages. In workplace setting the currency can be cashed in performance points that can be used towards promotion, holidays etc.

The virtual currency provides a quantitative measure for the effort spent by an individual to help others. If needed, this measure can be expressed also in reputation units, i.e. the person with more actively earned currency can for example appear on the "The Top 10 Helpers" list and obtain community respect. Visibility in the society based on reputation has been already applied by some web-sites like *slashdot.com* or *thewines.com* to self-organize the materials so that those sent by the most respected members are most visible. In I-Help, the discussion forum postings can be displayed so that those sent by the most respected members of the community are get high visibility. Of course, mechanisms for developing reputation for each member should be in place. In I-Help, the reputation is calculated as a score of the average number of people who read the postings of this person and of positive (or negative) votes.

Generally, there is no ideal policy in cashing the virtual currency in real world rewards. It depends on the values of the community and the values of the individual (another area, where individualization can play an important role). However, there is a tradeoff with fairness, since if a person is altruistic or motivated by glory, s/he might still want to have a better mark and perceive as unfair if another helper "cashes" her I-Help currency to get a better mark.

A lot of interesting problems arise when such an artificial agent economy works to facilitate a real economy (the marks, money, reputation or whatever is exchanged in the real world). How can the economy be designed so that it is predictable, stable and manageable? How to ensure protection from crooks or malicious agents that appear always when something of importance is at stake? Reputation and trust mechanisms and multi-agent market simulations can help (Kostiuk & Vassileva, 1999), (Winter, 1999).

Future Work

In our future work, we would like to address other mechanisms for motivation, including social ones. Personal agents in I-Help already take into account existing interpersonal relationships among their users (each agent keeps a list of the friends and foes of the user). These relationships are taken into account when seeking help, as well as when negotiating with the personal agent of another user (friends get a "discount"). However, a more interesting question is whether agents can help in building new interpersonal relationships between people? We have investigated trust based mechanisms for coalition formation in agent-based electronic market systems (Breban & Vassileva, 2001) and found that agent coalitions lead to increased stability and predictability of the system. However, can these agent coalitions be used to build teams of users that are likely to be stable and productive? We are working to answer these questions and to build motivating and productive learning communities.

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