

Animal Companions as Motivators for Teammates Helping Each Other Learn

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Abstract. This paper describes and discusses the design rationales of a system called My-Pet-Our-Pet that intends to realize an approach to using simulated animal companions to encourage students to help each other learn. A class of students is divided into several teams. Every student keeps her own *individual animal companion*, called My-Pet. An important component of animal companion is the student model of its master that supports self-reflection in different perspectives. Also, every team has a *team animal companion*, called Our-Pet, being kept by all the members of the team collaboratively. Our-Pet has a collective student model composed by all the student models of the team members. The design of Our-Pet help set a team goal through participating a competition game among Our-Pets of different teams, support collective reflections among team members, and shed light for the team how to help each other. We are currently conducting an experimental trail of the system in an elementary school where every student in the class has a Tablet PC.

Keywords: Learning companion, team animal companion, student model, active student model, open student model

BACKGROUND

With the development and advance in computer and information technology, computer supported collaborative learning (CSCL) environments bring more opportunities to foster communication and interactions in the social learning settings. Two kinds of approaches to realizing the CSCL environment: computers simulate intelligent agents to interact with learners, and computers provide smart tools or environments to foster social interactions among learners. A typical example of the former approach is the learning companion system in which the computer simulates two agents, a learning companion and a teacher, so that the user student can collaborate with the learning companion under the supervision of the teacher (Chan & Baskin, 1988, 1990). Chan (1996) also suggested that the student model can be used in different ways, other than hiding behind the student as an internal component inside the ITS. An example for this is the four animal companions that play different roles—collaborator, troublemaker, peer tutor, and tutee – based on the variations of student models interacting with learners to benefit learning (Chang et al., 1999). One way to use student model is to make it open or “inspectable” to the student for provoking self-reflection (Self, 1988; Kay, 1997; Bull, 1998; Bull, 2004) and later some researchers have been working on this direction. PHelpS system is an example that provides smart tools and environments to enhance social interactions among peer learners based on their student models (Greer et al., 1998).

Animal companions are simulated pets to be taken care by students who have to learn in order to earn the pet food. In our previous study of a simpler version of animal companion, My-Pet, (Chen et al., 2001, Chen et al., 2002; Chen et al., 2003) which was implemented in EduCities (Chan et al., 2001; Chang et al., 2003), we found that students demonstrated compassion and affection towards their pets, like Tamagochi (Webster, 1998; Pesce, 2000). For example, they expressed numerous feelings by emotional words on a discussion forum to show their care and concern about their pets. Because of these affective factors, students showed strong willingness of

learning in the process of taking care of the pets (Chen et al., 2004). By the same reason, some students kept their My-Pets for a long time, about 5 percent of them for more than a year. After that study, in addition to improving My-Pet, we add Our-Pet in the system in order to promote positive interactions and helpful behaviors among teammates.

My-Pet

A student participates in learning activities to get resources such as foods and tools, so that the student can feed her My-Pet and play with My-Pet in many mini-games. My-Pet includes an important component, its master's student model, which is externally represented to the student by the attributes of My-Pet. Currently, the representation of this student model is a simple one. However, it includes cognitive, social, and emotional domains and there are a few attributes representing each domain. While the student is aware of her low academic performance on the cognitive domain by viewing the domain representation of her My-Pet, the student then participates more in learning activities. Similarly, when the student perceives her poor social performance, the student, to demonstrate her positive social behavior, may assist her teammates in learning to demonstrate her positive social behaviors. Figure 1 shows a student viewing the internal representation of multiple domains in My-Pet to reflect.

My-Pet plays three roles: a *motivator*, a *reflector*, and a *sustainer*. First, based on the human attachments to real pets (Melson, 2001), the strategy of learning by taking care of an animal companion triggers a student's emotional engagement and involvement in learning activities. The good will for My-Pet is the cause and learning is the effect. Although this initial motivation for learning is not for the purpose of learning itself, however, if the student later finds that the required learning is an intriguing and rewarding experience, this initial motivation may change qualitatively to motivation in learning itself. Second, self-reflection through viewing the domain representation of My-Pet, which is essentially the student model of the student herself in different domain, can help the student look at herself from different perspectives, and hence understand herself better or enhance her self-awareness. Third, pet keeping is a regular and long-term activity. With appropriate reinforcement, the system may be able to sustain some desired student behaviors and then to become a habit.

Our current version of the student model is a simple one but the framework offers flexibility for future extension and sophistication. The attributes of the cognitive domain include "what have learned", which is a record of what topics the student supposes to have learned, "degree of understanding" of concepts involved in a topic, "mastery level" of a topic, "overall performance", and so on. The attributes of emotional domain currently include "confidence" and "interest". Confidence is evaluated by the rate of successes in answering questions correctly or solving problems of a topic and that "interest" is determined by the frequency the student involved in learning activities of a topic after class or even if the student is not asked to do so. The attributes of social domain consist of "reminding" and "helping", which represent the student's collaborativeness. We use honor system, that is, the student reports to My-Pet how many times each time she "reminds" or "helps" her teammates to learn.

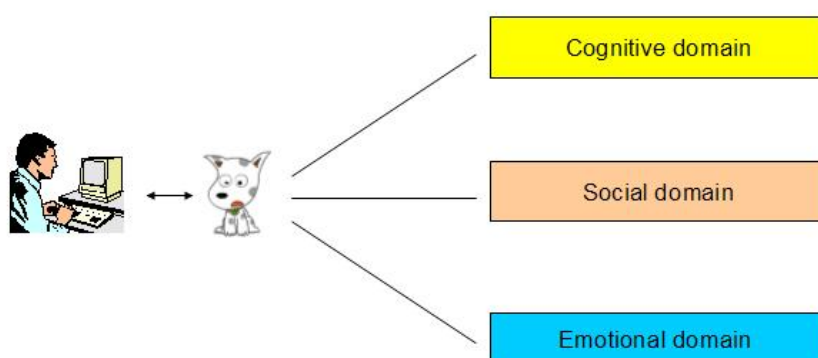


Figure 1. Student viewing My-Pet to reflect

Our-Pet

A class of students is divided into 4-children teams and each team takes care a *team animal companion*, called Our-Pet. As illustrated in Figure 2, a team's Our-Pet will interact with other teams' Our-Pets. An important component of Our-Pet that largely governs the behaviors of Our-Pet is a *collective student model*, with attribute values based on those in student models of all the team members. As this collective student model is "inspectable" by all members, it thus serves as a vehicle for promoting solidarity and collaborative behaviors of the team. In cognitive domain, there are four kinds of attribute values in that domain for each topic, namely,

“minimum”, “maximum”, “average”, and “variance” of all team members’ attribute values of cognitive domain in the same topic. For example, “mastery level” of a certain topic is an attribute in the cognitive domain. Our-Pet’s mastery value if adopts minimum, that means its mastery value is represented by the value of weakest team member. As all team members can view this value, other members will then naturally be urged to “help” or “remind” the weakest member to do more remedial work. If it adopts maximum, Our-Pet’s mastery value will then be the strongest team member’s value, and it then encourages the strongest member to do more for enrichment and strive for excellence, but then it will increase their “variance” value. With similar reasoning, “average” calls for more effort by all members and “variance” asks the stronger members to help the weaker members so that they can minimize their differences and hence the “variance”. The mechanisms of emotional and social domains are similar to that of the cognitive domain.

Besides, all Our-Pets involve in a competition game as a motivator for members of a team to take actions to help each other learn. The rules of the game are designed so that winning and losing of a game depends on attribute values of two competing Our-Pets as well as luck. The competing game may use either attribute values in somewhat random way and thus the chance Our-Pet wins the game depends on all these attribute values and thus it demands efforts of all team members to improve all these attribute values. Each game has four rounds of competitions, and the game result is calculated by accumulating the results of four rounds. Each student stands for the team in one round by rotating three turntables to determine which domain, which attribute, and which kind of attribute value of Our-Pet to compete with the other team.

In sum, there are two roles of Our-Pet sub-system. The first is that the competing game will serve as a *motivator* for students to collaborate in order to win the game. The second is that the collective student model is an *indicator* that indicates how the teammates should help each other.

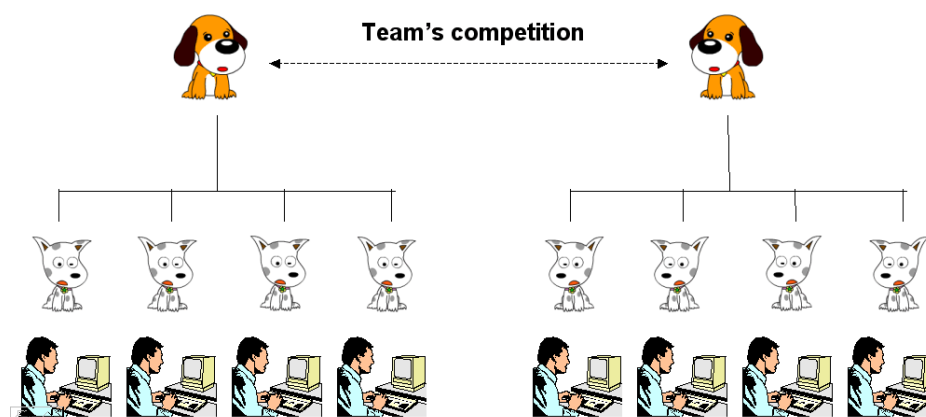


Figure 2. Intra-team collaboration for inter-team competition

IMPLEMENTATION

Figure 3 (a) shows that the My-Pet is eating food while being fed, and the student can inspect into domain attribute values of My-Pet. The subject domain of our current My-Pet-Our-Pet is idiomatic phrases for elementary students and can be easily transformed into other subject domains. For keeping My-Pet, a student has to earn a living for it – learning to get the resources such as foods and tools. In the current case, the student needs to participate in a series of activities for learning idiomatic phrase, including reading the historical story to understand the original meaning, identifying the key words, and practicing the applications of idiomatic phrases used in different contexts in our daily lives. If she can pass an assessment test, then she earns the required resources. Figure 3 (b) illustrates a four-children team where each team member has a My-Pet, taking care an Our-Pet. Every teammate can inspect the all other members’ attribute values, in addition to Our-Pet’s.

Different from our previous version of My-Pet used on Internet, My-Pet-Our-Pet, an extension of My-Pet, is used in the classroom where every student has a Tablet PC. My-Pet-Our-Pet now is being trial tested for future improvement of the system in an elementary classroom with 31 fifth-grade students. The students use the system fifteen minutes each time, and three times per week from November 2004 to January 2005. The results show that most students not only paid efforts in individual learning to improve the My-Pet’s attributes, but also encouraged each other to study hard for Our-Pet’s attributes. Some students also gave other teammates hints on how to do well in reading, or helped others solve problems in learning idiomatic phrases. But the interaction and collaboration among teammates in learning activities still have many spaces to improve.

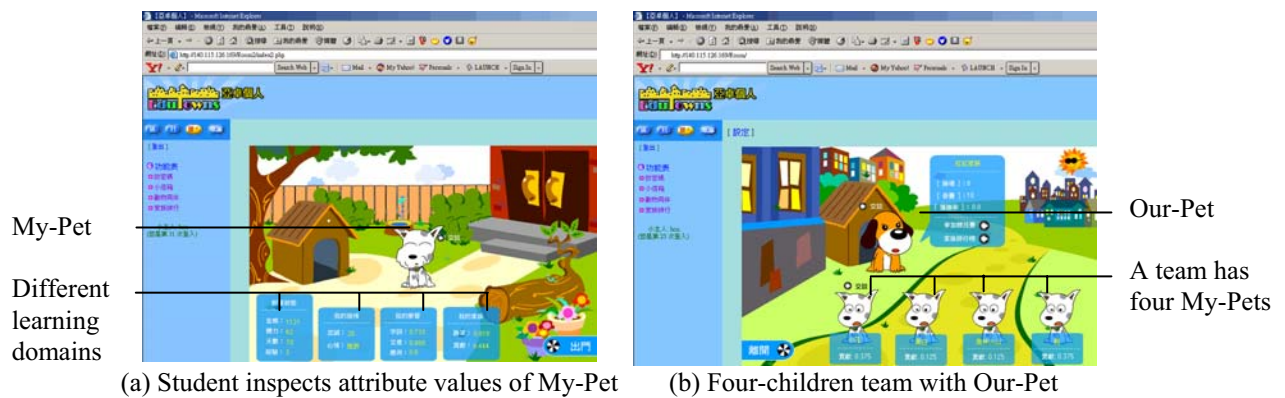


Figure 3. Snapshots of My-Pet-Our-Pet

SUMMARY

My-Pet-Our-Pet provides an ingenious way of adopting the metaphor of animal companion, underlying which is a student model, in a collaborative learning environment. My-Pet is essentially an active student model; yet, it is open to the student in an inspectable form. Harnessing affection and compassion brought by children's keeping pet hobbit, it provides a driving force for students to learn since their emotional engagement can direct to participation of some designed learning activities. Of course, we hope those learning activities can arouse their intrinsic motivation in the subject to learn itself. Also, representing student model in multiple domains offers the student a mirror to understand herself better about her own learning status from different perspectives. Furthermore, allowing students to view other team members' animal companions, they know what others have not learned, what have mastered, who need help, who can help, and so forth. Our-Pet, help establish the team goals that impel the teammates holding together to endeavor to realize their team goals. Besides it sheds light on directions how teammates help each other learn, hence positive social interactions among peers.

FUTURE WORK

As more and more researchers envision that one-on-one (1:1) educational computing, that is, every student has a computing device with wireless capability used as indispensable as a pencil, in a future not too long, will lead deep and far reaching changes in education (see www.glonl.org), My-Pet-Our-Pet is being pilot tested in such a 1:1 classroom. In such an environment, our research team will develop a series of synchronous small group activities in class, including reciprocal tutoring, learning by asking questions, competitive learning games, and so forth. Also, we shall extend the content to some cardinal subject such as language and mathematics learning. As the subject matter and learning activities are getting more sophisticated, both individual and collective student models will be more complicate and thus these animal companion behavior will become more sophisticate. Thus My-Pet-Our-Pet is essentially a framework of incorporating all these efforts. Besides using in 1:1 classrooms, My-Pet-Our-Pet is also appropriate to be used via Internet after class to support individual or group learning or used in a large learning community such as EduCities where there are 1.3 million students using it (Chan et al., 2001; Chang et al., 2003)

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