Early adolescents’ perceptions of educational robots and learning of robotics

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Introduction
The use of robots in our daily life is becoming more and more popular. For example, robots can be used to serve the human beings, in teaching children language or in assisting the disabled. The learning of robotics maybe a trend and can give students an opportunity to design and create new applications (Resnick, Ocko & Papert, 1988). Many researchers have attempted to probe the factors that influence the manner in which students use and learn robotics (Liu, Kou, Lin, Cheng & Chen, 2008). However, few have explored students’ perceptions of educational robots and learning of robotics. This study can be considered as a pilot study that investigates early adolescents’ perceptions of educational robots and learning of robotics. The students’ perceptions of educational robots and learning of robotics shape their attitudes and behaviours towards the use of educational robots and learning of robotics. Therefore, this study conducted interviews to investigate early adolescents’ perceptions of educational robots and learning of robotics, to assign categories to the descriptions of their perceptions, and to develop a scale in order to collect more students’ perceptions of educational robots and learning of robotics.

Method
Sample
The interview sample in this study included fourth, fifth and sixth graders (24 boys and 24 girls) from northern Taiwan. These early adolescents were selected from three elementary schools in northern Taiwan. A total of 16 early adolescents were selected from each elementary school in order to conduct interviews regarding their perceptions of educational robots and of the learning of robotics. All of them had prior experience in learning robotics (eg, Lego Mindstorms) and in using robots. The survey sample in this study included 318 elementary students (fourth, fifth and sixth graders) selected from three elementary schools in northern Taiwan.

Data collection
The research procedures of the interview study strictly followed the research procedures proposed by Tsai (2004). The research data for the survey study were collected...
using a questionnaire with a four-point Likert scale that was developed on the basis of the interview study. This questionnaire included three subscales that described educational robots as a plaything, learning of robotics as a source of employment, and learning of robotics as a way to high technology. The factor loading for each scale of this questionnaire was high (ranging from 0.749 to 0.882); the interscale coefficient of the correlation between each scale of this questionnaire was suitable (ranging from 0.658 to 0.773); and the reliability of this questionnaire was high (ranging from 0.821 to 0.881).

**Results of the interview study**

**Category 1: the educational robot as a plaything**

Students in this category considered the educational robot as a plaything used for having fun and passing time, especially when their parents are not at home. For example, one of the early adolescents stated that ‘The robot for me is a kind of a brand new technological companion. To play with a robot is fun and it helps me to overcome loneliness when my parents are not at home’ (by S3).

**Category 2: learning of robotics as a source of employment**

Students in this category considered learning of robotics as a source of earning a high income and wished to become professional engineers, in keeping with their parents’ expectations. For example, one of the early adolescents stated that ‘The robot for me is an opportunity to earn more money. My parents usually tell me that today, it is hard to find the job, and I have to learn innovative things in the school’ (by S21).

**Category 3: learning of robotics as a way to high technology**

Students in this category considered the learning of robotics as a way to high technology that makes our society more advance than before. For example, one of the early adolescents stated that ‘I should learn the robotics, because the robot is the high technology and it’s our future’ (by S46).

Table 1 presents early adolescents’ interview responses, which are labelled into three categories for representing their perceptions of educational robot and learning of robotics. These perceptions might overlap in these three categories. For example, during

| Table 1: Early adolescents’ perceptions of educational robots and learning of robotics (n = 48) |
|-----------------------------------------------|-----------------------------------|-----------------------------------|
| Category                                      | No. of responses | %                                |
| Perception of educational robots              |                    |                                  |
| Plaything                                     | 42                 | 87.5                             |
| Perception of learning of robotics             |                    |                                  |
| Source of employment                          | 24                 | 50                               |
| Way to high technology                        | 30                 | 62.5                             |

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an interview, a student responded by saying that ‘the robot for me is a toy and I want to
learn the robotics in order to be an engineer of robot’ (by S48). Subsequently, this
student’s perceptions of educational robots and learning of robotics were classified as
‘plaything’ and ‘source of employment’. The procedures of classification were con-
ducted by the author and was further validated by other researcher with educational
technology background; the percentage of agreement between both the researchers
was high (96.9%). The results indicated that most students considered educational
robots as a plaything and most students considered learning of robotics as a way to high
technology.

Results of the survey study
The descriptive data presented in Table 2 show students’ perceptions of educational
robots and learning of robotics. In the perception of educational robots, the students
tend to perceive educational robots as a plaything (mean = 3.106). In the perception of
learning of robotics, the students tend to perceive learning of robotics as a way to high
technology (mean = 2.926). The early adolescents placed lesser emphasis on learning
of robotics as a source of employment (mean = 2.345). The gender differences with
respect to the perceptions of educational robots and learning of robotics were also
tested using t-test statistics. A greater number of males tended to regard learning of
robotics as a source of employment and a way to high technology. In other words, males
tended to perceive learning of robotics as a way to high technology and an occupational
choice in the future.

Conclusions
This study concluded that early adolescents perceived educational robots and learning
of robotics as a plaything, as a source of employment, and as a way to high technology.
The questionnaire used for evaluating students’ perceptions of educational robots and
learning of robotics was developed with high validity and high reliability. Males tended
to perceive learning of robotics as a source of employment and a way to high technol-
yogy. On the other hand, both females and males perceived educational robots as a
plaything. Today, in Taiwan, parents tend to invest more time in their careers than in
tending to their children. This is because parents need to earn enough money to raise

Table 2: Gender differences in students’ perceptions of educational robots and learning of robotics

<table>
<thead>
<tr>
<th>Perception of educational robots</th>
<th>All</th>
<th>M</th>
<th>SD</th>
<th>Male</th>
<th>M</th>
<th>SD</th>
<th>Female</th>
<th>M</th>
<th>SD</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plaything</td>
<td>3.106</td>
<td>0.869</td>
<td>3.155</td>
<td>0.836</td>
<td>3.122</td>
<td>0.805</td>
<td>0.342</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perception of learning of robotics</td>
<td>Source of employment</td>
<td>2.345</td>
<td>0.934</td>
<td>2.612</td>
<td>0.871</td>
<td>2.17</td>
<td>0.903</td>
<td>4.108*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Way to high technology</td>
<td>2.926</td>
<td>0.898</td>
<td>3.15</td>
<td>0.757</td>
<td>2.732</td>
<td>0.93</td>
<td>4.078*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.001.
their children. Early adolescents need a companion in their daily life; therefore, an educational robot is perceived as a plaything for children. In learning of robotics, males can be motivated by two factors that are source of employment and way to high technology, but females are less motivated. Therefore, the instructional designers of robotics may include other motivated strategies, such as playfulness, relevance to their life, confidence building, and satisfaction, for females. The future study may verify which motivated strategies are effective for females.

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References