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DEVELOPMENT AND APPLICATION OF A TEACHING METHOD USING A COMMUNICATION ROBOT
- BASED ON THE CONCEPT OF A WEAK ROBOT –

Abstract

Recent studies have provided valuable insights about the use of communication robots in learning situations, but their use has not been examined in detail even though several schools have begun to use such robots in classes. This study develops a teaching technique using the communication robot „PALRO" manufactured by Fuji Soft in an environmental learning curriculum. It evaluates the effects of such usage quantitatively. We propose a three-stage usage; we have applied and evaluated the first stage. We taught environmental lessons with the robot and compared outcomes to those from traditional teaching. The results of a survey suggest that the class with a robot better promoted students' awareness and interest in the environment.

Introduction

New studies of robotic and human learning theory are in progress, and it is expected that there might be a place for robots in enhancing human learning. The Robotics Society of Japan has positioned this area as „human robot symbiosis studies." Oshima (2011) said „Human Robot Learning (HRL) that between people, man and robot each other grow each other is common thread. And learning science and Human robot interaction (HRI) is to creating a new academic area that mutually enhances each other fusion both."   Applications to learning have been promoted as research to „collaborative creation of wisdom." Then, the tabular robot by remote control can function as peer learning was confirmed. Although several methods of practice have been investigated, no clear mode of classroom use has been developed.

Consequently, by quantitatively evaluating the use of a communication robot in an environmental education program, our objective is to develop new teaching methods that improve learning.

Previous Research

Previous studies have examined communication between robots and people. Focusing on robot–human conversation, Okada (2009) notes, „Better that it is a weak presence is likely to pull out the involvement of aggressive children." As an example, Okada developed the Social Trash Box. It is what this robot cannot gather up the mess alone, but that would pick up the trash as a result while pulling well assist the child.

Research also has investigated uses in education. Tanaka (2010) has proposed a „robot that can be taught by children." Caregiver robots that teach something to children are commonly discussed. However, the thing to care receiver-type robot that is taught, it has been proposed that it might be lead to that act of child or Shitsukeke teach the robot learns unconsciously certain challenges. It is important that the robot be a weak presence in a class or training situation. Therefore, we study the use of the communication robot developed by Fuji Soft, called „PALRO," to develop new educational methods based on a „weak robot" concept.

PALRO is a human-type communication robot developed for use in health care facilities for the elderly. He has conversation skills using multiple functions, a life-log function to record and sort, ability to select related words or phrases, and Internet connectivity.

Cases that were introduced into the classroom PALRO is present some. In an elementary school social studies class, he provides tips to question a child and he went a summary of the lesson. In a junior high school technology department, he introduces the sensors and actuators that are attached to the PALRO own and chimed in with student ideas. However, these are examples of caregiver-type robot with a teacher present, and the usage is not as care receiver type. We suggest teaching methods, including how to take advantage positioned as a weak presence of PALRO.

Utilization of Communication Robot of Three Stage in the Class

There is a problem in the evaluation of children and limit the performance of PALRO that becomes complicated is that it's incorporated at a time that the element that can be PALRO. We divided the use of PALRO into three stages. The first stage is the utilization on the theme of „assistants of education." Teachers operate PALRO in presenting lessons. For example, we positioned as there catching the care of children as a weak presence of PALRO. To be able to be more active in class by announcing PALRO is to take the initiative when you can attract to teaching children by PALRO speaks with the introduction of classes, presentations and remarks by the children got stuck. Also other ways to use that teach the ignorant PALRO by providing an opportunity for children to teach PALRO is considered.

Second stage pursues the theme of „growth of PALRO." This is what he continue to record the growth process of the kids in the PALRO who is gradually involved in long-term children and to share the growth by communication. For example, to realize the growth, children born willingness to further growth in the child to tell a change in the expression and thought.

Third stage follows the theme of „evaluation by PALRO." The authors have conducted a quantitative evaluation of educational technology in teaching people by line-of-sight and sound analysis and quantitative evaluation of the learning effect of the transformation of pro-environmental behavior. On the basis of information accumulated up to second stage, pro-environmental behavior and educational technology are evaluated. We think that to feedback to the children's classes and the content of the evaluation and it might be possible that encourage the growth of children and lecturer.

To continue to take advantage of PALRO in three steps (Fig. 1), we will quantitatively evaluate the learning effect of the manner of utilization.
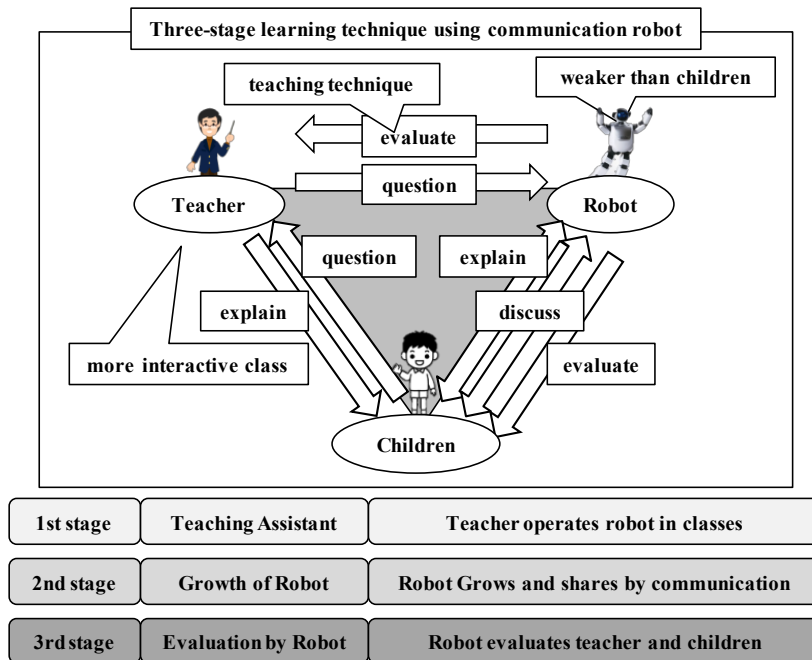
Figure 1: Three-stage use of a communication robot in teaching

Practice and Evaluation of Environmental Education

Using a Communication Robot

We sought out schools that are conducting environmental education utilizing PALRO and discovered the Waseda University „Children's University" in Saitama Prefecture. We show the state of practice and PALRO (Fig. 2).

Seventy students in the fifth and sixth grades of Honjo City participate in the Children's University. The class was divided into students who did and did not use PALRO, and we conducted a questionnaire comparison. (Fig. 3). To compare the results of the two questionnaires, percentage that it was able to participate actively and glad to participate was more children. It is believed that from these, there is the effect of improving motivation for learning that take advantage of PALRO.

In addition, we compared students' concentration by line-of-sight analysis. Three times during the 180 min lesson, we measured the gaze of five students (Figs. 4 and 5) students' concentration had decreased significantly by the third measurement in the class that did not use PALRO. In the class that did employ PALTRO, students' concentration had increased by the third measurement. It is believed therefore to be or not to be able to focus on teaching again by using the PALRO.

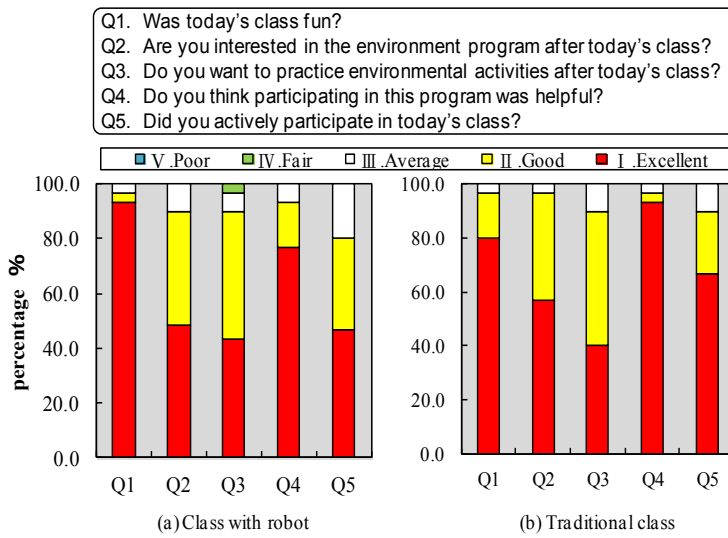510

Figure 2: PALRO (left) and the State of Class (right)

Q1. Was today's class fun?
Q2. Are you interested in the environment program after today's class?
Q3. Do you want to practice environmental activities after today's class?
Q4. Do you think participating in this program was helpful?
Q5. Did you actively participate in today's class?

(a) Class with robot   (b) Traditional class

Figure 3: Survey results showing outcome differences between teaching with a robot and traditional teaching
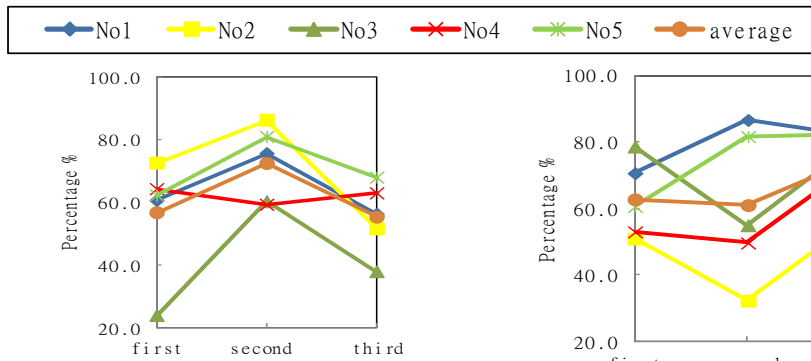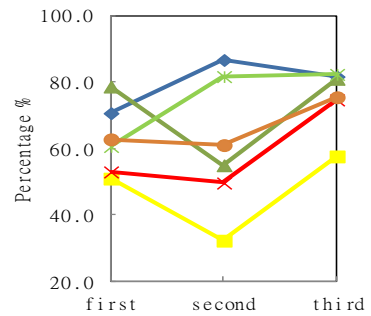
Figure 4: PALRO Not Used

Figure 5: PALRO Used

It was also verified what differences whether occurring in interests by using the PALRO by Freescale Rating. We heard „Please write freely what you want to know about the environment now, that I want working that you want to examine" with respect to a child after the lesson. Children have shown by the size of the circle the items they wrote. We were classified as a theme for each entry of the child. And we were compared in the classroom of PALRO without lessons and PALRO have a percentage of the area. We were covered in class mainly it is the theme of the four „recycling," „trash," „rare metal," and „limonene." The children were interested in various environmental issues concerning subjects other than those dealt within the classroom that did not use PALRO (Fig. 6). The children were intensely interested in topics, such as garbage and recycling, in the class that used PALRO (Fig. 7). PALRO apparently provokes strong interest in the topics it presents.
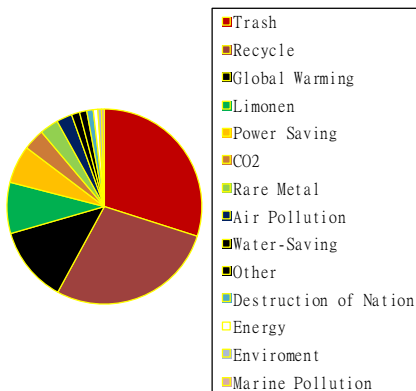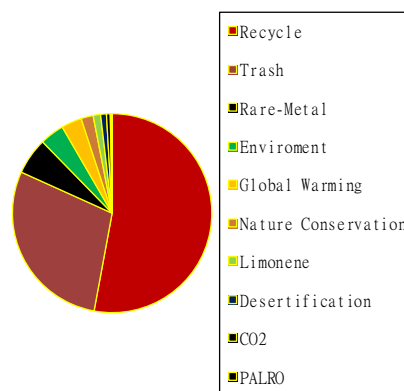

Figure 6: PALRO Not Used

Figure 7: PALRO Not Used

Future Development

In this study, we practice environmental education utilizing communication robot based on the „weak robot" concept. Effects such as students' heightened interest and increased concentration were obtained. Going forward, we will develop teaching methods that focus on children who have difficulty studying. For example, we will consider how children and to correct it for the robot to a wrong description on purpose and how to establish knowledge by children to explain to the robot that as Revenge of the lesson.

References

Jun Oshima, Nahomi Miyake. 2011. Collaborative creation of wisdom human and robot symbiosis science. Japan Robot Journal. 29 (10), 875–878.
Mitio Okada. 2009. Research contact between social robotics and conversation analysis. Cognitive Studies. 16 (4), 487–493.
Fumihide Tanaka, Hideki Kozia, Syuuzi Itakura, Kazuo Kai. 2010. Robotics for children proposal of new education and rehabilitation assistance directionality. Japan Robot Journal. 28(4), 455–462