

The use of agents to represent learners in role-play training

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Abstract— This paper proposes the use of agents to involve learners in supporting online group work for the study of project management.

Role-play training may be an appropriate tool for universities to use as an efficient alternative to on-the-job training (OJT) for project management education. However, we have found that because of the way that role-play exercises using an on-line group work training system in the project management course have operated, students have not been able to share the required information adequately with other students.

In order to investigate the effectiveness of using an agent in role-play training, we have developed a role-play scenario so as to practice with agents. The results of analyzing the behavioral track record of each learner in a role-play exercise with agents are discussed. The results of a questionnaire survey taken among students who participated in a role-play exercise with agents indicate that the use of role-plays will enable them to learn human-related skills such as communication, leadership, and team building.

Keywords-component; Project management education; Agent; Role-play training

I. INTRODUCTION

The IT industry in Japan has required higher education institutions such as universities to provide project management education [1]. Role-play training could form an appropriate tool for universities as an efficient alternative to on-the-job training (OJT) for project management education [2].

Since 2007 we have been developing an online group work training system named PROMASTER (Project Management Skills Training Environment) to increase the learning opportunities when studying project management using role-play training and to achieve profile-based education (PBE), which takes account of the progress in study of each individual student[3]-[5].

However, we have found that because of the way that the role-play exercises using PROMASTER in the project management course operated, students have not been able to share the required information adequately with other students. In addition, a lack of understanding of the stakeholders' roles assigned to learners has meant that students have not really

been able to fully appreciate the project management scenario that they have been role-playing. Accordingly some students may not be able to acquire the expected skills for project management.

In order to cope with this problem, it is desirable that a team performing a role-play exercise has at least one participant who can play the role of a mentor. This person should be an experienced project manager. However, it is not realistic to expect an experienced person to assist in leading a role-play exercise as a team member. Instead of having such a person, a software agent system, which implements the advanced professional skills of project management, may be able to act as a mentor in a role-play.

In order to realize a sophisticated agent, a Non-Player Character (NPC)-based system which can estimate the appropriate behavior of an NPC assigned to a stakeholder role to maximize its profit and generate alternative scenarios should be developed [6]-[10]. NPCs act in a role-play scenario using an outline description of a procedure for project management as stakeholders and can interact extemporarily with learners [11].

In our research, it is planned that the development of an agent system based on the general idea of an NPC will proceed on a step-by-step basis, as described by the following four stages: (1) an agent provides information which a learner needs to play a role; (2) an agent lets learners know the information needed for decision-making and encourages them to acquire information, and ensure information sharing; (3) an agent evaluates alternatives for decision-making by learners; (4) an agent proposes alternatives for decision-making [12].

This paper focuses on the first stage and discusses the results of analyzing the behavioral track record of each learner in a role-play exercise involving an agent, and the results of a questionnaire survey taken among students who participated in a role-play exercise. In section II, the expected advantages due to employing an agent in a role-play are described, along with a way of implementing such an agent. An experiment to assess and demonstrate the effectiveness of using an agent is described in section III. In section IV, we discuss the results of the experiment and future work, while section V provides a summary of our research.

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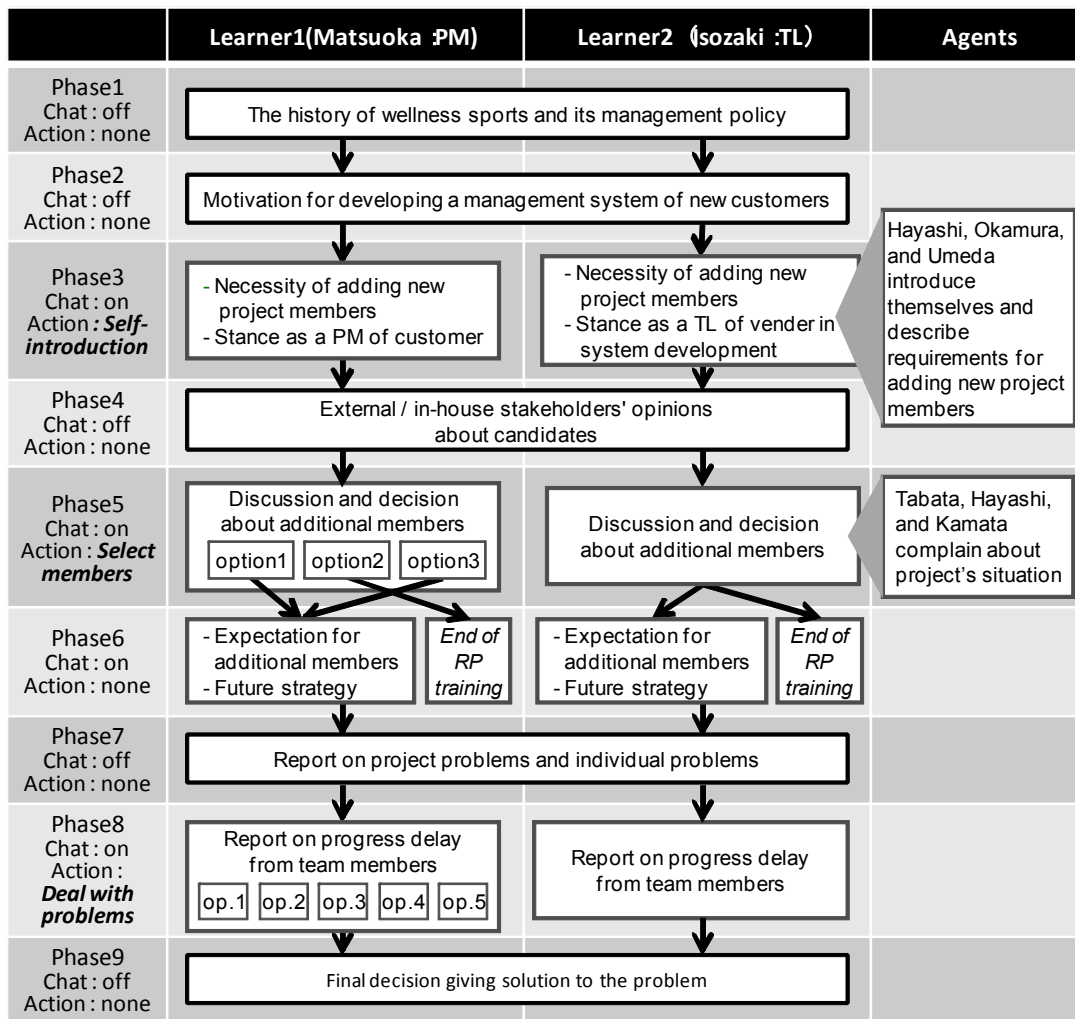


Figure 2. The structure of the team building scenario

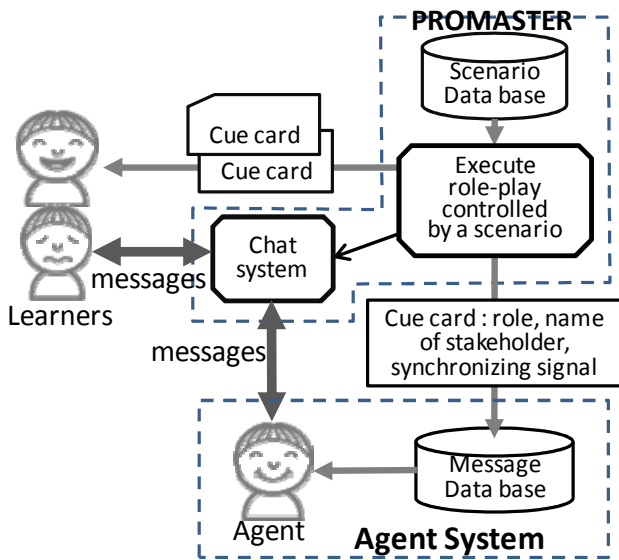


Figure 1. Role-play training environment with an agent

II. AN AGENT FOR ROLE-PLAY TRAINING

A. Role-play training environment with an agent system

Figure 1 shows the cooperation between the role-play training environment using PROMASTER and the agent system. PROMASTER provides information about a role which the agent will play and the contents of the next cue card, in accordance with the timing described in the role-play scenario for the agent. Two learners in the role-play have different priorities and exchange opinions through chat system in order to make a decision about the issue resolution in a virtual project with an agent who takes the place of one of the stakeholders, perhaps as an NPC and may be a mentor-agent advising. Two learners and the agent make effort to arrive at a win-win situation. Then the agent responds with appropriate opinions or comments to messages sent from PROMASTER to a chat system. The information retrieved from the message database in the agent system is displayed on the screen of a learner computer through a chat system.

B. A role-play training scenario using an agent

The role-play scenario used for practice with agents concerns building a team before starting a system development project. Two learners play the roles of the team leader of a system integration company and the project manager of a customer company, respectively. The task the two learners should practice is to select the appropriate members of the project in a situation where there is a conflict of interest between two stakeholders, the project manager of the customer company and the leader of the system integration company. The two learners exchange information provided by cue cards. The structure of the scenario is shown in Figure 2. In this scenario the agents take roles of other stakeholders and give different advice individually to the two learners.

The role-play exercise advances step by step with the actions of the two learners synchronized, and consists of nine steps. This scenario also has an undesirable path. If the project manager makes a decision which would result in a violation of information leak, the two learners are disqualified from further participation.

In each step the agent speaks first, before the two learners exchange opinions. The first talk by the agent in the role-play

exercise seeks to make sure that the learners understand their roles and urges them to exchange the information needed to provide a solution.

The principles of designing a role-play scenario in which an agent appears are four in number, as follows.

- (1) The agent must clearly present the same information to both learners through a chat session.
- (2) The two learners exchange information provided by cue cards and the role-play exercise progresses.
- (3) A chat medium should be used as a convenient way of exchanging information.
- (4) The two learners analyze the information shared, exchange opinions, and make a decision on how to build the project team for system development. The attributes of an agent appearing in the role-play scenario are shown in Table 1. These attributes are categorized into three types: Basic attribute of an agent; Factors influencing the agent's behavior; and Control information required by PROMASTER. If the agent takes the role of Project manager, it is acting alongside the learner.

TABLE I. Attribute Information for an Agent Appearing in a Role-play Scenario

type	Attribute name	Content	
1 2 3	Basic attributes of an agent	Name	Name of stakeholder: e.g. Mikami
		Title	Occupation and title: e.g. Project manager and director
		Affiliation	Name of the organization/department to which the stakeholder belongs: e.g. TUT/Planning department
4 5 6 7	Factors influencing the agent's behavior	Interest	Interest of a stakeholder
		Sense of value	The most urgent and crucial thing for a stakeholder
		Criterion for judgment	An important factor a stakeholder has to keep in mind when a decision is made
		Character	Characteristics of a stakeholder: e.g. strong, strict, conscientious, bureaucratic
8 9 10 11	Control information required by PROMASTER	Action	The action expected by the agent
		Timing	Time at which an agent should speak in a chat session
		Phase number	Number of role-play step
		Cue card number	Unique number of a cue card

TABLE II. ROLE-PLAY EXERCISE PARTICIPANTS AND ACTIVITY

Group No.	Learner No.	Role of a learner (Experience of role-play training)	No. of messages exchanged		Total no. of characters in messages		No. of times learners referred to cue cards	Duration of RP (mm:ss)
			sent	respond	sent	respond		
1	1	PM*1 (inexperienced)	6	1	427	16	10	40:24
	2	leader*2 (inexperienced)	5	2	241	23	0	
2	3	PM (experienced)	6	2	258	40	5	39:34
	4	leader (inexperienced)	6	5	309	66	6	
3	5	PM (experienced)	6	3	307	67	11	32:28
	6	leader (inexperienced)	3	3	186	56	13	
4	7	PM (experienced)	4	2	420	53	5	36:27
	8	leader (experienced)	4	2	480	58	1	
5	9*3	PM (experienced)	16	11	1116	215	26	103:49
	10	leader (inexperienced)	17	12	1880	137	11	

*1 PM, a Project Manager is working in the customer company, named Wellness Sports. The name of the PM is Matsuoka.

*2 A Leader is working in the vendor company. The name of the leader is Isozaki.

*3 This student had experienced the earlier version of the same role-play scenario without an agent.

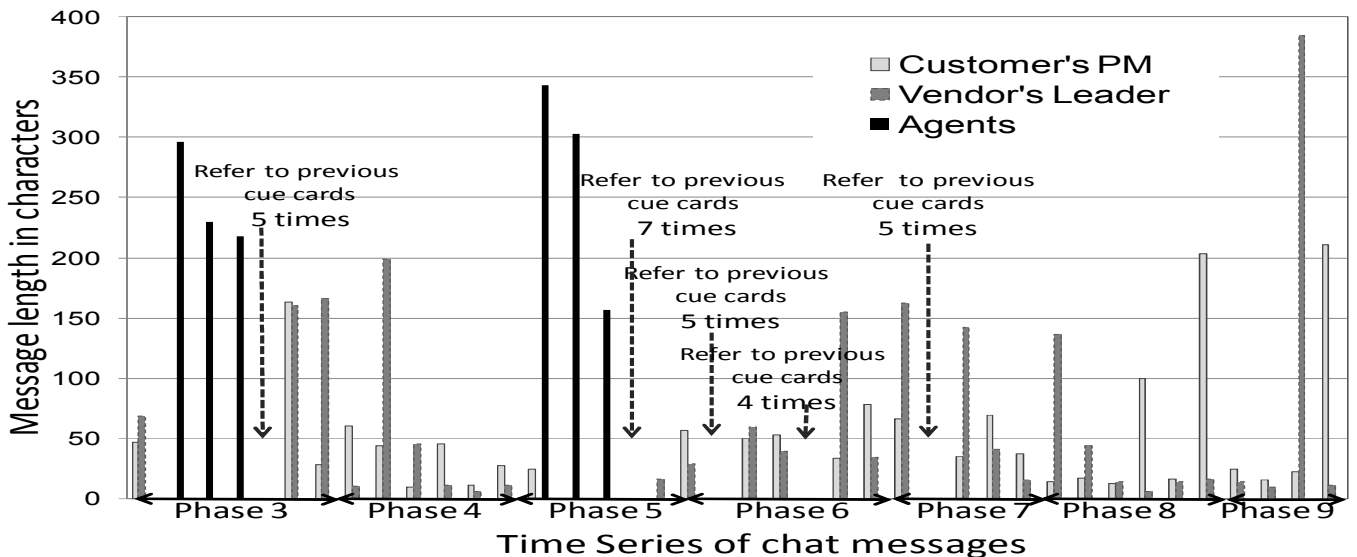


Figure 4 An example of the behavioral track record presenting the time series of chat messages of Group 5

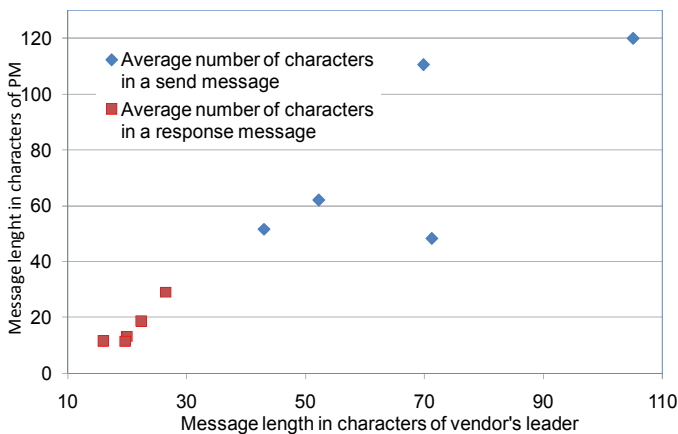


Figure 3 Relation between average length of messages (in characters) of the two participants for each group

III. EXPERIMENT USING A ROLE-PLAY EXERCISE

Ten students took part in the experiment. They were eight fourth-year undergraduate students, and a 1st-year and a 2nd-year master's degree students at the School of Computer Science, Tokyo University of Technology. Five students had previously experienced role-play exercises using PROMASTER on at least one previous occasion. Those previous exercises, which did not use an agent, had used different existing scenarios, except in the case of one of these five students, the first-year master's student, who had experienced the role-play exercise using the same scenario as we used in this experiment, although without an agent on the earlier occasion. The other five students had no prior experience of role-play training for project management education.

A. Experimental results

Table 2 shows the number of messages exchanged by each learner, the average message length in characters, the number

of times previous cue cards were referred to, and the role-play execution time.

1) Role-play exercise execution time

Four groups, group 1, 2, 3, and 4 were able to finish the role-play exercise within the estimated time, which is about 60 minutes. However students in these four groups may not have exchanged enough information to make the best decision. In contrast, group 5 spent much more time on the role-play than the estimated period and exchanged five times as many messages as other groups did.

2) Number of messages exchanged

It is known that students in group 5 exchanged a large enough number of messages to practice the skill of team building because the chat log shows a change of the students' way of thinking about team member selection. Also, this group did not violate the law in handling of confidential information.

Figure 3 shows the relation between the average length of messages, measured as number of characters, which the two learners sent or responded to. One player sends more messages another player also sends more messages. The correlation coefficient of two lengths of message exchanged by the two learners is 0.92. If one player were an agent and exchanges many useful messages, other players who are students might be well trained.

3) Behavioral track records of each learner

Figure 4 presents the behavioral track record of students in group 5 from phase 3 to phase 9 in the role-play scenario. The students regularly referred to earlier cue cards after receiving many messages from agents in order to analyze the information delivered by the cue cards and gathered by chat. The agent's messages may motivate students to exchange information because Figure 3 indicates that one of players, even though the player was an agent, sent longer messages and this resulted in the other participant also sending longer messages.

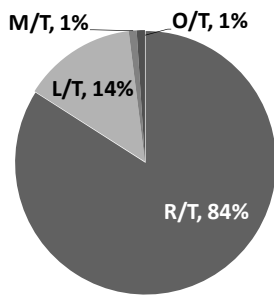


Figure 5 Message ratio of R, L, M, and O

4) Categories of messages exchanged

Chat messages were categorized into four types as follows: message as a role-player, R (Role-play); message about lesson or practice, L (Lesson); message about manipulation of role-play, M (Manipulation); other messages that do not fall in any of the above categories, O (Other) [5]. The total number of messages for all Groups, T, was 116.

The value of the message ratio R/T indicates how seriously a learner is immersed in the role of the stakeholder described in the scenario. The value of R/T is larger when a learner is more seriously immersed in the role described in the scenario. Similarly the value of (R/T plus L/T) is larger when new learners in the experiment were becoming familiar with the process; the value of R/T plus L/T was 98%, as shown in Figure 5.

B. Questionnaire survey

After the role-play students answered questions on whether they had been able to share the required information, to be conscious of their roles, and to visualize the work of project management through the role-play exercise.

1) Information-sharing

Figure 6 shows the results of the survey question about information-sharing during the role-play exercise, without an agent and with an agent, and the effectiveness of using an agent. 32 third grade students practicing the role-play without an agent answered this questionnaire and, of these, 66% felt positive about the feasibility of information-sharing while for the 10 participating students studying the role-play with an agent, 70% felt positive. Similarly, 31% of students who took part in role-play without an agent had negative feelings, but of the students participating with an agent only 20% felt negative.

In order to investigate the effectiveness of introducing agents into role-play training, we asked five learners who had experienced a role-play exercise on at least one previous occasion whether they were able to get the information required for the role-play exercise through chat, both with agent and without the agent. Two students felt that were able to obtain the information required for the role-play more effectively with the agent than without it. Another two students also recognized the advantages of adding an agent into the role-play training. Therefore we have deduced that the use of an agent may help learners share the information required to take part in a role-play exercise.

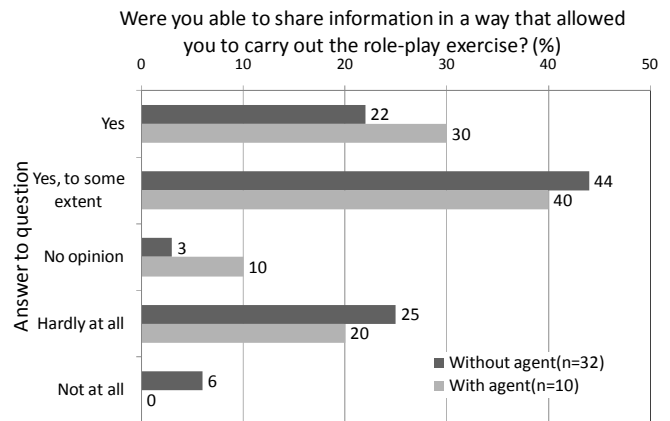


Figure 6 Information-sharing with agent / without agent

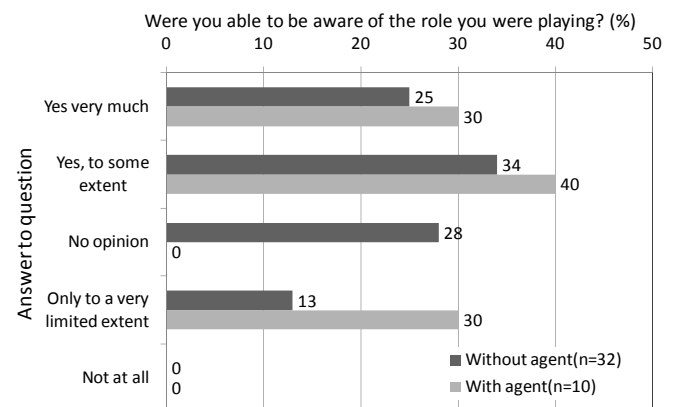


Figure 7 Awareness of role in role-play

2) Awareness of role in the role-play

Figure 7 shows the results of the survey question about the awareness of their role as a stakeholder, for students participating without an agent and those participating with an agent, to determine the effectiveness of using an agent.

Without an agent, 59% of students felt they had got into the character of a stakeholder, while for students participating with an agent, the Figure was 70%. This increase of 11% may arise from the powerful incentive of students doing the role-play exercise with an agent. Only two out of the five students said that the agent might encourage students to immerse themselves more fully in the role of a stakeholder. Some students answered an additional free response question about the effectiveness of using an agent. These answers were: they were able to get the feel of working in a real project because the information about the stakeholders whose roles were not assigned to learners was presented to students through the chat; and they were able to be immersed in a character and could understand what they should say in the chat session because a statement from the agent had provided a good example.

3) Ability to imagine a real project

Three students who had experienced previous role-play training were able to imagine a real project through

participating in a role-play exercise with an agent taking the part of other stakeholders.

IV. DISCUSSION AND FUTURE WORK

A. Analysis of chat log data

From the data in Table 2, group 5 spent three times the length of time and exchanged three times the amount of information, compared with other groups, even though student 10 had no experience of role-play training.

The major reason for this significant difference is that the student 9 had experienced the earlier version of the role-play scenario, was seriously immersed in the role of the stakeholder, and so probably acted as a mentor to the others.

The two students in group 5 were both graduate students and so may have taken the role-play more seriously. If an agent were able to play the role of a mentor in the role-play, role-play training including such an agent might be a powerful tool for project management education.

According to the results of the questionnaire survey, the use of an agent may help information-sharing among learners, may help learners understand their roles as stakeholders, and may help learners imagine what it is like to participate in a real project.

B. Future work

We plan to pursue our research based on the principle of using an NPC (Non-Player Character) as follows: in the next stage, an agent will let learners know the information needed for decision-making and encourage them to acquire information, and ensure information sharing; in the following stage, an agent will evaluate alternatives for decision-making by learners; in the next stage, an agent will act as a mentor in proposing alternatives to learners making a decision; and finally an agent expressing human emotion will be provided in order to simulate practical team work in a system development project.

Scripting all of alternative scenarios which may be derived by a learner while a role-play exercise is running is typically labor-intensive. A method for automatically generating all alternative scenarios should be established. In order to generate the behavior scripts for not only a learner but also an agent, case based reasoning (CBR) may be applicable to create scenarios [11].

V. CONCLUSIONS

The aim of this research is to use an agent system to provide the function of a mentor in order to realize project management education for students who have no practical experience of project management; this will enable them to learn human-related skills such as communication, leadership, and team building.

This paper reports work which leads to the conclusion that agent can be useful in helping learners to share information, to understand their roles as stakeholders, and to visualize the job

of project management. It would be very helpful to develop an agent system which can solve the problem of how to improve human-related skills. We will define an observable evaluation metric which can be used to evaluate the effectiveness of learning human-related skills by using the concept of NPC. We will also seek to implement human characteristics in an agent.

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