

# r-Learning Services for Elementary School Students with a Teaching Assistant Robot

Jeonghye Han, Dongho Kim  
Dept. of Computer Education  
Cheongju National University of Education,  
Chungbuk, KOREA, 361-712  
+82-43-299-0853  
{hanjh, dhkim}@cje.ac.kr

## ABSTRACT

The r-Learning paradigm with educational robots is emerging as a part of e-Learning, which means using technology for learning. This study on using robots as a teaching assistant robot opened the possibility of r-Learning for English in classroom. We found that children like robot services for personal relationship in class and teachers prefer them related to their convenience to manage the lesson. Related robot services such as praising and cheering up or calling the roll are the effective way for motivating children to learn, enhancing the relationship between TIRO and children. We are going on conducting further field trials for new scenarios and services that motivate children and make them concentrate on class with teachers, pre-teachers, children, parents, robotic researchers, social scientists, etc.

## Categories and Subject Descriptors

[HRI Communication]: Dialogue, Interface design and usability,  
[Human's Responses to Robots]: Affective & emotional responses, [Robots in Context]: Roles that robots can/should take in social and organizational settings

## General Terms

Design, Experimentation, Human Factors

## Keywords

e-Learning, r-Learning, Robot Service, Teaching Assistant Robot, Personal Relationship

## 1. INTRODUCTION

As studies on robot-aided education are still in a starting phase, recently many attempts are made to use robots for educational purposes and to investigate the effects of the educational use of robotics. Robot-aided education has been studied mostly with PAPER0 in kindergarten, ROBOVIE and RECYCLER in elementary schools [4]. IROBI as a home tutor that serves 'e-learning contents of a robot', r-Learning services, was introduced in Han and Kim [2]. The robots' educational services, r-Learning, was from the CAI (Computer-Aided Instruction) and WBI(Web-Based Instruction) or e-Learning (electronic-learning).

Now, we are starting to recognize the issue how we can enhance children's English learning abilities by interaction with tutoring robots. The design of r-Learning services is different

from the existing HCI-based ones. Researches on Human-Robot Interaction in designing educational contents of tutoring robots are still underway in contrast to human computer interaction. Moreover although contents displayed on the monitor and the voice of a robot are the same with those in HCI, the whole expressions of robots such as robot's actions, emotion, and agony are unique and dynamic in HRI. Therefore, studies and experiments on the use of such functions are necessary.

## 2. RELATED WORK

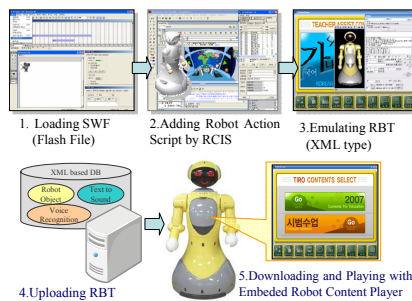
The r-Learning paradigm with educational robots is emerging as a part of e-Learning, which means using technology for learning. Experiments were performed by Han et al. [1] to analyze educational effects with a tutoring robot, IROBI in short period, and Hyun et al. [3] with a advanced tutoring robot, IROBI-Q in relatively long period (2 months). The experiments with a tutoring robot as an English education tool for children indicate that linguistic abilities of children in the robot-assisted groups improved significantly compared to those in media-assisted groups. Han and Kim [2] defined robot in learning as 'Learning about Robot' and 'Learning with Robot', similarly as learning in computer education is divided into 'Learning about Computer' and 'Learning with Computer'. The r-Learning is a kind of learning which takes place by or with robots.

## 3. R-LEARNING CONTENTS OF T.A. ROBOTS FOR ENGLISH

Robot services consist of a collection of interaction with human in real environments. Likewise robot service is the non-material equivalent of a good, it differs from providing physical goods. An example of robot services is a whole interaction that silver robot provides such as bringing a cup of water, or medicine to the aged person. In this paper we describe robot services for learning as educational interactions with robot and human.

We designed and developed r-Learning services of a teaching assistant robot, TIRO that can help teachers as an educational media in class, and a schoolmate of children for English learning. We had tried to reflect the concept of 'human-friendly Internet-connected robot with e-Learning technology'. TIRO's contents can be downloaded from the server by teacher's command through wireless internet, and we can upload robot's own contents to the server for public sharing. We use an authoring tool for TIRO to meet the expectation, and called it 'eR-Author' [2]. eR-Author gives feature to support multimedia objects such as the

Flash files (SWF format) are displayed visually in the stage window, to easily create and edit interactions between users and robots in XML type script as well as GUI, to support voice recognition and synthesis (See Figure 1).



**Figure 1. Procedure of Developing TIRO's Contents**

The educational unit of 'How many cows?' was developed for English class of the 3rd grade students and to be played for about 40 minutes. TIRO presents various services such as calling the roll, displaying teaching materials presentation by teacher's voice command, transmitting it to TV automatically and displaying multimedia presentation, warming up (English chant), providing the learning goals of lesson, selecting a child to present the role play (see Figure 2), praising children and cheering up children, saying attention please, holding the clock on for practice activities, sending children's photos in class to contents server, providing review and a quiz game, and so on.



**Figure 2. Role Playing of TIRO with Children**

#### 4. FIELD STUDY

Experiments were executed in field trial classes for English learning. The subjects in English class were 117 children and 20 teachers were watching the class. To investigate children's responses, we randomly selected 27 among 117 children, and then questionnaire interview were conducted. The subjects were asked 'which do you prefer among T.A robot services?', and might choose plural preferences in Table 1.

The most popular is TIRO's praising and cheering up service that enhances the relationship between children and TIRO in English class. Second one is face-to-face conversation and role play with TIRO. Next English chant and dance is ranked. The

calling the roll and selecting a child to present are similar, but the former is more impressive because all the children can interact with TIRO.

**Table 1. A Popularity on TIRO's Services in English Class**

Teaching Assistant Activities	Teacher Group Rank	Student Group Rank
Calling the Roll	7	4
Attention Please	4	7
Selecting Children to Present	5	4
Displaying Multimedia Presentation	2	6
Conversation and Role Play	1	2
English Chant and Dance	7	3
Praising and Cheering Up	2	1

For teacher group, it was investigated that they most preferred face-to-face conversation and role play with TIRO that pronounce well because some of them pronounce badly. TIRO's praising and cheering up service and displaying multimedia presentation were ranked next. By TIRO's assistance, teachers expect to reduce their movement in classroom. Teachers prefer accommodating ones among TIRO's services than enhancing the relationship between children and TIRO. Teachers' expectation on the learning effect with TIRO is positive with average value 3.6 (p-value=0.0001) in 5-scaled. Teachers recommended encyclopedia services of TIRO during the breaking time and sending children's photos in class to the content server for public sharing.

#### 5. CONCLUSION

Children like robot services for personal relationship and teachers prefer them related to their convenience to manage the lesson. It is needed further field trials for developing new services that motivate children during the long term.

#### ACKNOWLEDGMENTS

This work is supported by Korea Institute of Industrial Technology Evaluation and Planning, 2007. We would like to thank Yujin Robotics Co., Ltd. and Hanwool Robotics, Inc. for their supports in conducting all the experiments.

#### REFERENCES

- [1] Han, J., Jo, M., Park, S., Kim, S. 2005. The Educational Use of Home Robots for Children. *Proceedings of the 14th IEEE International Workshop on Robot and Human Interactive Communication (RO-MAN 2005)*, Nashville, TN, USA, August 13-15, 378-383.
- [2] Han, J. and Kim, D. 2006. Field Trial on Robots as Teaching Assistants and Peer Tutors for Children. *Proceeding of the Asia Pacific International Symposium on Information Technology*, Hanzhou, China, January 9-10, 497-501.
- [3] Hyun E.J., Kim S.Y., Jang S.K. and Park S.J. 2008. Comparative Study of Effects of Language Education Program using Intelligence Robot and Multimedia on Linguistic Ability of Young Children, *Proceedings of the 14th IEEE International Workshop on Robot and Human Interactive Communication (RO-MAN 2008)*, 187-912.
- [4] Kanda, T., Hirano, T., Eaton, D., Ishiguro, H. 2004. Interactive Robots as Social Partners and Peer Tutors for Children: A Field Trial. *Human-Computer Interaction*, 19, 1&2, 61-84