

Exploring Children's Perceptions of the Robots

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Abstract. In order to introduce robots into education field appropriately, it is necessary to consider the children's perceptions of the robots. In this study, the researchers developed the questionnaire for exploring the children's general impressions of the robots, the roles of the robots in the classroom and the appearances of the robots. A hundred and sixty seven fifth-grade children took this questionnaire. The results show that most students have good impressions of the robots and positive attitude to see the robots in their classroom. Their responses also reveal that they might have over expectations of the robots. Besides, the results show that most of children like cartoon character-like robots and animal-like robots, because the robots are very cute.

Keywords: Robots, Children, Educational settings, Attitude, Classroom.

1 Introduction

Robots with different shapes and functions are already applied in various instructional environments. For example, robots are commonly used as a medium for programming course. The learners could practice the complex concepts by editing the codes for manipulating the robots. Robots in teaching programming can provide the learners authentic practice opportunities and immediate feedback [1]. Furthermore, Robots are also applied as the teaching assistant or learning companion in the classroom to enhance students' learning motivation and improve students' leaning achievement [2].

Like other innovative technologies, some researchers point out that even exciting educational technology innovations have taken hold in some places, such as intelligent service robots, in many places, this new technology lies unused in schools. One reason to this statement comes from the perception differences between robot designers and the users. Therefore, the perceptions of the users are needed to be taken into consideration. Children are the frontline users, hence, we need to know children's perceptions of different robot designs [3].

Few studies explored the related issues [4]. Lee, Lee, Kye and Ko [5] had developed a Likert-scale questionnaire to survey the perceptions and needs of intelligent educational service robot among 1,528 people, including teachers, students and parents in Korea and found some valuable information for using robots in schools. Due to the

limitation of the questionnaire format, the study could only know the perceptions of the students toward to the robots, but could not get the reasons from the students. On the contrary, Shin and Kim [4] interviewed 85 students about their perceptions of learning from robots and learning with robots. However, the considerable effort and time required in interviewing and data analysis make the technique unsuitable for a large-scale study.

In order to meet the educational needs of using robots in schools, this study developed the questionnaire with multiple item types. The questionnaire can not only help researchers to identify students' perceptions of using robots for educational purpose in school, but also help the teachers to get more information and well prepared before using the robots as a new technology to educational practices. The purpose of this study is to understand children's perceptions of the robots, especially to the intelligent educational service robots.

2 Method

A hundred and sixty seven fifth-grade children from three primary schools at the northern Taiwan were participated this study. They all had ideas about robots. Seventy eight girls and eighty nine boys were included, and they aged between 11 and 12 years.

The questionnaire used to explore children's perceptions of the robots in this study was developed by the researchers. The original contents of the questionnaire referred to three sources: the members of the robots company (robots designer), the researchers who study educational robots, and the literatures about the students' perceptions of the robots.

The questionnaire is composed of 20 items and the questionnaire covers four topics presented in three types. The distribution of the items for different topics and types is showed in Table 1. The first part consists of 5 items which aimed to collect the essential information of the respondents, including their experiences with the robots. The second part consists of 8 items which aimed to investigate the children's general impressions of the robots. The third part consists of 4 items which aimed to explore the children's thoughts about the robot roles in the classroom. The final part consists of 3 items which aimed to investigate the children's thoughts about the robot appearances.

In order to make sure that the questionnaire is readable and suitable to the children, ten fifth-grade students were invited to discuss the first edition questionnaire after they completed the questionnaire. The researchers revised the sentences which were not described clearly according to children's comments. The revised questionnaire (the 2nd and formal edition) then was used to collect the perceptions of the robots among 167 children. The average time spent in completing the questionnaire was 40 minutes. The content analysis was used to analyze the three item types and classify the responses into different topics. Furthermore, the description analysis was conducted by SPSS 13.0.

Table 1. The questionnaire for exploring children's perceptions of the robots

The topics of the questionnaire	The types of the items	Items	The examples of the item
Respondents' essential information	Short answer questions	5	<ul style="list-style-type: none"> Item 1: What are my name, gender and age? Item 4: What are the top three favorite cartoons I like?
General impressions of the robots	Short answer questions	3	<ul style="list-style-type: none"> Item 6: If I have a robot, what kind of work I hope the robots can do? Item 10-1: I think the robots are novel.
	5-point Likert scale + short answer question	5	<ul style="list-style-type: none"> Item 10-2: Why I (do not) think that the robots are novel?
Robot roles in the classroom	Short answer questions	1	<ul style="list-style-type: none"> Item 9: In which subject I would like to let the robots be the teacher and why I think they can teach? Item 17-1: I want to have a robot companion in the classroom.
	5-point Likert scale + short answer question	3	<ul style="list-style-type: none"> Item 17-2: Why I (do not) want to have the robot companion in the classroom?
Robot appearances	5-point Likert scale + short answer question	2	<ul style="list-style-type: none"> Item 19-1: I like mini robots. Item 19-2: Why I (do not) like mini robots?
	Multiple choice question + short answer question	1	<ul style="list-style-type: none"> Item 20-1: Among the 16 types of robots displayed below. Which is my favorite one? Item 20-2: Why I like this robot?

3 Findings and Discussions

Due to space limitations, the researchers will touch upon the last three topics of the questionnaire: General impressions of the robots, robot roles in the classroom, and robot appearances.

3.1 What Are the Children's General Impressions of the Robots?

What the feeling a child will have when he/she hears something about robots? This question is concerned by the researchers who focus on the children's perceptions of the robots. There are 8 items related to this issue in the questionnaire. The results of item 6 and item 10 can be good examples to summarize children's perceptions or impressions of robots in Taiwan. Item 6 is used to investigate the expectations of the robots that the children have. The top two expectations are (1) be my servant (26.5%), e.g. "I hope it can help me deal with a lot of things, such as doing homework" and (2) Keep company

with me (26.5%), e.g. "I hope it can be my good friend and accompany me forever". Based on the results, some children like to have robots be their servants and help them handle lots of things, and some children prefer to have the robots as their companions. But so far, the developed robots can not reach the goals. It seems that the children had over expectation of the robots. In addition, it is obviously that none of the children would like to have robots to assist them in learning.

Item 10 is used to investigate that whether the children consider the robots are novel or not and why they have the thoughts. The results show 66% of the children agree or strongly agree the robots are novel and 22% of the children disagree or strongly disagree that the robots are novel. The top two reasons about why the children think the robots are novel are (1) the robots have multiple functions (77%), e.g. "the robot can fly and transform" and (2) the robots are stronger than human beings (14%), e.g. "the robots are smarter, and they can do many things which we human beings can not do". Those responses also show that children have high expectations of robots, and they thought that robots can do much more things than human beings.

The top two reasons about why the children do not think the robots are novel are (1) robots are created by human beings (44%), e.g. "robots can exist just because human beings make them, so they are not novel" and (2) the prevalence of robot (39%), e.g. "you can easily get the robots, thanks to the remarkable technology that almost everyone has his or her own robot". When robots are applied in education, it might be an issue to investigate that if there are differences in learning effects between the children who think the robots are novel and who do not.

3.2 How about the Children's Thoughts If the Robots Are Placed in the Classroom?

What feeling the children may have when they know a robot will be their teacher or classmates tomorrow? This question should be concerned when someone wants to introduce the intelligent educational service robot to the classroom. There are 4 items related to this issue in the questionnaire. The results of item 9 and 17 are good examples to investigate the children's thoughts if the robots are placed in the classroom. Item 9 explores which subjects the children would like to have robots to teach them. The results show that "Nature science" is the subject that most of children choose (26%). The top two reasons are (1) robots are machines (68%), e.g. "we can observe their mechanical structure" and (2) natural science is the most difficult subject (15%), e.g. "natural science is hard to understand, but robots seem could deal with that kinds of problems". The contents of nature science in Taiwan primary schools include physics. Therefore, the children may think the robots are good teaching aids due to the robots are machine.

Item 17 is used to investigate that if the children would like to learn with robots and why they have the thoughts. The results show 59% of the children agree or strongly agree that they want to have a robot companion while learning and 27% of the children disagree or strongly disagree. The top two reasons of why the children want to have a robot companion are (1) robots could be the tutors (34%), e.g. "if I lose some important points told by teachers during class, I can ask the robots repeat those points for me" and (2) learning with robots might be interest (29%). On the other hand, the top two reasons of why the children do not want to have a robot companion are (1) negative learning

effects (53%), e.g. "robots might distract me from learning" and (2) robots are not living creatures (18%), e.g. "I prefer to learn with real person". According to the children's responses, it shows that when and how the robots are used in the classroom should be carefully considered when the educators introduce robots as learning companions in the classroom. Furthermore, the robots don't like living creature or don't have emotions may be the crucial reason for why the children did not like the robots becoming their companions. The limitations might be solved by the researches of human and robots interactions [2].

3.3 How about the Children's Thoughts of the Robot Appearances?

What feeling the children may have when they see different robot appearances? Some studies have shown that people have different feelings to different shapes of robots [3] and the robots with good appearances can enhance the learners to engage in their learning [6]. Therefore, the robot appearance is a crucial issue to the designers and the researchers. There are 3 items related to this issue in the questionnaire. The results of item 19 and 20 are good examples to explore what robot appearances the children like. Item 19 focuses on the robot sizes and item 20 focuses on the robot shapes. The results of item 19 show that 65% of the children agree or strongly agree that they like mini robots and 18% of the children disagree or strongly disagree. The top two reasons for why the children like the mini robots are (1) mini robots are very cute (66%) and (2) mini robots are very convenient (32%), e.g. "it is small, so I can carry it with my back bag or pocket very easily". The top two reasons for why the children don't like the mini robots are (1) the functions of the mini robots are weak (66%), e.g. "the robots can not do many things" and (2) the mini robots look not cool.

Item 20 shows the children 16 different robots which belong to four main shapes, including cartoon character-like robots (such as PAPER0), animal-like robots (such as AIBO), humanoid-like robots (such as Sapiens) and machine-like robots (such as LEGO). Forty one percents of the children like cartoon character-like robots and 32% of the children like animal-like robots, and they both had the similar reason to their selections, that is, "the robots look cute". Therefore, the robot designers should take it into consideration when design the robots.

4 Conclusions

Robots are the innovative technology which has potential to be broadly applied in education in recent years. In order to introduce robots into education field appropriately, it is necessary to consider the children's perceptions of the robots. Therefore, in this study, the researchers developed the questionnaire with multiple item types for exploring the children's perceptions of the robots. In overall, the results show that most of fifth-grade children have good impressions of the robots and have positive attitudes to see the robots in their classroom. However, they also show higher expectations to the robots and that might be resulted from the mass communication about the robots. The significant differences between student expectations and the real robots might have negative impact on the application of using robots in educational field. To solve this

problem, the educators should make the children know more details about the limitations of the robots before introducing the robots to the classroom.

With respect to the children's perceptions of the robot appearances, the results show that most children like cartoon character-like robots and animal-like robots, because these two kinds of robots are cuter than humanoid-like robots and machine-like robots. For enhancing the children's learning motivation, the robot designers need to consider the result while designing the robots. In order to successfully apply robots in the education field, not only the robot designers but also researchers should take this study's results into consideration. The study results could help the robot designers and educators use robots appropriately and successfully. The researchers also suggest that the future studies could further explore the deferent users' perceptions of the robots with different educational purposes.

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