Designing the Game-based Environment to Facilitate Learners’ Interaction in Performance-based Learning by Virtual Pets

Calvin C.Y. Liao, Zhi-Hong Chen, Tak-Wai Chan
Graduate Institute of Network Learning Technology, National Central University, Taiwan
{calvin, hon, chan}@cl.ncu.edu.tw

Abstract: Digital game-based learning attracts increasingly attention due to its positive influences on learning. Different games promote different aspects of learning. This paper attempts to propose a performance-based learning (PeBL) approach to create stage contexts in game-based learning environments. A My-Pet-and-Our-Stage system is developed according to this PeBL approach, and contains My-Pet and Our-Stage, which contains pet-nurturing mode and task learning mode, pet-performance mode and pet-performance mode, respectively. The learners in order to gain identity-making in front-stage, and therefore the learners need to be effort-making in back-stage. Since these the animal companions are driven by learner models.

Keyword: game-based learning, performance-based learning, animal companions

Introduction
Digital game-based learning attracts increasingly attention due to its positive influences on learning (Ke, 2008; Kili, 2005; Rosas et al, 2003). Digital games often own multiple motivational factors, and are helpful to motivate people to learn (Crawford, 1982). In other words, game-based learning is a potential way to provide learners with a great deal of learning opportunities to improve their learning. Therefore, Gee (2003) suggested that human’s learning should adopt good learning principles built in the game design.

Besides, it is the natural for children to enjoy games. To children, a game is learning, acting, adapting, living, or working (Papert, 1994). Since, a child would choose a game based on their intrinsic motivation, they would naturally actively participate in playing the game. They would be naturally engaged. Therefore, the children playing game are full of laughter and they aren’t tired of playing games. In the past, some researchers promote strangely that we could reach the education goal by game (Froebel, 1887; Papert, 1994). The children interactive with different game could improve the development of different aspects (Luckin, Connolly, Plowman, & Airey, 2003). Thus, we could provide a stage where the performers could easily perform themselves. Further, we could take the virtual learning space as a performance stage performance. In this stage, the learners could either play the role of performers, present their production and performance, or play the role of audiences, appreciate and comment the performers’ work.

This study will propose that environment of pet-style as virtual character support the performance stage required by learning, called My-Pet and Our-Stage. The learners need to bring their trained animal companions, as virtual pets, and join the activities on the stage. The animal companions substituted the learners present what they learn on the performance stage and competition stage. It is performance-based learning approach that the process that the learners train the animal companions and make them show.

### Table 1 Summarized the Related Projects

<table>
<thead>
<tr>
<th>Since</th>
<th>Description</th>
<th>NeoPets</th>
<th>Triple-A Game Show</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>Nintendogs features an animated puppy which owners must feed, water, walk, wash, groom, play with and train.</td>
<td>Neopets, a virtual pet website, has many active games from which users can earn Neopoints and awards.</td>
<td>The student teaches his or her agent and customizes the agent’s look. The student and agent then participate in an on-line game show with other students and their agents.</td>
</tr>
<tr>
<td>2006</td>
<td>The student teaches his or her agent and customizes the agent’s look. The student and agent then participate in an on-line game show with other students and their agents.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Agent</th>
<th>Pet-like agent</th>
<th>Pet-like agent</th>
<th>Human-like agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Game type</td>
<td>Pet-training game</td>
<td>Puzzle game</td>
<td>Agent-teaching game</td>
</tr>
<tr>
<td>Subject</td>
<td>Child</td>
<td>Child</td>
<td>Adult</td>
</tr>
<tr>
<td>Categories</td>
<td>Competition</td>
<td>Performance/Competition</td>
<td>Competition</td>
</tr>
<tr>
<td>Platform</td>
<td>Nintendo DS</td>
<td>Personal Computer</td>
<td>Personal Computer</td>
</tr>
</tbody>
</table>
Related Research and Projects
Pet-nurturing simulation games can be "simulations of real animals, as in the "Petz series" or "fantasy ones like the Tamagotchi" (Webster, 1998). Unlike biological simulations, the pet does not usually reproduce. They generally do not die. The pet is capable of learning to do a variety of tasks. "This quality of rich intelligence distinguishes artificial pets from other kinds of A-life, in which individuals have simple rules but the population as a whole develops emergent properties". For artificial pets, their behaviors are typically "preprogrammed and are not truly emergent". Pet-raising simulations often lack a victory condition or challenge, and can be classified as software toys. See Table 1 summarizes the related research, including NitenDogs (2008), NeoPets (Ito & Horst, 2006), and Triple-A Game Show (Schwartz et al, 2007).

Performance-based Learning Approach
Recently, through game-based learning makes children have different benefits (Guberman & Saxe, 2000; Luckin, Connolly, Plowman, & Airey, 2003; Squire, 2005). In this part, we describe the performance-based learning (PeBL) approach which facilitates the transition of educational virtual stage design that for intention in game-based learning. Before introducing the PeBL approach, educational roles of pet-style virtual character, as animal companions, in two dimensions are identified.

Two dimensions of intention: identity-making and effort-making
Previous studies pointed out that why we utilize technology to design virtual pets for learning located in that virtual characters bear quite promising opportunities to play essential roles to deepen both engagement and reflection (Chan, 2005). This paper proposes a performance-based learning (PeBL) approach, focusing on two aspects. First, the ‘back-stage’ denotes motivation of learners to engage in learning activities and encourage continuously efforts to accomplish assigned learning tasks, as training and learning. Second, the ‘front-stage’ implies that a learner is provided with feedbacks from different perspectives to promote reflection, as performance and competition.

According to the performance-based learning approach, educational roles played by animal companions in game-based learning could be categorized into two dimensions: effort-making and identity-making. For the effort-making dimension, personal companions are designed to motivate the learners to participate in a series of learning activities. For the identity-making dimension, personal animal companions are designed to help the learners observe, compare, and evaluate her learning outcome from different perspectives.

PeBL Approach
In order to facilitate the design of virtual characters in effort-making and identity-making dimensions, the PeBL approach is proposed. The PeBL approach consists of three elements: learners, game world, and learner models.

The game world is a digital game environment in which learners attend learning activities which are one kind of game playing. A learner’s profile and the portfolios in the activity space are collected in the learner models, which may further enable the behavior of animal companions. In other words, learner models provide indicators for animal companions to play appropriate educational roles and govern their interactions to benefit learners’ learning.

My-Pet and Our-Stage
My-Pet-and-Our-Stage (MPOS) is an animal companion system (Chen, Deng, Chou, & Chan, 2007), designed for children’s learning companion, which are portrayed as pet characters called My-Pet. Children interact with My-Pet and keep pets engage them learning motivation, and participate in learning tasks and performance activities, which contains My-Pet system and Our-Stage system.

The learners need to complete pet-nurturing game and the learning task in back-stage, called My-Pet system; the learners have to dominate pet to performance and competition in front-stage, called Our-Stage system. In My-Pet system, the learner could control his/her My-Pet, a virtual character, and the My-Pet could present the learner’s productions or performances. In Our-Stage system, the learner could control My-Pet to play the performer role and experience the hope and the response from the audiences (other learners).

Although the drama or sport performance means rival, it is effort making that is a positive effect on the performance development. To perform perfectly in the front-stage, the performers would prepare themselves ready in the back-stage. In the stage of preparation, in other words, the performers with the competition and pressure have turned into the motivators. At the same time, it would form the force and promote the performers self-regulation (Schunk, Zimmerman, 1998).
My-Pet
My-Pet consists of pet-nurturing mode and task learning mode. In My-Pet system, the activities were divided into two categories: pet-nurturing mode, home and training ground; task learning mode, school and forest types.

Pet-nurturing mode
In pet-nurturing mode, the learners need for their pet to nurture, that is nurturing game, which contains feeding, watering and treats, squirts at home and training ground, respectively. In the mode, if My-Pet’s “hunger” attributes increases, then the learner needs to buy food to feed it. However, buying food requires virtual coins, which have to be earned according to the efforts made in learning activities in the learning task mode.

Some researchers pointed out that taking care of animal companions might be a powerful game strategy for learning (Chen, Deng, Chou & Chan, 2007). While learners interact with animal companions, they are actually taking good care of their own learning status in the form of game playing. In addition, previous research adopts animal companions for learning with potential benefits. In regard to the motivation aspect, employing animal companion more than puzzle-based gaming for the learners to learn has sustainability (Liao, Chen & Chan, 2008).

Learning task mode
In learning task mode, the learners need for their pets to solve a series of problem, that is learning task, which contains learning to task and quests to retrieve items at school and forest, respectively. The learners should achieve the learning tasks and get the confidence from the learning. The learners with confidence would acquire from hardly completing the learning tasks by themselves rather than directly be given. The learners should constantly try to practice the learning task until them accomplishing it. In other words, the confidence is that the learners own the belief of successfully achieving the learning tasks. Besides, some studies found that feeding pets could potentially promote the learners the effort of behaviors (Chen, Liao, Chien, & Chan, 2008b).

Our-Stage
Our-Stage consists of pet-performance mode and pet-competition mode. In Our-Stage system, the activities were divided into two categories. First, pet-performance mode is the amphitheater and theater. Second, pet-competition mode is the stadium, arena, and competition type.

Pet-performance mode
In pet-performance mode, the pets substituted for the learners to join different kinds of activities, which contains pet-beauty contest, spotlights showcase at amphitheater and theater, respectively. Therefore, both the learners and the audiences have the opportunities to present their productions and performance on the stage. On the stage, the learners use My-Pet to show and to acquire the positive evaluation, applause, and encouragement from the audiences; under the stage, the audiences should appreciate and criticize the performances of the learners.

The audiences need to learn the advantage of performers, judge the disadvantage and then help improving their performance. Furthermore, the learners would play the performers roles and experience and expect the reflections from the audiences, other learners. The audiences could play the lurker, cheerer, encouragement roles as well and interact, communicate with the performers, other learners. In this kind of environment, every learner, including the peripheral audience and the core performer could find his/her performance style which fit himself/ herself. The learners would play the different roles and they could learn different knowledge from different aspects (Lave & Wenger, 1993; Wenger, 1998).

Pet-competition mode
In pet-competition mode, the learners need to adopt My-Pet and to race with other pets, which contains pet-challenge, pet race, and, catch Frisbee competition at stadium, arena, and competition, respectively. In mode, the learners could control and dominate own My-Pet, and My-Pet could present the learner’s productions or performances. Therefore, the ability of the learners presents through revealing the skills and the appearance of My-Pet without directly showing out.

There is the advantage that the learners would be able to use My-Pet to reduce the pressure from the performance and My-Pet would be a buffer so the learner wouldn’t directly face too much pressure (Lebow, 1993). In addition, some researchers suggested the concept of learning by substitutive competition, the employ of animal companion (My-Pet), as a layer of protection, in the process of competition to diminish the unfavorable effects (Chen, Liao & Chan, 2008a; Schwartz et al, 2007).

In My-Pet system, the learners have to complete the learning task and pet-nurturing game, with the need for keeping and feeding their My-Pet. In Our-Stage system, the learners need to train their pets in the stage performances and competition will be learned through a My-Pet to look at students and teachers. The learners would nurturing and learn by My-Pet in the back-stage; the learners would dominate and control My-Pet in the
front-stage. This process is not only effort-making in back-stage, but also identity-making in front-stage, called performance-based learning approach.

Future Directions

The objective of this study focus on the pet-stage effect in terms of two aspects: cognitive aspect (effectiveness, time-on-task) and affective aspect (self-efficacy, motivation). If the learners practice conceptual and procedure knowledge upon a certain level, and then they will show the productive results to other peers and teachers. Through the system, learners could acquire the skills of planning and controlling their own learning progress, yet, they could own the confidence in the process of practice.

At present, the MPOS system is focused on the mathematics domain, and is still developing in progress. More feedback and comments from experiments are required for system improvement. A preliminary experiment is now planning to be conducted for elementary school pupils. Data gathering for this research consist of three parts: (1) scale and questionnaires, (2) discourse analysis of transcripts, (3) observation and interview.

Some researchers reported that using video game as an educational tool tend to be more positive (e.g., self-regulation of students’ learning process, attention, and concentration) than negative (Ke, 2008; Kiili, 2005; Rosas et al, 2003). Therefore, the first investigative issue is that MPOS’s impact on learners’ self-efficacy, learners’ motivation, learners’ effectiveness, and time on task. Moreover, a number of studies should be further conducted in the future, including a formal experiment to examine the influence of learner’s confidence, more scaffolding designs to support learners’ learning in My-Pet-and-Our-Stage.

References


**Acknowledgments**

The authors would like to thank the National Science Council of the Republic of China, Taiwan for financially supporting this research under Contract No. NSC 97-2520-S-008-001.