Help&Learn: A Peer-to-Peer Architecture to Support Knowledge Management in Collaborative Learning Communities

Renata S. S. Guizzardi[1], Lora Aroyo[1,2], Gerd Wagner[3]

[1]Computer Science Department – University of Twente (UT)
P.O. Box 217 – 7500 AE Enschede – The Netherlands

[2]Department of Computer Science
[3]Department of Information & Technology
Eindhoven University of Technology (TU/e)
P.O. Box 513 – 5600 MB Eindhoven – The Netherlands

{souza, aroyo}@cs.utwente.nl, G.Wagner@tm.tue.nl

Abstract. *Collaborative learning motivates active participation of individuals in their learning process, which often results in the attaining of creative and critical thinking skills. This way, students and teachers are viewed as both providers and consumers of knowledge gathered in environments where everybody teaches and learns, by interacting with each other. Peer-to-peer (p2p) networking reflects and supports this non-hierarchical relationship between teachers and students in a collaborative learning community. A crucial issue here is the provision of efficient support for the knowledge organization and sharing within such communities. We follow a semantic approach in the organization of resources and propose an agent-based architecture for their management and sharing, taking a user-oriented approach. We illustrate these ideas within the p2p collaborative support system Help&Learn.*

Keywords: collaborative learning communities, knowledge management, peer-to-peer, agent-oriented architecture.

1. Introduction

Collaborative learning reflects the ‘constructivist’ approach, where the learner does not simply reproduce reality but actively creates it, usually in a collaborative dialogue with other actors [Freire 1970]. Cognitive psychology theories, and especially the work of Piaget and Vygotsky [Dillembourg 1999], claim that collaboration is essential for the development of logical thinking and, ultimately, learning. This way, instead of being based on information assimilation and memorization, collaborative methods are based on students of different performance levels working in groups, sharing a common goal.

Contrasting with traditional education practices, which view teachers as *producers* and students as *consumers* of knowledge, in collaborative learning, both teachers and students are seen, at the same time, as producers and consumers, gathered in an environment where everyone has something to teach and something to learn. This way, instead of playing the role of detaining and transmitting knowledge, the teacher assumes other functions, such as those of *motivator*, *guide* and *collaborator*. Meanwhile, the students become more active and responsible for their own learning.

Papert’s Constructionist theory [Bruckman 1997] emphasizes the importance of sharing knowledge by the means of concrete artifacts. He claims that learning effectively occurs when the learner is “engaged in the construction of something external or at least shareable... a sand castle, a machine, a computer program, a book.” [Bruckman 1997]. According to Papert, building something meaningful and sharable leads to a cyclic process of *externalizing* knowledge that is in the mind of the learner and *internalizing* new structures, as a result of the social interaction around this external artifact.

This externalization and internalization cycle seems to coincide with Nonaka & Takeushi's Knowledge Management (KM) theory [Nonaka and Takeuchi 1995]. According to them, there are two types of knowledge: *explicit* and *tacit*. The former refers to codifiable components, which can be disembodied and transmitted, while the latter refers to knowledge that is "confined in people's mind", being difficult to articulate and disseminate. Through social interaction and collaboration, tacit knowledge is turned into explicit, and individual knowledge is turned into organizational. Organizational knowledge creation is a result of a continuous and dynamic process of conversion between these two knowledge types.

Since the ultimate goal of KM is allowing workers to learn and evolve within organizations, research in the areas of KM and collaborative learning could profit a lot from cross-fertilization. Nowadays, both collaborative learning [Bruckman 1997; Souza and Menezes 2000] and KM [Gongla and Rizzuto 2001; Dignun 2003] are converging for the use of the sense of *community* [Graves 1994] to support learning. Collaborative learning communities can be seen as organizations that share both explicit and tacit knowledge. A common problem of these settings is the fact that the community's resources are distributed among its members, thus it is not easy to find out who has the right piece of information, knowledge or advice. Targeting this problem, we propose Help&Learn (H&L), a peer-to-peer system aimed at supporting the organization and sharing of distributed knowledge in collaborative learning communities. Peer-to-peer technology allows sharing of resources via direct exchange among individual systems in a digital network, naturally supporting KM by closely adopting the conventions of face-to-face communication [Tiwana 2003]. In such networks, there are no central servers controlling the interactions among peers. This horizontal relationship between peers allows the creation of rich knowledge sharing environments, in which people look for each other based on common interests, social affinity and personal characteristics. This configuration can be quite interesting to support collaborative learning communities, reflecting the non-hierarchic relationship between teachers, students and other members.

Further in this paper we will discuss the use of peer-to-peer architectures for KM in collaborative learning communities (Section 2). In Section 3, we introduce Help&Learn and describe its main functionalities and components. Section 4 proposes a layered framework for Help&Learn, and discusses how these layers guide the development of the Help&Learn architecture. In order to give an appropriate context of our work, we give a state-of-the-art overview of the related work in Section 5. Finally, section 6 presents the conclusions and directions for future work.

2. Knowledge Management in Collaborative Learning Communities

Maçada and Tijiboy [Macada and Tijiboy 1998] consider three essential elements for collaborative learning to succeed in network-based environments: a) *cooperative posture*, which involves: non-hierarchical relationship between the participants, collaboration, constant negotiation and open-mindedness; b) *collaborative technological infrastructure*, i.e, the technological environment developed for the learning community must effectively support collaboration; and c) *a non-hierarchical method*, i.e. it is very important that all the participants get involved in the constant organization and re-organization of the environment dynamics (meaning the establishment of goals, norms, roles, priorities of tasks, etc.). Note that, in these scenarios, the teacher is still responsible for proposing tasks, evaluating the students, and providing them with appropriate guidance. On the other hand, students are given more autonomy on choosing means and procedures to accomplish their tasks.

Peer-to-peer networks support the above three elements, providing a framework for interaction and resources access and exchange. "Peer-to-peer introduces a set of concepts that takes a human centered view of knowledge as residing not just in people's minds but also in the interaction between people and between people and documents" [Viant 2002]. What makes peer-to-peer different than the traditional client-server approach is the fact that there is no central server, i.e. each node of the network can play the role of either a *client* or a *server* [Tiwana 2003]. This reflects the non-existence of a central power or any kind of authority controlling the peers interactions and exchanges. This way, teachers, students, experts and organizations can be seen as providers of information and owners of knowledge, gathered in communities, where people look for each other based on needs and profiles, not on roles and titles. In these settings, knowledge resources are locally stored and managed by each peer in the network.

Peers may exchange knowledge resources such as *learning material* and *messages*. A learning material could be any artifact locally stored by its owner (produced or not by him). The learning material may have various presentation formats (text, graphics, audio, video, etc.) and different application types (exercise, report, seminar, etc.). A message refers to a communication construct, used to mediate dialogue and discussion. Messages can be exchanged by email, mailing lists, chat rooms, and so on. The difference between learning material and messages is important here because they have different purposes within the community. While a learning material is used by the community members to study a particular theme, messages are typically used for communication purposes (for instance, to inform something, to ask and answer doubts and to debate particular issues). Participants in the scenario can exchange knowledge resources in various ways: sending documents to each other, interacting through messages, and sending documents and messages at the same time. It is important to emphasize that the resources exchanged by the peers are not stored in a central server. Rather, they are locally stored in the machine of each peer, from which the peer may search for resources from other user's computers (client role) or may allow other users to access his/her own resources (server role). Besides learning material and messages, it is important to acknowledge the existence of tacit knowledge. This is also relevant since much of one's knowledge is not registered in any kind of physical artifact, but rather confined in one's mind. Nevertheless, tacit knowledge can be shared through social interaction in collaborative environments.

Help&Learn aims at providing an infrastructure to support knowledge sharing in peer-to-peer communities. This involves allowing the peers to organize and exchange their learning material, and share knowledge through text messages. Help&Learn helps a peer to find others with whom to collaborate and exchange information, and provides intelligent support for knowledge retrieval. The proposed architecture is the subject of the next section.

3. Help&Learn

Help&Learn (H&L) is an agent-oriented system, which exploits the helpdesk metaphor in order to support knowledge management in collaborative learning communities. It expands the student's possibility of solving their doubts, getting involved in a collaborative learning experience that transcends the limits of classrooms. By collaborating with other peers, the students learn with the doubts of others, besides developing cognitive abilities, such as to state clearly their doubts and thoughts; to interpret questions; to mediate discussions; and to solve problems. The helpdesk metaphor is interpreted in a way that a system user can ask for help (playing the *helpee* role) and another user can provide the needed help (playing the *helper* role).

Knowledge in H&L is exchanged in the form of HelpItems. These HelpItems can be *what-is* or *how-to-do* explanations, bibliographic or Web references, electronic documents, or even hardcopies, depending on the peers setting (e.g. inside a school or a company, hardcopies can be exchanged in addition to electronic copies). In other words, HelpItems materialize both learning material and messages, illustrated in the previous section. Section 4.1 discusses how these HelpItems are stored and managed.

As in a typical peer-to-peer application [Viant 2002], a key issue here is finding the best peer to satisfy a certain help request. A helper is selected if he can fulfill a help request, by providing the helpee with appropriate HelpItems. Besides expertise, other peer's characteristics, such as the time and availability of the peer are also considered for the best helper indication. As an example, a teacher may know the answer to a student's question but he may have less time than an advanced student to spend on it (see Section 4.2 for a more detailed discussion on this topic).

We have adopted an agent-oriented design and development approach, where system's agents are responsible for managing knowledge exchanged among peers. This includes: a) handling a peer request for help and delivering help in a personalized way; b) finding the best peer to answer to a help request; and c) searching through previously asked questions/answers [Souza and Menezes 2001].

3.1. Help&Learn Agents

In order to guide the analysis and design phases of Help&Learn, we apply the Agent-Object-Relationship Modeling Language (AORML), which extends UML to specifically model agent-oriented environments [Wagner 2003]. More details on the use of AORML for KM and its application within H&L's modeling are given in [Guizzardi, Aroyo and Wagner 2003]. Figure 1 depicts H&L's agent model illustrated by an AORML agent diagram, which includes all agents and objects involved in the helpdesk, as well as their relationships. Note that this diagram is very similar to the UML class diagram, showing the system's classes (agents and objects) and relationships between them. Agents are represented as rounded-rectangles, while objects are depicted as in traditional UML.

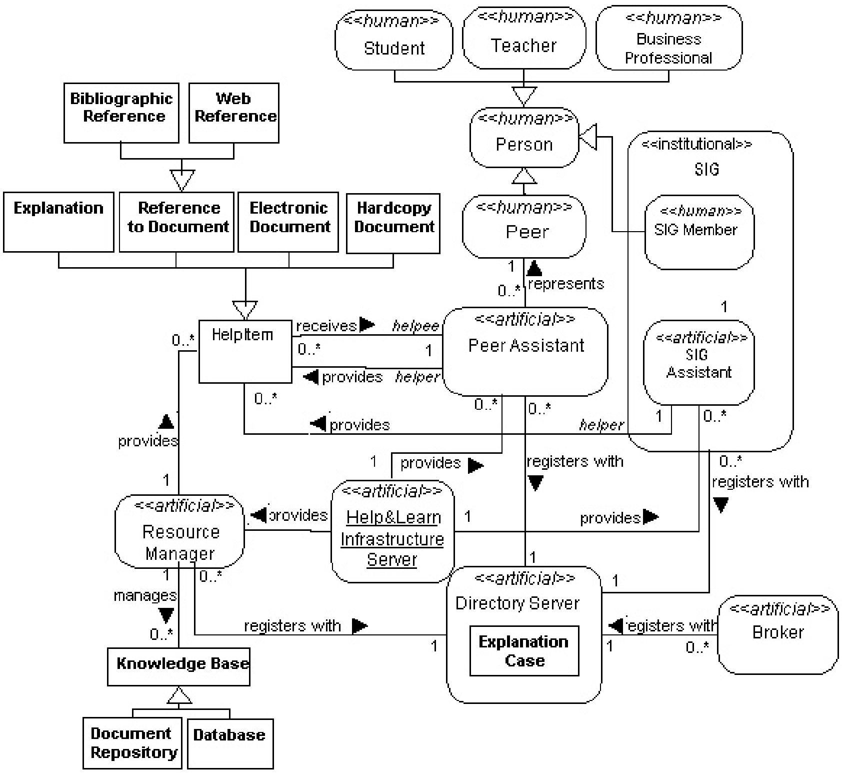

Figure 1. Help&Learn's agent diagram

Here follows a brief description of each artificial agent of the system. **Help&Learn Infrastructure Server (IS).** This agent addresses the management of the H&L system itself. It provides the other artificial agents of the system, as well as periodic updates. **Peer Assistant (PA).** The PA supports the systems Peers in managing their HelpItems. Besides, the PA will act on behalf of its Peer, retrieving for him/her valuable HelpItems both reactively, on user's request, and proactively, by identifying user's needs and preferences. **Directory Server (DS).** This agent maintains a registration of all online peers, along with their domains of expertise. The DS also maintains a repository of previously provided explanations, along with their respective request (typically, a question). This way, the PA consults this agent every time a question is forwarded to it by a helpee, to check whether or not this question has been already answered. If so, the answer is immediately recovered to the helpee; otherwise, the PA consults the Broker for a best helper indication. In this repository, Information Retrieval Techniques are used in order to group similar questions and aid the retrieval of the relevant ones, as well as to support the creation of an automatic FAQ, according to the proposals of a previous work [Souza and Menezes 2001]. **Broker.** The Broker is responsible for indicating helpers to answer to a specific help request. In order to accomplish this, this agent ranks the peers based on expertise, availability and trust. Other factors are also considered, such as the peer's collaborative level and the value of his previous contributions (see section 4.2 for a detailed discussion on this issue). When a PA asks for a best helper indication, the Broker delivers a ranked list of possible helpers that the PA should contact, sending the help request. **SIG Assistant.** Special Interest Groups (SIGs) are also allowed to participate in the system through the SIG Assistant. These SIGs usually pre-exist the system, but can also be created by suggestion of the Broker. The Broker has a representation of the SIGs and can include them as best helpers to answer a certain help request. When the SIG Assistant receives a help request, it broadcasts the message to all members of the SIG. Today, there are many SIGs advertised in the Web, specialized in several different areas. By introducing them to the helpdesk system, we hope to broaden their interaction scope, at the same time that we give the opportunity for the system peers to have their help request answered by an expert on the topic. **Resource Manager (RM).** The RM brings to the system existing knowledge bases, which can be databases or document repositories. This way, HelpItems that are not owned by any of the system peers can also be considered and consulted by the PAs. These knowledge bases can be consulted through *keyword* or *query search*. A system peer does not directly contact a RM. Instead, this is done through the PA. For the keyword search, the peer simply submits a list of keywords. In the case of a query search, the peer uses an RDF-based query language [Nejdl 2002], which will then be translated by the contacted RM to the query language of the specific knowledge base. This agent is typically downloaded by the owners of existing knowledge bases, who must provide the translation specification. Both the SIG Assistant and the Resource Manager are added in an attempt to bring the external world, available through the Internet, to enrich the educational environment, giving the system peers access to new knowledge sources, in the form of domain experts and electronic documents, respectively.

4. A Layered Model for Help&Learn

In H&L, agents must cooperate to provide knowledge to the right person at the right time. In other words, knowledge is delivered both reactively, at user request, and proactively, relying on the agents' reasoning capabilities to find appropriate knowledge to the peers. In order to accomplish that, agents must: a) have access to the semantic of the content of the available knowledge resources; and b) identify the peer's needs and preferences. Our approach to support knowledge sharing, accomplishing a) and b), can be described in four layers illustrated in Figure 2.

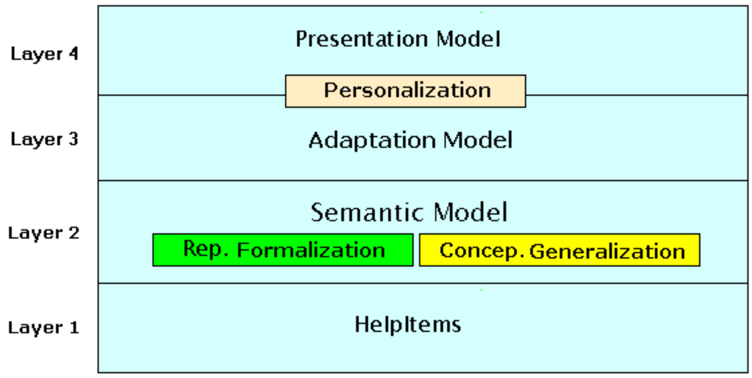

Figure 2. Help&Learn's layered approach

The layer 1 of Fig. 2 represents the knowledge resources exchanged by the learning community, named *HelpItems* in H&L. As mentioned in section 2, these HelpItems may be materialized in the form of learning material or messages exchanged by the peers. We emphasize the importance of the exchange of messages, because they may be able to support the explicitation of tacit knowledge, since it is through social interaction that such type of knowledge emerges [Nonaka and Takeuchi 1995]. The *Semantic Model* of layer 2 is responsible for the reasoning of the system agents about knowledge, addressing the problem early mentioned in a) (in other words, this model provides the agents with information about the content of each HelpItems). Thus, the Semantic Model is responsible for the two tasks described by Fischer and Ostwald [Fischer and Ostwald 2001] as related to knowledge integration in KMSs: **representational formalization**, i.e. putting information in an appropriate computational syntax so that the system agents can access and interpret it; and **conceptual generalization**, i.e. providing domain specific semantics to each HelpItem. The problem early presented in b) is addressed by Layers 3 and 4: the *Adaptation Model* and the *Presentation Model*, respectively. The Adaptation Model is specifically concerned with **'what'** is going to be presented to the users, while the Presentation Model determines **'how'** such knowledge will be presented. Both layers deal with Personalization, i.e. consider user's needs and preferences to support knowledge delivery.

4.1. Metadata and Ontologies Supporting the Semantic Model

Semantic Web research suggests Resource Description Framework (RDF) and RDF Schema (RDFS) as interesting choices for representation formalization [Davies, Fensel and van Harmelen 2003; Davies et al 2003]. The system peers can provide metadata about their learning material, such as general information (e.g. material's author and date) and data that is particularly important in the learning community (e.g. why he considers a specific document important; which community projects or tasks can benefit from the knowledge contained in a document). Using RDF(S) for knowledge representation in H&L enables its Peer Assistants to reason about the HelpItems, supporting their decisions regarding which item to provide to their associated peers. Important here is how to decide which metadata should be considered? Several research initiatives propose solutions, such as the Dublin Core Initiative [Dublin 2003]. Besides, there are already some specific metadata standards to describe learning resources, such as LOM and SCORM [Sherwood 2002]. However, as mentioned in [Davies et al 2003], some metadata might be specific for a given community. This way, it is important to keep this option customizable, allowing the community members to negotiate and create new relevant metadata for their particular purposes.

In order to provide concept generalization, we are working towards an ontology-driven approach. Ontology can be defined as a specification of a shared vocabulary in a domain of discourse [Guizzardi et al. 2002]. In the context of H&L, we use the ontology to represent the domain model, as a set of concepts and relations. This model provides semantics about a specific domain, i.e. by looking at the model, one is able to understand how the model's developer (a person or a community) interpret that specific domain. In H&L, peers relate their learning material to the concepts within the domain ontology. It is important to note, however, that such shared conceptualization may not pre-exist peer interaction. Here, three approaches are possible: 1) suppose that some learning communities might have already built/imported an ontology for their use, as exemplified in some Semantic Web initiatives [Davies, Fensel and van Harmelen 2003]; 2) consider that such shared vocabulary will emerge and evolve as a result of the negotiation the peers will realize; or 3) consider some intermediary approach, in which both global and local conceptualizations co-exist, being the local conceptualizations interpreted within the global one. In this paper, we explore the possibility described in 2), adopting the approach of [Bonifacio et al 2000], in which each peer organizes his knowledge assets according to a personal and local conceptualization. Then, a linguistic-based algorithm [Bouquet et al 2003] is applied in order to find mappings between the conceptualizations of two peers. This approach is implemented in the KEx system [Bonifacio et al 2003]. Figure 3 shows two different conceptualizations about the domain of "Agents".

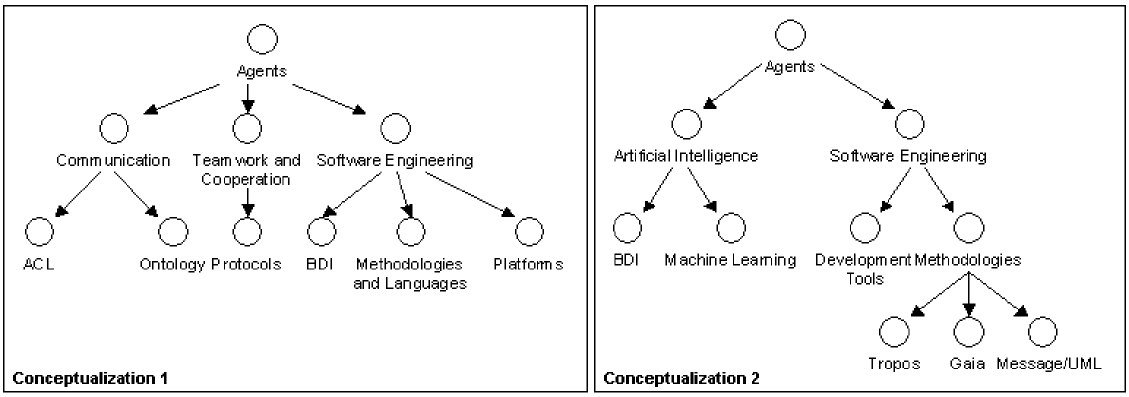

Figure 3. Two different conceptualizations about the domain of "Agents"

The models shown in Fig. 3 represent the point of view of two different peers regarding the "Agents" domain. Although these conceptualizations (named *contexts* in [Bonifacio et al 2000]) may not be considered an ontology in a strict sense, they can play an important role on knowledge sharing, since they make explicit personal interpretations about specific domains. H&L peers are requested to provide contexts about their domains of interest and, then, they are asked to associate their learning material with the concepts within this model. When searching for specific material, a peer contacts his PA, sending keywords and, alternatively, the related 'focus' in his conceptualization (a focus is a path in the tree, going from the root of the tree until a selected concept). Let us consider an example: When Peer A, owner of Conceptualization 1 (Fig. 3) searches for documents about agent-oriented software engineering methodologies, he can contact his Peer Assistant, selecting the specific focus *"Agents→Software Engineering→Methodologies and Languages"*. His PA will search for other peers who have similar conceptualizations. Eventually, it will find Peer B, who created Conceptualization 2 (Fig. 3), and will retrieve the documents associated with the concepts *"Methodologies"*, *"Tropos"*, *"Gaia"* and *"Message/UML"*. More than this, by applying the algorithm described in Serafini et al. [Bouquet 2003], the PA will be able to indicate to his peer the relations between the concepts of the helper and those of the helpee. For instance, he will show that *"Tropos"*, *"Gaia"* and *"Message/UML"* are more specific concepts than *"Methodologies and languages"* (they are types of agent-oriented methodologies).

Finally, in H&L, the peers' contexts are also used when peers ask and answer questions. When a peer asks a question, he indicates the focus of the question, again by selecting a specific concept from his context. This way, when the helper receives the question, he can also have some contextual information about it. As an example, when Peer A asks *"How can I model interactions in Gaia?"*, again selecting the focus *"Agents→Software Engineering→Methodologies and Languages"* , Peer B can infer, by the focus, that Gaia here is the agent-oriented methodology he is familiar with. The focus information is also used by the system agents to retrieve similar previous questions and answers from the Explanation Case. This is done by an Information Retrieval method based on similarity between vectors [Souza and Menezes 2001]. This method will be the subject of further publications.

4.2. User Modeling Supporting the Adaptation and Presentation Models

The Adaptation and Presentation Models are responsible for providing the system agents with the means to retrieve knowledge according to the user interests, preferences, community role, and current tasks. In order to accomplish that, these layers are built around a user model, which describes specific characteristics of a peer. The first issue here regards which user characteristics to consider in the user model, here called **Peer Model** (PM). Table 1 shows a list of these characteristics.

Table 1. Relevant characteristics when retrieving knowledge for a helpee

Helpee's Characteristics	Helper's Characteristics[1]	Helpee's Physical Context
interest/need for specific contents	trustability	current task
level of expertise	availability	time
preferences on presentation format	collaborative level	Location
activity/role performed within the community	reliability	

Different factors guide the system agents when retrieving knowledge for a specific H&L helpee. First of all, his personal characteristics, such as **interest** for particular content, **level of expertise** in specific areas, **preferences** regarding the HelpItem presentation, and the type of **role** he performs within the learning community (Table 1, Column 1). The domain of a peer's defined semantic conceptualizations (see Section 4.1) will determine his interest and expertise. Besides providing a list of domains in which the user is interested and has expertise, the PM contains numeric values, expressing

[1] It is important to note that *helpee* and *helper* are two roles that can be played by any user in Help&Learn. Hence, this column presents the characteristics of a user (the helper) in interaction with another user (i.e. in the helpee's point of view).

the level of peer's interest and expertise in each of these domains. Peers may play different roles within a learning community. For instance, a peer may be a student or a teacher. Besides, if the peers are divided in groups to perform particular activities, the group members may be given different roles, as group leader, group web-master, etc. These different roles might determine user's preferences regarding specific HelpItems. For instance, a group's web-master might be interested in accessing websites prepared by other web-masters.

Columns 2 of Table 1 describe the aspects that the Broker considers when selecting a helper to answer to a given help request. The KM literature claims that **trust** is one of the most important factors considered when people share knowledge. In H&L, the peers may indicate those who they trust and determine different levels of trust for each one. Other factors considered by the Broker are: **i) availability to answer help requests**: H&L allows the peers to indicate how much time they can spend on answering help requests. This way, those peers who have higher availability are more contacted than the others; **ii) collaborative level**: the peer's collaborative level is measured throughout his interactions in the system. If a peer receives questions and does not reply to them, this has a negative impact on his collaborative level. The opposite happens if a peer promptly replies to incoming help requests. By explicitly modeling the peers' collaborative level in H&L, we hope to avoid (or at least diminish) the existence of "free riders", i.e. peers that seek for contributions but never contribute to the others; and **iii) reliability:** when receiving an answer to a given help request, the helpee is allowed to annotate the helper's contribution, giving it a grade. An average value of all annotated contributions is stored on the PM, indicating a measure of how reliable the community members consider a particular helper to be. The Broker then uses this information to select and rank helpers.

Besides personal information, the peer's physical context [Chen and Kotz 2000] is also taken into account when a PA is searching for knowledge. Depending on the helpee's **current task**, the system agents may infer that he needs a certain piece of knowledge. For instance, if a user is planning a meeting, it might be useful to retrieve for him information about his colleagues' holidays and commitments. **Time** and **location** are also explored. Here, we can consider for instance, if a user is at home or at school, and the time of the day to determine the choice for specific artifacts (e.g. if it is late at night, the user might prefer a shorter or less complex text to read). Finally, it is important to add that the PM is created by the Peer's PA based on peer's feedback. Besides, the PM is constantly adjusted, based on information collected by the PA throughout peers' interaction within the peer-to-peer community.

5. Related Work

There are several ongoing initiatives related to the work presented in this paper. One of these initiatives is the EDUTELLA project [Nejdl 2002], which aims at providing a peer-to-peer networking infrastructure to support the exchange of educational material. In order to accomplish this, peers can make their documents available in the network, specifying metadata information as a set of RDF statements. Bonifacio et al. [Bonifacio et al 2003] have developed KEx, a peer-to-peer system to mediate distributed knowledge management. H&L shares similar vision with KEx, since it is also based on the Distributed Knowledge Management approach [Bonifacio et al 2000]. KEx allows each individual or community of users to build their own knowledge space within a network of autonomous peers. Each peer can make documents locally available, along with their context (see section 4.1). When searching documents from other peers, a set of protocols of meaning negotiation [Bouquet 2003] are used to achieve semantic coordination between the different representations (contexts) of each peer. Both EDUTELLA and KEx are specifically concerned with the exchange of documents and do not address peer collaboration through the exchange of messages, which is one of the targets of H&L. The work proposed by Vassileva [Vassileva 2001] describes a peer-to-peer system to support the exchange of messages between students. A student needing help can request it through his agent, which finds other students who are currently online and have expertise in the area related to the question. As in H&L, there is a centralized matchmaker service, which maintains models of the users competences and matches them to the help-requests. On the other hand, this system does not support management and sharing of learning material, restricting itself to messages exchange. The OntoShare system [Davies et al 2003] facilitates information sharing between communities of practice, and encourages people to make contact, based on mutual concerns and interests. Like in H&L, OntoShare users annotate documents using RDF and link documents to an ontology. However, this system adopts a client-server approach, and presupposes the existence of a shared conceptualization (ontology) among the members of the community. Besides delivering knowledge reactively, by matching the incoming documents with the user model, the system is able to proactively retrieve knowledge to the user. All these initiatives share with H&L the common goal of providing support for KM, using peer-to-peer architectures, ontology-based approaches or Semantic Web languages. They provide us with good grounds for our research in this direction. Most of them concentrate on the exchange of documents [Nejdl 2002; Bonifacio et al 2003; Davies et al 2003], while one of them focuses on message exchange [Vassileva 2001]. H&L aims at supporting the exchange of both learning material and messages, as both are important types of knowledge resources in collaborative learning communities.

6. Conclusions and Future Work

In this paper, we have presented our work in progress on Help&Learn, a peer-to-peer architecture to support knowledge sharing in collaborative learning communities. We aim at creating for the learning communities' members a rich environment for sharing knowledge, providing support for finding relevant information and useful collaboration partners. In order to do so, we have used results on collaborative learning [Macada and Tijiboy 1998; Souza and Menezes 2001; Vass 2001] and KM related research [Dignun 2003; Fischer and Ostwald 2001] in the conceptualization and modeling of H&L. Many issues still remain to be developed. In this paper, we target functionalities concerning the PA and Broker agents. We find the issues related to the peer model (PM) very interesting. Thus, it is our intention to develop a more careful investigation (based on a real case study) on what are the user's characteristics to be considered in the PM. In other words, we would like to find out what are the important issues that drive people to select their collaboration partners when sharing knowledge. Besides this, the implementation of the PMs, along with the agent's reasoning mechanism over them are also included in our research agenda.

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