Exploring parents’ perceptions towards educational robots: Gender and socio-economic differences

Chun Hung Lin, Eric Zhi Feng Liu and Yuan Yen Huang

Address for correspondence: Dr Eric Zhi Feng Liu, Graduate Institute of Learning and Instruction, Center for Teacher Education, Research Center for Science and Technology for Learning, National Central University, No. 300, Jhongda Road, Jhongli City, Taoyuan 320, Taiwan. Email: totem@cc.ncu.edu.tw

Introduction
An important recent trend in education has been towards the integration of different technologies, such as digital games (Chen, Chen & Liu, 2010; Chiang, Lin, Cheng & Liu, 2011; Lee & Chen, 2009; Lin & Liu, 2009; Liu & Lin, 2009) and educational robots (Chang, Lee, Chao, Wang & Chen, 2010a; Chang, Lee, Wang & Chen, 2010b; Wei, Hung, Lee & Chen, 2011), and the learning and teaching about design and implementation of educational robots (Liu, Lin & Chang, 2010). The development of educational robots, such as Topobo and LEGO Mindstorms NXT, gives students more chances to learning to build their own robots (Feng, Lin & Liu, 2011; Liu, 2010). Liu (2010) found that students perceived that educational robots were a useful learning technology and considered that learning to construct robots could help them develop important technological skills. Many researchers investigated the effect of integrating educational robots into educational fields, and they found that educational robots not only can enhance students’ learning motivation (Chang et al., 2010a; Liu et al., 2010) but also can improve students’ learning (Chang et al., 2010b). The findings from past studies showed that educational robots have become an important learning technology and a subject for students to study. The support and confidence of parents to help their children to learn with or learn to build robots are important for promoting the use of educational robots. The previous study (Liu, 2010) explored the students’ perceptions of educational robots, but the further investigation of parents’ perceptions towards educational robots has been lacking.

Parents’ perception and behavior towards education technology is an important factor that will affect children’s attitude towards the technology and affect how children use the technology (Valcke, Bonte, De Wever & Rots, 2010). Feng et al. (2011) found three factors related to parents’ perception towards educational programmable bricks: usefulness and confidence in teaching children with programmable bricks. The aim of this new study was to investigate how parents perceived educational robots.

Methods
Participants
Thirty-nine parents, whose children study in a junior high school in northern Taiwan, responded to the self-report questionnaire. Seventeen were male (43.60%) and 22 were female (56.40%). Eight were 30 years of age (12.80%), 26 were 40–49 years of age (66.70%) and five were above 50 years of age (12.80%). Twelve parents graduated from senior high school (30.80%); 20 parents held bachelor degree (51.30%); and seven parents held master’s degree (17.90%). In addition, we used educational level and occupation prestige to evaluate parents’ socio-economic status (SES). Eleven parents had low SES (28.2%), 18 parents had middle SES (46.2%) and 10 parents had high socio-economic status (25.6%).
Research context
The children of the participants were from the same junior high school. In this school, a robotics club has been established for 2 years (since 2009), and the school administrators positively encourage students to participate in the robotics learning activities. Furthermore, this school provided robot summer camp for their students. In 2011, the students entered the World Robot Olympiad (WRO) 2011 competition in New Taipei City and won the second and third places. Basically, the school administrators actively designed different robot learning activities and devoted to provide more chances for students to learning robots.

Instrument
The perception questionnaire was adopted from the parent perception scale developed by Feng et al. (2011). There are 15 Likert-type questions, ranging from 1 (strongly disagree) to 5 (strongly agree), and three dimensions were included in this questionnaire: usefulness of educational robots (six items) (eg. I think educational robots can enhance the interaction between parent and children), confidence in teaching children with educational robots (three items) (eg. when children learn educational robot, I can help children solve the problem they face) and supportive behaviors (six items) (eg. I encourage my children to join educational robot courses). The factor loading of the first dimension, usefulness of educational robots, ranged from 0.53 to 0.89. The factor loading of the second dimension, confidence in teaching children with educational robots, ranged from 0.55 to 0.83. The factor loading of the third dimension, supportive behaviors, ranged from 0.61 to 0.92. The exploratory factor analysis method with principle component analysis and varimax rotation was used to analyze the structure of the data. The total variance explained reached 70.11%, and the result of factor analysis showed that the questionnaire demonstrated adequate construct validity. The reliability analysis indicated that the values of Cronbach’s $\alpha$ ranged from 0.72 to 0.91 and showed that the questionnaire has adequate reliability.

Results
Parents’ perceptions towards educational robots
The repeat measure analysis of variance (ANOVA) was employed to investigate parents’ attitude towards educational robots. The result indicated that significant differences were found among the three dimensions ($F = 34.12, p < 0.001$). The post hoc testing showed that the scores of the two dimensions, usefulness of educational robots and supportive behaviors, did not showed significant difference. The score of the dimensions, confidence in teaching children with educational robots ($M = 3.74, SD = 0.49$), was significantly lower than that of the other dimensions, usefulness of educational robots ($M = 4.46, SD = 0.60$) and supportive behaviors ($M = 4.45, SD = 0.62$). The result indicated that the parents considered that educational robots were benefit for their children, and they were willing to provide chances and to encourage their children to learn educational robots, but they showed less confidence in teaching and playing the educational robots with their children.

Gender differences in parents’ perceptions towards educational robots
The two-way Multivariate analysis of variance (MAMONVA) was employed to further examine the effect of gender difference and SES on the three dimensions of parents’ attitude towards educational robots. The result showed that there was no significant interaction between gender and SES with parents’ perception towards educational robots. However, gender difference showed significant effect on parents’ perception towards educational robot (Wilks’ lambda = 0.65, $p < 0.01$). Males ($M = 4.46, SD = 0.60$) perceived higher usefulness of educational robots than females ($M = 3.85, SD = 0.40$) ($F = 14.34, p < 0.01$). Moreover, males ($M = 4.45, SD = 0.62$) expressed more willingness to support children to learn educational robots ($M = 3.85, SD = 0.64$) ($F = 9.50, p < 0.01$). Males ($M = 3.74, SD = 0.49$) also showed significant higher confidence in
teaching children with educational robots than females ($M = 2.99$, $SD = 0.64$) ($F = 16.09$, $p < 0.001$).

**SES differences in parents’ perceptions towards educational robots**

The result showed that the SES did not show significant effect on parents’ perception towards educational robot (Wilks’ lambda = 0.76, $p > 0.05$), and the result indicated that parents with different SES showed similar perception towards educational robot. The result of ANOVA indicated that parents with different SES did not show significantly different perceptions towards the usefulness of educational robots and supportive behaviors. However, parents with high SES ($M = 4.10$, $SD = 0.47$) showed significant higher confidence in teaching children with educational robots than parents with middle ($M = 3.07$, $SD = 0.90$) or low ($M = 3.12$, $SD = 0.93$) SES ($F = 4.90$, $p < 0.05$).

**Conclusion and discussion**

Recently, integrating robots into educational fields has become popular (Liu, Liu, Wang, Chen & Su, 2011; Young, Wang & Jang, 2010), and children have more chances to participate different international robot competitions, such First Lego League and WRO. The change in education has let parents sense the importance and usefulness for their children to learn educational robotics, and parents have become an important supportive power for children to learn about this new educational technology (Feng et al., 2011). This study investigated parents’ perceptions towards educational robots and examined the effect of gender and SES differences on parents’ perceptions. The results indicated that parents hold positive attitude towards educational robots and considered that it was beneficial for their children to learn about educational robots. In addition, parents expressed high willingness to provide chances for their children to learn about educational robots. The robot is not just for entertainment, but also beneficial for students’ learning. Even during the period with high academic pressure, such as junior high period, parents still hold positive attitude towards robotics education. The school environment may be another important factor that affected parents’ perceptions about the learning issue. As school more engaged in promoting robotic learning, parents would have more chances to be familiar with robotics learning and then hold more positive attitude towards robotics learning. However, it was found that parents have lower confidence in teaching or playing educational robots with their children.

Besides, the gender difference and SES difference in parents’ perception towards robotic learning were found. Parents’ with lower SES showed significantly lower confidence in using robot with children than parents with higher SES. Moreover, this study also found that males showed more positive attitude towards educational robots than females. The result indicated that female or parents with lower SES need more support to enhance their perception towards educational robot.

Today, most of the educational robotics courses are provided only for children, not for parents, and this kind of situation reduces the chances for the parents to exposure to educational robots. Parents could enhance the interaction with their children and get deeper understanding about educational robots through joining the educational robot learning activities together with their children. Therefore, more training or learning course of educational robot for parents was crucial, and parents develop more confidence and understanding about how to learn together with their children with educational robot during the process. In the future, different educational robot training programs could be provided for parents. More attention should be paid to help females or parents with lower SES to enhance their familiarity to educational robot and increase their confidence in teaching children with educational robots.

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