Assistive Technology for Children with Autism Spectrum Disorder Emotion Understanding: A Preliminary Study

Aisyah Abdul Manap1, Eizwan Hamdie Yusoff2, and Riaza Mohd Rias1

1Universiti Teknologi MARA, Shah Alam, Malaysia, aisyahmanap.13@gmail.com
2Universiti Teknologi MARA, Selayang, Malaysia

ABSTRACT
Primordial purpose of this study is to propose a framework that will be guidelines for design and development of a visual interactive application to improve emotion understanding for ASD children. This study will benefit the ASD children and their therapist. This application will enable children to recognize other people emotions to encourage them into interaction between people thus improve their social and communication skills. Preliminary study was done to understand and gather information on autistic children in the aspect of their behaviour and the attention strategies in order to propose a framework to guide software development in designing appropriate visual interactive application that supports emotion understanding.

Keywords: visual interactive, emotion understanding, children with autism.

I INTRODUCTION
It is well known that autistic patient have difficulties in social interaction, verbal and non-verbal communication and repetitive behaviour. In Malaysia, persons with autism are referred to NASOM by Government hospitals and private practitioners. They have experience a 30% increase in their intake for the past 3 years. Yet the waiting list gets longer every day. (NASOM)

According to Tanaka et al. (2012) and Chaby (2012), autism is a pervasive development disorder involving impairment in reciprocal social interaction as well as impairments in verbal and non-verbal communication, a lack of imaginative play and repetitive solitary activities. Autism Spectrum Disorders (ASD) and autism are both general terms for a group of complex disorders of brain development.

ASD is considered pervasive developmental disorders, which are a category of disorders that pertain to delays in the neural development of several basic functions. Children with autism often exhibit a lack of motivation and responsivity in circumstances such as learning situations (Carter, 2001). Autism (or ASD) is a wide-spectrum disorder. This means that no two people with autism will have exactly the same symptoms. As well as experiencing varying combinations of symptoms, some people will have mild symptoms while others will have severe ones.

When children with autism appear aloof or unresponsive, it does not mean that they are not experiencing emotion. Sometimes autistic children express their emotions differently than typical people do. Studies have shown that children with autism do not always recognize facial expressions, which is part of the difficulty in reading the emotional responses of others. Within the area of emotional impairment, children with ASD experience deficits in recognizing, understanding, and using facial expression (Ripoll, 2007). The shortfall in emotion and facial expression recognition is particularly a limiting factor among people with autism to interact with people (Tseng & Do, 2010). Individuals diagnosed with autism display an impaired ability to understand the emotions and feeling of others (Tanaka et al., 2012). They tend to avoid looking at human faces and find it hard to understand why facial features move in the way that they do. The inability to read emotions on human face impairs their ability to communicate with other people. (Park et al., 2012).

Computer aided interaction systems and other forms of technology have shown potential and could be beneficial in helping to diagnose and remediate those with ASD (LaCava, 2007). One of the main reasons behind the push to use technology and multimedia to help interact with children diagnosed with ASD is that they have shown a preference for, as well as a fascination with, “visual stimuli” such as computer applications, games, and videos.

II EMOTION IN AUTISM
Ordinary social interactions contain considerable emotional components. Children that diagnosed with autism display an impaired ability to understand the emotions and feelings of others with lack of social reciprocity (Tanaka et al., 2012). Therefore difficulties understanding the emotional and mental states of others play a major role in the social characteristic of autism (Golen et al., 2010). Success in social interaction relies on the capacity to
recognize and interpret facial emotions in a social context (Tanaka et al., 2012)

Autism often affects an individual's ability to understand unspoken interpersonal communication which someone with autism might not detect sadness based solely on body gesture language or sarcasm in the tone of voice. Individuals with Autism have difficulties recognizing emotions from facial expressions, vocal intonation, body language, separately and in context (Cohen et al., 2009).

Emotion recognition and understanding seems to be rather permanent in individuals with ASD, therefore intervention tools for improving emotional recognition skills of individual with ASD are desirable (Kuusikkko et al., 2009).

III TECHNOLOGY ASSISTED FOR AUTISM

An increasing number of studies show that computer technologies used in teaching and in therapy are well accepted by individuals with ASD (Miranda et al., 2011). A consistent theme for children with ASD is the need to keep the children engaged with the computer application by creating an attractive, simplistic and predictable design (Harold et al., 2012).

The previous studies suggest that ICT is an effective approach to help children with ASD (Tseng & Do, 2010). An increasing number of studies show that computer technologies used in teaching and in therapy are well accepted by individuals with ASD (Miranda et al., 2011).

There is a significant need to develop technology that can help autistic children in education because Characteristics of children with autism limit their opportunity to take advantage of formal education (Cankaya & Kuzu, 2010). Several examples of using technology as a third party in therapy sessions are some animations, CD/DVDs and games. The electronic teaching software available in CD/DVDs cannot be customized for a special child (Rahman et al., 2011).

IV PRELIMINARY STUDY: QUESTIONNAIRE AND SURVEY

The Questionnaire and survey was conducted with 8 respondents which consist of 4 doctors, 2 teachers and 2 experts. The average years that they had experience with autism is 2 to 4 years. The survey was conducted by using online questionnaire. This questionnaire and survey were to investigate whether emotion understanding was really a problem to children with autism and to inspect the element of technologies preferences that are most affective to use and more suitable for children with autism. The data result from the questionnaire had been concluded as below:

![Figure 1. Three Aspect That Affected By Autism](image)

Every child with autism must have at least these three aspects in order to be diagnosed as children with autism. If in case the child only affected on communication skills but have no difficulties in social impairment and repetitive behaviour, then the child will not be considered as autistic children. These three aspects are very important to recognize the basic problem in children with autism and help find the specific goal in research. Figure 1 shows the aspect that mostly affected by children with autism. It can be concluded that communication skills and social impairment are the main problems in autism. Some of these children may have speech delay and have difficulties to mix with people around them.
Figure 2. Three Basic Criteria In Social And Communication Impairment

Figure 2 shows three basic criteria that mostly important in improving social impairment and communication skills for children with autism. Social interaction is difficulties with social relationship for example they are being indifferent to other people. Social imagination is difficulties in the development of interpersonal play and imagination for example they have a limited range of imaginative activities. Social communication is having difficulties with verbal and non-verbal communication for example they were not fully understand the meaning of common emotion recognition, facial expression or tone of voice. Figure 2 indicate that social communication is the highest problem in social and communication impairment. The children with autism lack in communicating with others because they have trouble in interpreting other’s emotion and facial expressions.

Technologies such as computer, smartphone, tablets and ipad can assist children with autism to improve their life better. Some children prefer computer and some prefer tablets, ipad and others. It is crucial to determine which technologies that children with autism prefer in order to increase their level of engagement towards the application. Figure 4 shows that ipad and tablets are among the technologies that autistic children know and like to use. All the respondents also agree that most of autistic children are more familiar to use touch screen devices rather than using operating computer mouse. This is because touch screen allow the child to navigate and interact with the computer by touching the screen thus increase their level of engagement and attention.

Figure 3. Factors That Prevent Autistic Children To Understand Emotions.

Figure 3 point out four factors regarding autistic children which have complication to understand other people’s emotion. Four respondents agree that due to mentalistic and emotional information conveyed by the eye and facial expression, children with autism often avoid eye contact and faces with others therefore prevent them from perceiving and fully understand the emotion on others. Other than that, autistic children may not find other’s facial expression intrinsically rewarding which they often interpret negative expression from other people.
Figure 5 identifies four emotion features which indicate from high rate of deficiency to low rate of deficiency. These four features are important in order to implement the features into the application. From the Figure 5, children with autism have high rate of deficiency in interpreting facial expression and people’s gesture. Thus, these two features will be a priority key that should be focuses more in order to build an effective application.

From the survey conducted and results obtained from Figure 1 to 4, it can be summarized that:
- Emotion Understanding proved to be a major drawback amongst ASD children.
- Touch screen and Tablets seem to be a favourite amongst ASD children.
- Interpreting others facial expression and people’s gesture are identified as the most difficult to be understood.

V. PRELIMINARY STUDY: INTERVIEW AND OBSERVATION

Interview and observation are one of the techniques used in the preliminary study. It was carried out in Letzhop Centre in Selayang and The National Autism Society of Malaysia (NASOM) Kuala Lumpur. The goal of this observation and interview is to gather information on the general characteristic of autistic children in the aspect of their behaviour and the attention strategies use in programs or activities.

A. Interview

The Letzhop Centre conducted an early intervention program in order to overcome the autistic children’s sensory or stimuli behaviour. The interviewees for the preliminary study consist of parent and teachers at Letzhop Centre in Selayang.

1) MrFakri

MrFakri is the owner of Letzhop Centre branched in Selayang. He is a father of an autistic child. He had a five-years experience dealing with autistic children for five years. He admits that when he found out that his daughter was diagnosed with autism, he had a denial phase. However, with the families and friends support, he overcame it and created a centre with autism care. He explained his experience with his daughter:

“My daughter is very hyperactive. She likes to climb and jump a lot. I guess she likes to be in the higher places. She would give no eye contact at all to anyone and she cannot read other people’s facial expression. When I am mad at her for climbing on the table with angry expression and high intonation voice, she does not response and continues to climb. But when I get up and walk to her with angry gesture then she stop climbing. She is weak in terms of focus and attention. She is quite sensitive with sound. She hates the sound of vacuum cleaner and often closes her ears with both her hands if she hears loud sounds.”

2) Teacher Lenny

Mrs Lenny is a teacher with 10 years experience with autistic children. She was once worked at National Autism Society of Malaysia (NASOM). She narrated that:

“Afi is an autistic child with hyperactive behaviour. He likes to play Lego toy more than anything else. There is no eye contact and he cannot talk. If he wants something, he will take my hand and show what he wants. Of course he is one of the children that cannot recognize other people’s emotion. Sometimes he talks to himself with the words that cannot be understood.”

Mrs Lenny also concluded that:

“In order to grab his attention and calm him, I showed educational videos such as Sesame Streets, Learn ABC and others. He likes to watch video and sometimes imitate the character in the videos.”

B. Observation

The Observation had been made in two areas which areLetzhop Centre Selayang and The National Autism Society of Malaysia (NASOM) Kuala Lumpur. The purpose of the observation is to observe how certain organisations run their activities with autistic children and to investigate their attention strategies. Certain organization used certain techniques in their activities suitable with children diagnosed with autism.

1) Letzhop Centre, Selayang

Letzhop Centre is also a non-profit organization that uses Early Intervention Program (EIP) for children with autism. Their interventions support the self help and behavior improvement of the children, balance their sensory stimulus depending on the children’s need which consist of seven children between 4 to 12 years old. The figure below shows the schedule activity in Letzhop Centre.

Observation had been made to observe the interest of children with autism in EIP. The first activity starts at 8.30 in the morning with the national song and Asma’ulHusna Song. The activities continued with morning exercises that involved jumping, walking, crawling, moving hand and legs with the aid of a video. This also stimulates the auditory skills as the children will move faster and slower according to the tone of music. Each of them follows their teacher’s movement. Two of them need the help of the teacher to make them move. After half an hour break, the teacher showed education videos such as sesame
streets, ABC song and cartoons. All of the children enjoyed watching the videos. They were happy, smiling, paid full attention and sometimes imitate the character in the video.

Then, the activity proceeds with one to one session where the teachers teach one by one how to write the alphabets, shapes and numbers. Most of the children did not pay much attention, does the half way work and some even cried. When the teachers instructed them to write with serious voice intonation and serious facial expression, most of the children seemed to ignore the teacher and did their own things. This session seems to be the most challenging for the teachers. The last session is the playtime where the teachers let the children play with lego, puzzles, colouring pictures and play with the clay while waiting for their parents to pick them up. Most of the children enjoy playing lego and clay because it varies in colours.

2) National Autism Society of Malaysia (NASOM)

Another observation carried out at NASOM in Taman BatuPermai in Kuala Lumpur. The centre’s aim is to equip the students with skills in baking, food preparation, laundry, housekeeping services, sewing and handicraft. Each student is given work that suits with their ability and their own skills. There were students who really like to bake and prepare food thus they will be in charge to prepare lunch. PnKartini, person in charge in NASOM, said that: “Most of the students like to sew and knit that they have produced very creative designs of knit goods as it involved many colours. They like varied colours. Products done by sewing and handicraft were then sold.”

Some student cannot talk and their communications were limited. In order to solve the communication problem, they use Picture Exchange Communication System (PECS). PECS is a form of alternative communication commonly use as an interaction aid for people with autism. They use visual card in order to understand what the non-verbal student need.

From the observation, the centre has low interaction among the students. There is one verbal student who can communicate with people but he speaks his mind with no boundaries and do not take account of what others might feel. There were 2 students aged 25 years old but act and behave like 7 years old children. They like sweets, colours, jumpy when happy, show tantrums when they did not get what they want which basically match with children behaviour.

C. Observation and Interview Outcome

The data from the preliminary study were gathered and analysed as follows:

- No specific emotion understanding session were done in any three observation centres. Emotion recognition proved to be one of the crucial aspects in social communication through literature review and questionnaire. This can be the research gap.
- A visual interactive application might help these children to understand emotion of other in an Early Intervention Program (EIP). It is important to assist children with autism to learn emotion of others in an early stage of development parallel with social skills development.
- Children with autism prefer visual interaction as a motivation for attention strategies since most of them cannot talk and cannot read. Visual is the best option for interaction, communication and attract the children’s attention. Certain elements in visual that can be pointed out:
  - Animation. In Letzhop Centre, children with autism like to watch cartoons. They paid full attention and enjoy watching the animated cartoons.
  - Picture/image. Picture and image are important as a symbol and meaning that can initiate interaction and conversation. People with autism easily process information given in pictures and text rather than text alone. In Nasom, they use PECS to understand student’s need.
  - Colours. People with autism were attracted to colours. PnKartini said before: “Most of the students like to sew and knit that they have produced a very creative designs of knit goods as it involved many colours. They attracted with varies colours.
  - Videos. In letzhop Centre, education videos session is the children’s favourite activities. They sit quietly and paid full attention to videos including those hyperactive children. Mrs Lenny

Figure 5. Picture Exchange Communication System (PECS).

http://www.kmice.cms.net.my/
mentioned in the interview before about Afi who is an hyperactive child:

“In order to grab his attention and calm him, I showed educational videos such as Sesame Streets, Learn ABC and others. He likes to watch video and sometimes imitate the character in the videos”

• Auditory. Audio brings out the information from a picture or animation presented to children with autism. However, the interest of the volume of the audio varies in these children because some prefer high and some prefer low audio. Mr Fakri narrated before about his daughter:

“She is quite sensitive with the sound. She hates the sound of vacuum cleaner and often closed her ears with both of her hands if she heard loud sounds.”

• Voice intonation. The tone of voice expresses one’s emotion. Children with autism were not sensitive not aware with other’s voice intonation. In Letzhop Centre, when the teachers instruct them to write with serious voice intonation and serious facial expression, most of the children seems to ignore do their own things. According to the interview with MrFakri:

“When I am mad at her for climbing on the table with angry expression and high intonation voice, she does not response and continues to climb.”

• Repetition. People with autism like to do thing they like repeatedly and do not get bored like other normal people. In NASOM, the students who enjoy knitting will continue to knit every day without fail. They did not get tired or bored in the thing that they do every day. Thus it is important to create consistent and repetition design in application.

VI CONCLUSION

These disorders are characterized, in varying degrees, by difficulties in social interaction, verbal and nonverbal communication and repetitive behaviors. Tanaka et. al (2012) mention that success in social interaction relies on capacity to recognize and interpret facial emotion in a social context. Thus, all the important data gathered from the preliminary study will be the features which will be embedded in the framework.

ACKNOWLEDGMENT

The authors would like to thank UniversitiTeknologi MARA (UiTM), the Research Management Institute (RMI), and Research Cluster Fund (600-RMI/DANA 5/3 (7/2012)) for sponsoring a part of this research.

REFERENCES


