Parent's Acceptance: Humanoid-Robot Intervention for Malay Autistic Children

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Abstract: Past studies have shown the related research on the acceptance of direct interaction among autistic children and teachers with humanoid-robot on how they accept or not if humanoid-robot is used in the therapeutic sessions. Humanoid robot is used as a mediator without neglecting the involvement of therapists because autistic children are found to be more attracted to respond to the technology rather than to human. The issue arises when there is lack of information on the parental acceptance and which factors influence their approval in accepting humanoid-robot use in their child's therapy. This study represents an identification of criteria that affect parent's acceptance if humanoid-robot intervention is used in therapeutic sessions. The finding is then need to produce a conceptual model of parent's acceptance towards humanoid-robot intervention in therapeutic sessions. This research was held in Seksyen 7, Shah Alam by approaching Malay parents who have autistic children within ages 2-9 years old. The research has used Snowball sampling and quantitative method was applied by distributing the questionnaires to 43 parents. It contains 13 questions excluding the demographic profile of the respondents. A theoretical framework of parental acceptance proposed from past research was also adapted and modified in this study. The results of multiple linear regressions stated that learning opportunities and subjective norm were the criteria that affects the parental acceptance with significant value of 0.033 and 0.049, respectively. It brings significance to the robot system developer in making enhancement to the current robot system for autistic children.

Key words: Parents, acceptance, autism, humanoid-robot, autistic children, conceptual model

INTRODUCTION

Autism spectrum disorder is fall under learning disabilities where it is a deficit in reading, writing and calculation (Iacono *et al.*, 2011). Autism can be identified before the age of 3 years old and this disorder has their own characteristics of impairment such as by social interaction, communication and repetitive behaviour (Fridin and Belokopytov, 2014; Ferrari *et al.*, 2009; Sampath *et al.*, 2013). Nowadays, a concern about learning process for autistic children is essential in order to make them gaining the same attention like other normal children and this will give chance for them to improve their quality of life (Shamsuddin *et al.*, 2012). There are many ways were used just because to give them the best treatment and services. Sign language, visual symbols, communication books are examples of conventional

methods used to improve their disabilities (Sampath *et al.*, 2013). Nonetheless, these methods were seen as less approachable since autistic children known to be more attracted with gadgets. That is the main reason technology approach is used in the therapeutic sessions for autistic children. Thus, the humanoid-robot intervention being used in the therapeutic sessions so that the autistic children could increase their confidence level and at the same time may perhaps improve their communication skills, social interaction and behavioural characteristics.

A little work and research were done about the parents involvement on this issue while the acceptances and participation among teachers or therapists with the intervention of humanoid-robot were more frequent to be found such as acceptance of socially assistive humanoid robot by preschool and elementary school

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teachers (Fridin and Belokopytov, 2014) acceptance, interaction and authority of educational robots and involvement of therapists in testing the humanoid robot to be used as a mediator in the treatment of autistic children (Giullian *et al.*, 2010). Therefore, this research is focusing on how child parent's care and whether they can accept when there is an intervention of humanoid-robot as a mediator in the therapeutic sessions. A modified theoretical framework that was adapted from a research is used with emphasizing on learning opportunities; subjective norm and experiences which lead to the parent's preference for humanoid-robot intervention and all of the data were collected using questionnaire method by approaching 43 parents of autistic children.

Literature review

Development disabilities: There are few types of disabilities such as learning disabilities, development disabilities and others. Learning disabilities include of dyslexia, dysgraphia, dyscalculia or attention deficit disorder while autism and down syndrome are at the development disabilities category (Ismail *et al.*, 2012) which also could affect their learnability. As mentioned above, it is stated that children with learning disabilities have difficulty in mathematics and write, however, according to Shamsuddin *et al.* (2012), high-functioning autism spectrum disorder have an ability to do these two works. Educational tool such as robot can be used in growing the children development and this situation could give beneficial effects to them (Marti *et al.*, 2009). The robots also can be used in the therapy sessions.

Autism Spectrum Disorder (ASD): Autism spectrum Disorder (ASD) is a disorder that include of the disability of children to learn something such as reading and others. This disorder can be detected at early age which is before the age of three (Shamsuddin *et al.*, 2014). The neuro development disability affecting about one in every 100 children. The autistic children have their own characteristics known as triad impairment. The triad impairment that has been identified in the autism behaviour is social interaction, impairment in communication and activities that they are doing are done, repetitively (Sampath *et al.*, 2013). However, it is stated in research which declared that autism cannot be curable but they could gain chances to live like a normal person if proper treatment and therapy would held (Shamsuddin *et al.*, 2012).

Technology used for therapeutic sessions: Technology is believed to be as a medium of intervention in order to assist autistic children in the therapeutic sessions by complement with traditional therapy (Sampath *et al.*, 2013). Many researches works about these were found such as gadgets, computer games and others were used in the sessions because autistic children feel more comfort to interact with those things. This situation could assist them in improving their social interaction. Before the technology has been used to aid the autistic children, there are many conventional ways that were used by the therapists in order to recover and improve the behaviour of autistic children such as the use of sign language, visual symbols, communication books and many more. However, the uses of usual approaches were seen as a failure since it could not encourage the children with autism to give responses (Shamsuddin *et al.*, 2012).

Robot intervention: According to Solis and Takanishi (2009), robots have been used for many purposes particularly in industrial, entertainment, personal use, welfare, education, rehabilitation, medical assisted-robotic systems. The uses of robot become emerge and it is a popular tool to be used since it can attract children such as autistic children (Solis and Takanishi, 2009). It is supported by Ismail *et al.* (2009) which stated that the involvement of humanoid-robot interaction and robotics elements could enhance the autism's behaviour. In this case, robots were used as a mediator in order to elicit children to interact with other peoples. There is another reasons why robots were used in therapy, this is because of therapies are much more safe and less side effects compared with taking any drugs or medicines (Bharatharaj and Kumar, 2013). Aforementioned, the autistic children are more attracted towards technology and feel more comfortable to interact with it compared to communicate with their parents, teachers, siblings and others. This is because the autism spectrum disorder behaviour itself is often avoid making eye contact, living in their own world and cannot to follow many social norms. It is become an obstacle to get their attention during the therapeutic session. Thus, in order to recover their behaviour, tablet, smart phones, computer has been used as a medium for therapy.

Humanoid-robot: Humanoid-robot has been a recent study for intervention in the therapeutic sessions with the autistic children. Humanoid robots are believed could encourage the autistic children in their social interaction. They would feel confident to interact with people surround them and the uses of humanoid-robot will

persuade the children to communicate with other persons without feel anxiety and need to be stressed that the use of robots in the therapeutic sessions are not to replace the role of therapists. In order to develop the robot systems so that it can understand their target users such as autistic children is quite challenging (Seifer and Mataric, 2008). Thus, even though there is an obstacle, however, the uses of humanoid-robot was seen as a success and it is recommended to be used in the therapeutic sessions since many researches stated that there were improvements on autism's interaction, communication and behaviour in terms of emotion recognition and facial expressions.

Appearance of the robots: The appearance of the robots also is the important aspects that need to take into account for rehabilitation process. This is because it would influence the engagement of the children with autism and the robot itself, since robots could give interests for them. Humanoid robots appearance are suggested if it is include of human-human interactions as the autistic children feel more interested to interact with. Even though children are more attracted to play with the robots, sometimes it could give adverse effect on the children if too much complexity on the robot's appearance (Yee *et al.*, 2012).

Parent's acceptance: Technology acceptance among user interaction and the robots has been a main focused for few years back. The research was to examine whether the target users accept to use such technology given to them. Few researches also had done in acceptance between teachers and robots itself (Fridin and Belokopytov, 2014; Giullian *et al.*, 2010). These situations were used a few model such as Technology Acceptance Model (TAM) (Davis, 1989) or Unified Theory of Acceptance and the Use of Technology (UTAUT) proposed by Venkatesh *et al.* (2003). However, there is little work focusing on parent's acceptance of a technology. The views from the parents also important since the targeted users of using the humanoid-robot intervention as a mediator in the therapeutic sessions are their children. To influence the learning performance, the involvement of parents were thought as a critical variable since the parents also one of the important role in the school system. Since, that the use of humanoid-robot in the therapeutic sessions is not intended to the parents themselves, it is impractical to apply TAM concepts. Based on a literature review on parental acceptance, there are two indicators to indicate the attitude of parents

towards intervention of technology in treating their autistic children such as anxiety towards technology and self-efficacy (Clark *et al.*, 2015). Parental self-efficacy is a reduction of guilt feelings among mothers towards their autistic children and superior well-being can be gained by increasing the parental knowledge and promotes positive perceptions about the autism. However, both of these things can be alleviated by giving more exposures towards technology used. Figure 1 shows that the theoretical framework that have been developed by Bourgonjon which was derived from theory of reasoned action and technology acceptance model.

Thus, they had developed a diverse model for third party which is the parents. However, it was applied for the case of parental acceptance for the use of video games in the classroom. According to Fig. 1, the independent variables that have been used are gender, personal innovativeness to in the domain of information technology, experience, negative effects, learning opportunity and subjective norm. Thus, this theoretical framework was modified to suit with this topic. Three independent variables that considered as relevant for this study are learning opportunities, subjective norm and experience. These three independent variables were used to identify the acceptance of parents in using humanoid robot intervention for autistic children. Experience was selected to be applied in this research because without knowledge from the experience, the parents cannot make judgment on how humanoid-robot able to give opportunities in learning for autistic children. With their awareness and knowledge about this issue, the parents know the advantages of having humanoid-robot intervention as a mediator in therapeutic sessions since the autistic children are more attracted to interact with gadgets (Kim *et al.*, 2013). Another independent variable in identifying the parent's acceptance regarding to this research was learning opportunities. This variable was need to take into account in order to know whether humanoid-robot intervention is able to offer opportunities or can increase performance of autistic children in learning sessions. Subjective norm is an opinion from other people as to which degree the parents believe with perceptions given by those people (Fishbein and Ajzen, 1975). The perceptions and opinions from their family members, relatives or friends can affected in the way how the parents accept in intervention of humanoid-robot as a mediator for autistic children. When their friends or family give support whereby the humanoid-robot have potential to be used in therapeutic session, indirectly it able to influence the parental acceptance on this case.
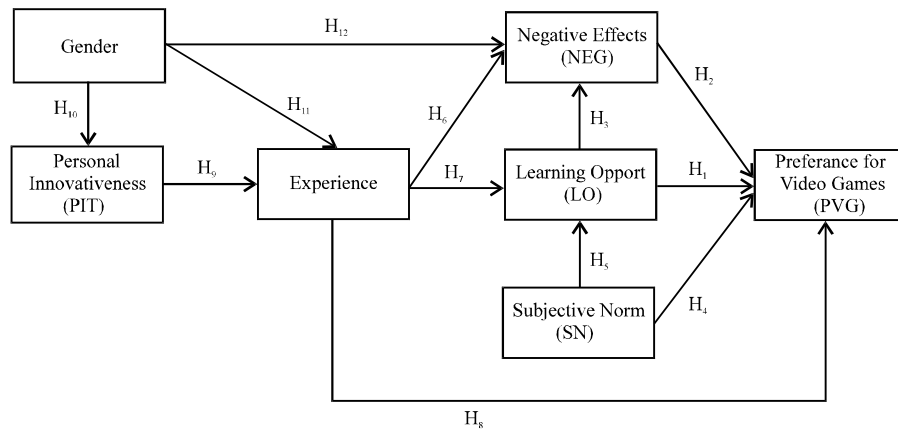
Fig. 1: Theoretical framework proposed by Bourgonjon

MATERIALS AND METHODS

Research design: The study was held at Seksyen 7, Shah Alam area with the cooperation of Malay autistic children's parents. This research is categorized into analytical type of research which involving factors affecting the parent's acceptance in the humanoid robot intervention of therapeutic sessions with their own children. The research is a cross sectional study which is only focusing on the parents from Seksyen 7, Shah Alam. Data were collected using questionnaire method with intend to approach individual person (parents) of autistic children. This will help to accomplish the first objective of the research which is identifying the criteria that affect the parent's acceptance in the use of using humanoid-robot intervention in therapeutic sessions. The identification of criteria affecting the parent's acceptance in the use of humanoid-robot intervention in therapeutic sessions was collected by reviewing the journal, articles and conference papers. Quantitative data was used in this research in order to collect data for parental acceptance hence; a conceptual model was produced.

Sampling strategy: Snowball sampling was used in this research in order to obtain the selected respondents. This sampling is one of the techniques from non probability sampling category. Snowball sampling was used because it was believed that it is very useful in locating respondents of rare populations (Seifer and Mataric, 2008).

Research model: Research model is to show the conceptual model that was used in the research involved the variables. How the conceptual model is map and the acceptance of digital game based learning. However, by using this theoretical framework, it can be modified that suits with the research problem. The new modified version
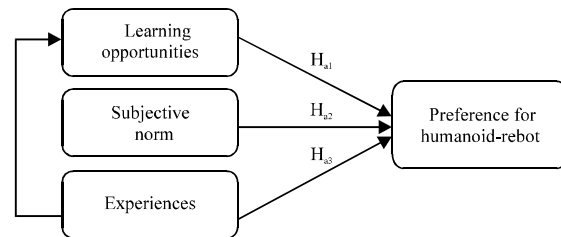

Fig. 2: Modified theoretical framework

in this research only takes three independent variables in measuring whether these three variables could affect the dependent variable.

Figure 2 shows that the whether these three positive relationships denotes as H_{a1}-H_{a3} were affected the preference for humanoid-robot. In addition to what have been explained earlier also had stated in their work which the use of Technology Acceptance Model (TAM) to the parents themselves is impractical since the use of technology is not up to them. Thus, it is can be concluded that TAM is not suitable to apply for the third party condition. The use of humanoid-robot was believed can promote opportunities for learning among autistic children. Bourgonjon, Anzalone and Boucenna were introduced the "perceived learning opportunities". In the case of parent's acceptance of humanoid-robot, it is refers on how humanoid-robot used for learning opportunities can increased the behaviour of autistic children what they think about the outcomes of using humanoid-robot in the therapeutic sessions and to what degree parents believe that using humanoid-robot in therapeutic sessions able to promote their children opportunities for learning. This was depends on whether parents have experience about this issue. Besides that, subjective norm also one of the independent variables that is relevant to be applied in the research. A subjective norm is "a person's perception that most people who are important to him think he

should or should not perform the behaviour in question" (Giullian *et al.*, 2010). This cultural environment from people's surrounding able to influence parent's perception towards this issue. Supports from everyone will encourage and increase parent's knowledge about the effect of intervention of humanoid-robot as a mediator. Another key factor that can be used in the case of parent's acceptance of using humanoid-robot intervention in therapeutics sessions is amount of experience that parents has and the level of involvements with humanoid-robot. Amount of experience includes that whether they ever seen, read and aware on how humanoid-robot used without neglect the participation of therapists in therapeutic sessions. These three independent variables can be hypothesized that it could lead to a preference for using humanoid-robot in the therapeutic sessions for their autistic children.

Hypothesis: This research is to look at the relationship between factors that might affect parent's acceptance in the use humanoid robot in therapeutic sessions for their children with autism spectrum disorder. The independent variables were measured against dependent variables. The null hypotheses were used in order to test whether the relationship does exist, if the relationships does not exist thus the null hypothesis are accepted. The lists of hypotheses are as:

- H_{o1}: learning opportunities do not have negative relationship affect preference for humanoid-robot
- H_{a1}: learning opportunities have positive relationship affect preference for humanoid-robot
- H_{o2}: subjective norm do not have negative relationship affect preference for humanoid-robot
- H_{a2}: subjective norm have positive relationship affect preference for humanoid-robot
- H_{o3}: experience do not have negative relationship affect preference for humanoid-robot
- H_{a3}: experience have positive relationship affect preference for humanoid robot

RESULTS AND DISCUSSION

This section discussed on the findings of the results gained after all the input being analysed and interpreted. Quantitative data analysis such as descriptive statistics, reliability analysis, correlation and multiple linear regression were conducted to generate the findings. Majority of the respondents were father (55.8%) ranging from group age of 29-44 years old that come from variety

of working background (i.e., despatch, banker, doing their own business, lecturer). All of the respondents were Malay and Muslim and have one autistic child in their family. Cronbach's alpha was used in order to analyse and measure the reliability of questionnaire. The alpha score of $\alpha = 0.945$ indicate that the questionnaire has high reliability. Meanwhile, the results indicate the reliability analysis for each variable such as learning opportunities ($\alpha = 0.862$), subjective norm ($\alpha = 0.894$) and experiences ($\alpha = 0.861$). Correlation analysis was used with intent to know whether the variables have significant relationship to each other. Based on the results, subjective norm have high significant relationship with preference for humanoid-robot intervention while learning opportunities and experience have moderate and weak relationship, respectively. It concludes that when there is positive correlation among two variables as the value of one variable increases, the value of the other variable increases as well. Table 1 indicates the summary of correlation analysis.

Multiple linear regressions was used to examine whether there is relationship between dependent and independent variables. The variables can be considered as significant to each other when the $p<0.05$. Thus, based on the coefficient table in SPSS, learning opportunities and subjective norm have significant relationship to the preference of humanoid-robot as shown in Table 2.

Research objective 1; identify criteria of parent's acceptance for humanoid-robot intervention: Based on the first objective of this research which is to identify the criteria that could affect the parent's acceptance if using humanoid-robot in therapeutic sessions, three variables were used. From the regressions results, learning opportunities and subjective norm were the criteria that affected parent's acceptance on humanoid-robot intervention for autistic children. However, results of

Table 1: Summary of correlation analysis

Variables	Results
Relationship with preference for humanoid robot intervention	Result (significant relationship)
Learning opportunities	Moderate
Subjective norm	High
Experiences	Weak

Table 2: Summary of regression

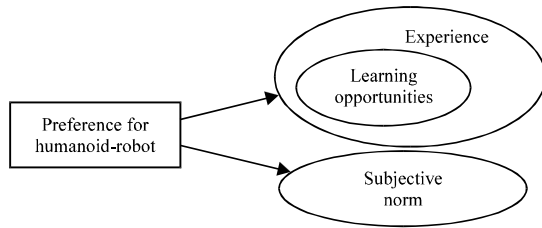| Variables	Results
Relationship with preference for humanoid robot intervention	Result $p<0.05$
Learning opportunities	Yes (0.033 = significant)
Subjective norm	Yes (0.049 = significant)
Experiences	No (0.383 = not significant)

Fig. 3: A conceptual model of parental acceptance

learning opportunities were affected due to the experienced parents. There was no direct influence between experience and preference for humanoid-robot.

Research objective 2; conceptual model: The conceptual model for this research was designed based on the theoretical framework that has been discussed previously. From the criteria that have been identified earlier, there were two variables that have significant between dependent and independent variables with involvement of parents who have experience about humanoid robot intervention for autistic children. Figure 3 shows the conceptual model for this study.

The parent's acceptance of using humanoid-robot intervention in therapeutic sessions were affected by two elements, results of learning opportunities was affected and a subset of 31 parents who have an experience, the other one was subjective norm.

CONCLUSION

The study has discovered the criteria that affects the parent's acceptance on the use of humanoid-robot in the therapeutic sessions for their autistic children. The findings show that the learning opportunities with influenced of experienced parents and subjective norm are the criteria that affect parents in accepting humanoid-robot intervention to be used for their autistic children in therapeutic session. Parent's perspectives towards learning opportunities seem to be the best predictor of their preference for humanoid-robot. Due to the fact that the parents accept humanoid-robot able to encourage in learning opportunities, thus there are more positive attitude towards the use of humanoid-robot in the therapeutic sessions. The parents agreed that the use of humanoid-robot intervention in therapeutic session could attract and increase autistic children level of responding of any tasks given considering that these children are more attracted to interact with technology.

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