

Reconstruction of a Link-List Type Learning System into an Explorative Virtual Learning Portal Based on an Avatar–Agent Model

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Abstract: This study describes the reconstruction of our Topic Maps-based e-learning system into an explorative online learning portal. Topic map ontology provides a structured system of knowledge, learning resources, a webpage design, and methods of recommendation. The previous system's webpages were essentially organized link lists annotated with learning records and evaluations. The purpose of this study was to transform the previous site into a virtual environment portal that facilitates explorative self-learning. For this purpose, an avatar–agent model was introduced, with the avatar representing the learner and the agent representing the system and instructor. This model implements the visualization of personal learning development and motivates exploration based on communication.

Keywords: Virtual learning environment, Topic Maps ontology, avatar–agent model, conference publications

1. Introduction

In this study, we have constructed an e-learning portal, “Everyday Physics on Web (<http://tm.u-gakugei.ac.jp/epw/>)” (Matsuura, 2009), based on Topic Maps semantic technology (Park, Hunting, 2002). This learning site's domains range from natural sciences to daily life knowledge, industry, artifacts, and policies. These domains' subjects were associated in topic map ontology and also with some types of online learning materials.

The structure of web architecture has been defined in the topic map ontology. Navigation structures, web design, and a part of the recommendation system have also been defined in the ontology. This ontology provides a consistent structure in the entire system, and it enables ease in systematic reconstruction. Although the ontology is basically generic and static, the development of the user's learning history is specific, and in some sense, rather narrative.

One key feature of online learning is communication with other users, instructors, and the system (Childs, M., Peachey, A., 2013). Communication invokes learners' motivation, and communication and reflection might be the important factors for explorative learning. In our previous system, these communication components were annotated to the links and learning materials.

In this study, an avatar–agent model was introduced to the ontology. The system's leading factor was changed from link lists to a dialog between an avatar and an agent, and the user's learning history was explicitly visualized.

2. Avatar–agent model

In the proposed model, the avatar represents the user, and the agent represents the system and the instructors. Messages on the learning history and evaluation come from the agent; the instructors' comments are represented as given by the agent. The homepage begins with the dialog between the avatar and the agent. The user's learning history is presented as the avatar's talks, and comments from other users are shown as their avatars' talking.

Avatars change their figures according to the users' learning status. For this purpose, the records of a user's activities are converted to points, which are grouped into the three categories of content

request, drill learning, and communication. The features of the emerging avatar depend on the points of these three categories. In addition, the avatar receives items that correspond to the domains explored by the user. On the “avatar’s room” page, one can visit another avatar’s room and see that avatar’s status through these items.

The agent seems to “talk” the drills’ questions and examples of answers. The user’s answers and the other users’ comments on the answers are represented as the avatars’ collaborative discussions. In the essay drills, the users’ answers are displayed on the question page. This particularly helps learners to better consider questions without a single optimized answer.

3. Results

3.1 Communication

The learning system’s instructors must comment online, commenting at least on the users’ questions and worries. Instructors may also reply, to some extent, to the users’ impressions. To their soliloquy-like comments, some words of encouragement in fixed forms may be sufficient as replies.

Table 1 shows the number of comments by the users about multichoice drills in a semester before reconstruction. The comments were divided into four categories according to their meaning. Mostly, they were written in short sentences. The rate of positive comments exceeded that of negative comments. To the negative comments, instructors sent some advice. Thus, as an avatar–agent dialog, an instructor’s comment for an avatar’s negative comment or question, or a randomly selected encouraging phrase or a hint phrase (Table 2) for a positive comment was shown automatically.

Table 1: Rate of positive and negative comments sent on the multichoice drills.

	On understanding	On the impression of quiz	On the user’s will	Question
Total number of comments	329	56	90	6
Mean number of letters per comment	22	30	32	47
Rate of positive comments	60.8	57.1	99*	
Rate of negative comments	39.2	42.9	1*	

Data were collected during spring semester 2012. *Number of negative comments was 1 in 90.

Table 2: Examples of agent’s phrases automatically shown for avatar’s positive comments*.

Type	Phrases
Cheering	“I know you work hard. I know you are growing.” “A bit tired with drills? Let’s go to explore related subjects.” “If you feel a topic difficult, I recommend you to explore the topics related with it.”
Hint	“Let’s try simulations and videos related with the text.” “You can learn from a simulation like playing a game.” “Don’t you try a new field today?”

*Examples of avatar’s positive comments are such as “I finally understood the drill.” “It was a nice chance to know and think about it.” “I’ve got interested in...”

3.2 Effect of the presentation of the avatar–agent dialog

Figure 1 shows the results of a questionnaire administered to university students after the autumn semester 2012, during which the avatar–agent was introduced. Students ($N = 172$ respondents) were asked whether they were motivated to practice drills, read content, and ask questions of the instructor by viewing the avatar–agent dialog. The results showed that more than half the students felt motivated to practice drills and read learning resources; about one-third of the students felt like asking questions.

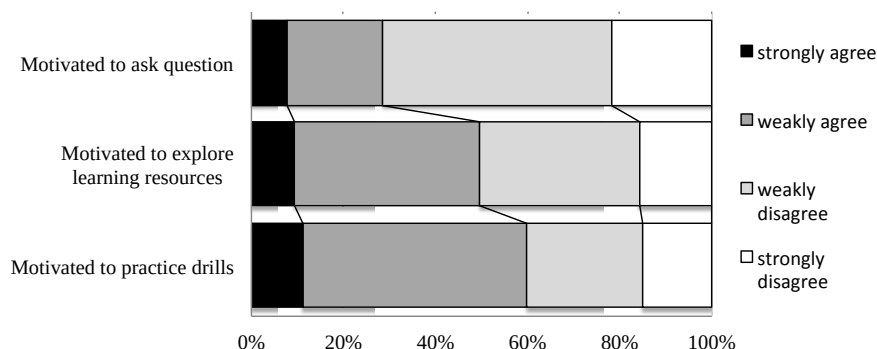


Figure 1. Results of the questionnaire on motivation for action after reading the avatar-agent dialog

Table 3 shows the students' responses to the multiple-choice question regarding why, after observing the avatar's dialog, they selected the actions shown in fig. 1. The results suggested that rather than to play the avatar's functions, the students were more motivated to learn through the dialogs. As for the gaming nature of this learning environment, it was suspected that the students did not necessarily require the system to be as enjoyable as a game.

Table 3: Reasons for the selection of the actions shown in Fig. 1 (one can select more than one item)

	Number of students		Number of students
To deepen understanding	179	To increase knowledge	149
To be able to solve quiz	134	To gain better evaluation	121
To overcome weakness	100	To establish knowledge	89
*To increase points	81	*To change my mood	79
*To raise an avatar	75	Others	26

*These items are system specific.

4. Conclusion

A link list with an annotation type e-learning system was reconstructed and aimed at an exploratory learning environment based on a dialog-centered interface. The dialogs between an avatar and an agent corresponded to those between a learner and an instructor and were supplemented with automatic replies containing encouraging phrases. This method was based on the learners making more self-encouraging comments compared with the negative comments that the instructor should address first.

Approximately half the respondents felt somewhat motivated to explore the system by looking at the dialog-centered portal. This suggests that the dialog evokes reflection on learning and stimulates further exploration.

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