Motivating Learners by Nurturing Animal Companions: My-Pet and Our-Pet

Zhi-Hong Chen¹, Yi-Chan Deng¹, Chih-Yueh Chou², Tak-Wai Chan³

Department of Computer Science & Information Engineering, National Central University, Taiwan¹,
Department of Computer Science and Engineering, Yuan Ze University, Taiwan²,
Center for Science and Technology of Learning³

hon@lst.ncu.edu.tw, ycdeng@lst.ncu.edu.tw, cychou@saturn.yzu.edu.tw, chan@cl.ncu.edu.tw

Abstract. This paper reports a pilot study of how to utilize simulated animal companions to encourage students to pay more effort in their study in the classroom environment. A class of students is divided into several teams. Every student keeps her own individual animal companion, called My-Pet, which keeps a simple performance record of its master for self-reflection. Also, every team has a team animal companion, called Our-Pet, kept by all teammates. Our-Pet has a collective performance record formed by all team members’ performance records. The design of Our-Pet intends to help a team set a team goal through a competitive game among Our-Pets, and promotes positive and helpful interactions among teammates. A preliminary experiment is conducted in a fifth-grade class with 31 students in an elementary school, and the experimental results show that there are both cognitive and affective gains.

Keywords: learning companion, open student model, motivation

1. Implications of Tamagotchi phenomenon in learning

“Motivation is relevant to learning, because learning is an active process requiring conscious and deliberate activity. Even the most able students will not learn if they do not pay attention and exert some effort” (Stipek, 2001). Motivation significantly influences learning, and how to stimulate learners to pay more effort in their learning activities is an important issue. However, pet keeping is a pervasive culture across gender and nationality over a long period, and some studies have observed that pet keeping is naturally attractive to children. The relationships built between pets and their owners are easily elicited based on the human’s attachment to pets (Beck & Katcher, 1996; Levinson, 1969). Children clearly have a special bond with their pets, and some researchers believe that children are naturally attracted to pets because they all share the same personality, such as cute, simple and straightforward behaviors (Melson, 2001). With the attachment to pet, children not only feel the feeling of be-loved, be-needed, and other emotional support from pets, but they also tend to respond their love, and taking care of them. Other works also note that interaction with animals increases the social competence and learning opportunities of children (Beck & Katcher, 1996; Myers, 1998). With technology advancement, some technological substitutes for pets have been created. One example is the well-known Tamagotchi (Webster, 1998; Pesce, 2000). Although it is merely simple animated pictures and some buttons, children are quite devoted to the process of nurturing a virtual chicken, caring for it from an egg to a mature rooster.

Our work was inspired by the idea of applying Tamagotchi from pure entertainment to educational field as well as the work on learning companion, a simulated agent that mimics the student herself and provides companionship to the student (Chan, 1996). Animal companions are one kind of learning companions especially designed for pupils. What are
implications of Tamagotchi phenomenon in learning? There is an array of interesting research questions to answer on how animal companion may affect self-beliefs, cognitive domain, affective domain, and social domain on students as well as system design. There are two different perspectives towards how people develop beliefs about themselves on motivation and achievement: intelligence or effort (Dweck, 2000). Does more effort significantly affect more positively on learning performance? Is it important for students in the process of developing the belief that success depends on effort rather than on intelligence if they experience that paying effort really contribute to better learning performance? If the answer is yes, then when we deploy animal companion in learning, can we reinforce that belief and become an attitude of students? it further involves several research questions: (1) How to design a goal and a set of mechanisms when incorporating animal companion into a learning environment that will motivate learners to engage in the learning activities and promotes more learning effort for achieving their goal? (2) Besides individual effort, could the learning environment also promote group learning efforts (e.g. mutual monitoring and encouragement for individual learning as well as collaborative learning? (3) For a student, besides feeling responsible for taking care of her animal companion, a healthily growing animal companion also represents her pride and achievement. How these affects impact her learning and can these be under her control? (4) Could such technological substitutes for pets also have the same benefits described above as the real pets? In this paper, the former two questions are focused, and the other two questions will be addressed in our following investigation.

For answering these research questions, a simple version of My-Pet system (Chen et al., 2001; 2002; Chen et al., 2003) is developed and deployed to EduCities (Chan et al., 2001; Chang et al., 2003), a web-based environment in the internet, for testing its initial feasibility. In this study, we have the improved version of My-Pet integrated with Our-Pet system to form the My-Pet-Our-Pet system. The system was used in an elementary classroom. We believe that My-Pet-Our-Pet is a rather specific example of adopting the concept of open student model (Self, 1988; Kay, 1997; Bull, 1998; Bull, 2004), a means for extending application range of student modeling. The learners are grouped into several teams, in which each learner is surrounded by two kinds of animal companions: individual animal companion, called My-Pet, and team animal companion, called Our-Pet. The repertoire of activities in My-Pet-Our-Pet consists of four modes: nurturing My-Pet mode, learning mode, inspecting My-Pet-Our-Pet mode, and team Our-Pet competition mode.

2. My-Pet-Our-Pet

2.1 My-Pet

*Nurturing My-Pet mode:* My-Pet is a computer-simulated pet needing a student’s nurture and care. In order to take good care of My-Pet, the student needs to make effort to learn so that she can earn the pet’s food and eligibility to use some caring tools. For example, while My-Pet’s energy level is low because it is hungry, the student has to spend her “coins” to buy food. However, these “coins” are designed to be earned according to the amount of effort paid by the student in the learning activity. In this mode, My-Pet plays two roles: *motivator* and *sustainer*. Based on the student’s attachment to My-Pet and good will for it, the student is motivated to take action to learn. The good will is the cause and learning is the effect. Such design is similar to what Rieber called “sugar coating” (Rieber, 1996). Although this initial motivation for learning is not for the purpose of learning itself, however, if the student later finds that the subject matter required for learning is an intriguing and rewarding experience, this initial motivation may change qualitatively to motivation for learning this subject matter itself. In addition, pet keeping is a regular and long-term activity. With appropriate reinforcement, My-Pet may be able to sustain some desired student behaviors to become a habit. It is quite
possible that nurturing My-Pet is the real intention of the students and learning is just happened to be a side-effect in the process of nurturing. This mode is sort of “package” mode for subsequent learning activities.

Learning mode: The learning task is to learn about and apply idiomatic phrases. A student could read the historical story to understand the original meaning, identify the key words and key sentences, and then practice the application of these phrases in different contexts. An important component of My-Pet is its master’s performance record. It is recorded in two levels: domain and attribute. Domains include cognitive, emotional, and social domains, as shown in Figure 1. For cognitive domain, My-Pet adopts a simple overlapping modeling approach, and there are three attributes: “remembering”, “understanding”, and “applying,” with values are numerically recorded according to student’s mastery level. Furthermore, the representation of attribute values of cognitive domain has two levels: detailed value and summarized value. The detailed value is presented aside each phrase, and the summarized value is the aggregation of the detailed values. This information makes the student quickly aware of her own performance about the learning task in the activity.

![Figure 1. Inspecting performance records reflected by My-Pet and Our-Pet](image)

The emotional domain consists of two attributes: “confidence” and “interest”. “Confidence” is evaluated by the rate of successes of answering questions correctly, and “interest” is determined by the frequency the student involved in learning activities of a topic even if she is not asked to do so or after class. With this information, the student could grasp easily the sense of how much effort she has paid. In the social domain, there are two attributes “reminding” and “helping” recorded according to student’s interactions among teammates. The attribute values are collected by an honor system in current version, that is, the student reports to My-Pet how many times she “reminds” or “helps” her teammates to study in each session. Moreover, for helping students understand their situation with impression, My-Pet’s emotional status and passively-initiated dialogues are designed to disclose the status of three domains based on some heuristics. For example, if a student’s value in cognitive domain is low, My-Pet’s mood will be sad. If the student initiates a conversation with My-Pet, it will tell the student what is the cause of its sadness. In this mode, My-Pet plays the role of self-reflector. Self-reflection through viewing the “internal” representation of My-Pet, which is essentially the performance record of the student in different domains, can help the student look at herself and hence understand herself better or enhance her self-awareness. In other words, My-Pet is sort of the mirror of the student. While the student looks at this performance record of My-Pet, she actually observes the result of her own learning effort.
2.2 Our-Pet

*Inspecting My-Pet-Our-Pet mode*: Our-Pet is a team’s pet that is commonly owned by four teammates. An important component of Our-Pet that largely governs the behavior of Our-Pet is a collective performance record, “inspectable” by all members. There are three levels of the collective performance record: domain, attribute, and viewpoint. The domains and attributes are the same as those in My-Pets. For each domain and each attribute, there are four kinds of viewpoints: “average”, “minimum”, “maximum”, and “variance.” Through “average” viewpoint, a student may view the average status of her team’s mastery values in the cognitive domain so that she can know the team’s overall situation. Through “minimum” viewpoint, all teammates can view mastery value of the weakest teammate, and other teammates will then naturally be urged to “help” or “remind” the weakest one to do more remedial work. Through “maximum” viewpoint, the strongest teammate’s value will be observed, and it encourages the strongest one to do more for enrichment and strives for excellence, but this will increase their “variance.” Therefore, it also urges the stronger teammates to help the weaker teammates so that they can narrow their gaps. The mechanisms for affective and social domains are similar to that of the cognitive domain. To provide different perspectives to promote self-reflection, Our-Pet’s passively-initiated dialogues are designed to express the different statuses between My-Pet and Our-Pet in three domains based on the rule-based mechanism. For example, if a student finds her My-Pet’s values in the cognitive domain are low. She may talk to Our-Pet, which then prompts the student what situation her performance is, what situation the team performance is, and what actions she can take to improve.

In this mode, My-Pet and Our Pet plays two roles: self-reflector and improvement indicator. Different from the reflector role played in the learning mode in which a student can only inspect her My-Pet, the student in this mode could observe both My-Pet and Our-Pet, and self-reflection is consequently further promoted. Moreover, by comparing these different perspectives of information, she knows what she has mastered, what she has not mastered, what other teammates have mastered, what other teammates have not mastered, and the directions to improve her current status or help other teammates.

*Our-Pet competition mode*: Our-Pets involve in a series of team competition games. Winning or losing a game will depend on attribute values of the two competing Our-Pets. Each game has four rounds of contests. The final result of a game is calculated by accumulating the results of four rounds and there is a ranking of all teams. A student represents her team in one round will rotate three turntables to determine which domain, which attribute, and which viewpoint of Our-Pet to compete against the other team. In other words, the chance of Our-Pet winning the game depends on some attribute values of teammates. To increase winning chance, it demands the whole team’s effort to improve all these attribute values. Team competition of Our-Pets forms the situation of intra-team collaboration, helps the whole team establish their common goal, and urges all teammates to work hard for learning. Moreover, it promotes the collaboration which not only needs individual accountability in the team, but also encourages positive and helpful interactions among the teammates. Therefore, in this mode, the roles of Our-Pet are goal setter and motivator for promoting both individual and collaborative effort for learning.

3. Experiment

A preliminary experiment of My-Pet-Our-Pet was conducted in a classroom of Wang-Fang elementary school (see Figure 2) from November 2004 to January 2005. The classroom was a
one-on-one classroom environment, that is, every student in this classroom has a computing device with wireless capability (see www.g1on1.org). Due to the constraint of regular school timetable in Wang-Fang elementary school, comparison of influences of My-Pet and Our-Pet on students still need further assessment. The objective of this experiment mainly focuses on evaluating the learning effect and affective influences of My-Pet-Our-Pet. The subjects were 31 fifth-grade students and they were arranged to eight 4-children teams (except the eighth team only has 3 students) with their academic performance well-mixed, that is, each team had one high-performance student, two mid-performance students, and one low-performance student. The experiment was divided into two phases, and each phase students used Tablet PCs for 10 fifteen-minute sessions in the class for one and a half months. However, only learning material was provided in the first phase for the control group, and both learning material and My-Pet-Our-Pet were provided in the second phase.

We addressed two questions, one in cognitive domain and one in affective domain, in this experiment. The cognitive question is: what are the learning effects after students use My-Pet-Our-Pet? The affective question is: what about their affective experience of using My-Pet-Our-Pet in the classroom environment? For the cognitive question, pre-test and post-test were administered for forty minutes in each phase. Each test has fifty items and contains three categories of questions: memorizing, understanding, and applying. To collect affective experience data, face-to-face interviews in the classroom were taken for further analysis and discussion.

3.1 Results
The results of pre-test and post-test in the two phases are illustrated in Figure 3. Figure 3 (a) is the score distribution of the first phase, where the pre-test (blue dotted-line) and post-test (red concrete-line) are almost the same. However, in figure 3(b), score distribution of the second phase was obviously different, where most of the scores in post-test were higher than pre-test, and is statistically significant (p<.005) in the paired-sample test, as shown in Table 1.

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<th>Table 1. Result of paired sample test in two phases</th>
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<td>Post-test – pre-test in 1st phase</td>
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<td>Post-test – pre-test in 1st phase</td>
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<td>Post-test – pre-test in 2nd phase</td>
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3.2 Feedbacks from interview

For collecting students’ affective experience, interviews are conducted and summarized as following. First, in the mode of “nurturing My-Pet”, while students were asked to compare their feelings in the two phases, 31 students were all impressed and enjoyed in the process of raising My-Pets.

“I like pets very much, but I can’t keep pets in at home. In My-Pet-Our-Pet, I can take care of my own pets, and it is very interesting.” (student #34)

“It (My-Pet-Our-Pet) uses many ways to make us feel that learning idiomatic phrases is an appealing task.” (student #28)

“My learning progress has doubly increased. I love My-Pet-Our-Pet because I not only can learn idiomatic phrase, but nurture pets.” (student #27)

Second, in the learning mode, when the students were asked to compare their engagement in these two phases, 2 students expressed that they were all the same to them, because they felt that learning idiomatic phrases is boring. 29 students stated that they were more engaged in the reading session in second phase.

“I will take it seriously, because I want to earn coins to nurture my pet.” (student #22)

“Of course, I must pass the assessment, and then I could gain the coins.” (student #12)

Besides, 26 students felt that My-Pet’s emotional expression is an effective way to convey information and learning status to its master, and further affects the students’ behavior, especially taking initiative to learn.

“When I’m seeing My-Pet’s mood is happy, I feel better too. But when it was depressed or unhappy, I would think what’s wrong? Then taking it along to buy candies with coins, to learn idiomatic phrase, and it will be happy.” (student #27)

“If my pet is sad, I will also feel unhappy. It seems to be my real pet” (student #13)

Third, in the inspecting My-Pet and Our-Pet mode, we asked “whether the inspecting functions provided by My-Pet and Our-Pet are helpful to you?” 27 students feel that they are convenient ways to understand their own learning statuses.

“I care its (My-Pet’s) status, because its status is equal to my learning status.” (student #21)

“I frequently see the average values of Our-Pet, and it lets me know what our team’s situation is. Then I go back to study hard for earning coins.” (student #25)

“When seeing my value is the highest among four people, I encourage them. I had encouraged all our teammates.” (student #27)
Finally, in the Our-Pet competition mode, the question is: “how team competition of Our-Pet affects the interaction with other teammates?” 4 students rarely care about team competition; 27 students are affected by Our-Pet competition. (15 students felt that team competition was the matters of honor and solidarity, and hence facilitated their communication and interaction. However, other 12 students seldom interacted with other teammates, but learned harder individually.)

“In the beginning, our team’s competitive ranking is the last, and then becomes the fifth. Because of that, I tell them (other two boys) to study more for raising the values, to earn coins harder.” (student #2)

“We (students #33 & #22) discussed the idiomatic phrase together. Sometimes we two girls answered the question together, and sometimes one found out the answer, and the other responded.” (student #33)

3.3 Discussion

According to the results of experiment, we found that all 31 students were engaged and enjoyed in raising My-Pet, and 29 students were willing to pay more learning efforts to improve their learning progress reflected by My-Pet and Our-Pet. Consequently, they earned better academic performances. Moreover, in order to win in the team competition of Our-Pet, 15 students were often monitored and encouraged each other while learning. In other words, the design of My-Pet-Our-Pet had promoted the individual’s learning effort, and group learning effort. However, regarding to collaborative learning among teammates, it seldom happened. What were the reasons? Analyzing the content of students’ dialogues, we found that topics of “what should we name our team?” or “which team should we select as our opponent?” were more popular. For team competition, against our expectation, most students went back to study harder by themselves, rather than having more interactions (collaboration) with other teammates.

There are some possible reasons: (1) Learning activities that need all members’ decision could trigger discussion and collaboration, and the four modes in My-Pet-Our-Pet lack such designs. (2) If the roles played by teammates were more diversified and each role is essential for winning, then it facilitated more teamwork. In My-Pet-Our-Pet, the teammate’s roles were the same. (3) There are no findings to support the original hypothesis: the stronger tends to help the weaker for team competition. Team’s ranking indeed stands for teammates’ honor, but some factors also have significant influences, such as students’ personality (if a student is shy and introvert, then she may not be very social), gender difference (girls like to play with girls, rather than boys), and friendship (some students ask us why couldn’t let them find their good friends to form a team).

4. Conclusion

In this paper, we described and discussed the design rationales of a system called My-Pet-Our-Pet which does not only encourages students to work hard in learning, but also promotes helpful interactions through the representation of the individual and the collective performance records kept in My-Pet and Our-Pet, respectively. The preliminary results show that all 31 students indeed were engaged and enjoyed in the process of raising their pets, and most of them (29 students) paid more effort to improve their learning statuses reflected by My-Pet and Our-Pet, and academic performance improvement is statistically significant by comparing the two successive phases. Furthermore, teams’ learning efforts were also promoted. About half of students (15 students) would mutually monitor and encourage each other to achieve their common goal. The quality and the design of interactions in collaborative learning should be enhanced and enriched because compared to the pure
Web-based virtual environment, learning in the classroom environment, where the personal interactions are direct, is more complex. To address these issues, more formal evaluations are required.

Most people conceive computer as a tool. Artificial intelligence researchers intend to make computer more than a tool. A candidate for them to pursue this goal is intelligent agent, which is required to be autonomous so that it can take initiative to interact with its user. On the contrary, for animal companion, a student takes a much stronger initiative for interacting with it. This is because users have a model on any entity they are interacting with. The animal companion is portrayed as a pet in real lives, urging a student’s innate drive to nurture it. Animal companion is not an autonomous agent, though in some occasions it can or should, nor a tool. Even there is a role of tool in animal companion, it is implicit and is used, at least on the surface, only for the sake of taking care of the animal companion itself.

Learning achievement is usually what a student cares about most, through which her self-concept and identity develop. Now, her animal companion is another thing the student cares about, so much as if it were her second identity. Furthermore, animal companions serve as “mirrors” on which a student interacts with in meaningful and fruitful ways, supporting active self-reflection on cognitive, affective and social domains.

References