DISCOVERING AUTISM CHILD POTENTIAL USING AUTISM PARENTING APPLICATION

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Abstract - Autism have become prevalent disorder among children nowadays. Parents with autism kid having higher level of stress among other parents. There is some remarkable skill in autism kid that by discovering the skill can make parents to have a better approach or better parenting toward their kid. The objective of the study is to identify the remarkable skills among autism children using qualitative method and to identify the features of suitable mobile app to help parent determine the remarkable skills using content analysis and literature review. Two main remarkable skill focusses in this study were rote memory and spatial visual. A study was carried out to produce a mobile application (prototype) for autism parents to discover their child's remarkable skills. Prototyping methodology was employed. The application is expected to help parents to discover their kid's remarkable skill.

Index Terms - Autism, parenting application, remarkable skill, rote memory, spatial visual.

I. INTRODUCTION

Autism refers to several neuro-development disorders that affect some parts of the central nervous system, particularly the way both verbal and non-verbal information is processed (Dodd, 2005). Finding in a study done in Gold Coast indicates parenting a child with Autism is associated with elevated levels of anxiety, depression and stress com-pared with normal population (Bitsika and Sharpley, 2004). Another study indicates using a strength-based approach to parents education could possibly be a tool to assist parents in coping with variety of chronic stress associated with raising a child with autism (Steiner, 2011). Autism spectrum of presentation has been characterized by qualitative behavior-al abnormalities in communication, reciprocal social interaction together with patterns of repetitive, restricted and stereotyped interest and activities and these deficits are pervasive, persistent, normally it occurs in early childhood and likely to lead to impairment in functioning across different settings (Yates and Conteur, 2016). According to Constantino and Marrus (2017), Diagnostic and Statistical Manual of Mental Disorders (DSM) 5 have include some new criteria in the diagnostic criteria a) Persistent deficits in social communication and social interaction across multiple context. b) Restricted, repetitive pattern of behavior, interests, or activities. c) Clinically significant impairment in social, occupational, or other important areas of cur-rent functioning caused by the symptoms. d) Clinically significant impairment in social, occupational, or other important areas of current functioning caused by the symptoms. e) The disturbance is not better explained by

intellectual disability (intellectual development disorder) or global development delay (social communication should be less than that expected for general developmental level).

II. STUDIES RELATED TO AUTISM STRENGTH

A. Rote Memory of Autism

According to Ozonoff (2001), in the study of examining working memory in autism have concluded that working memory is not one of the executive function that is seriously impaired in autism. Working memory has been defined as thinking skill during action, it is also a short-term memory-based model proposed by Baddeley (1986). Williams et al. (2005) done a research on verbal and spatial working memory in Autism. The research had conducted some task such as N-back Letter task, WMS-III and WRAML. The finding of the paper was no deficit in verbal working memory in high functioning children, adolescents and adult with autism using well-established and clinical test of verbal of verbal working.

Whitehouse (2006), in his research, he had included a sample of 23 children with autism and 23 comparison children with no known neurological or development disorder. The group were well-matched on verbal and non-verbal abilities, reading ability and gender. The pictures were presented on a computer screen, consecutively from left to right, and children were asked to recall the pictures in the serial order. The result shows that both groups of children used inner speech, but children with autism did not use inner

speech to the same degree.

Besides, in a study by Willams (2008) also used a picture for memory span task to investigate inner speech in children with Autism, the researcher focuses phonological similarity than length of the words, which are rather less controversial indicator of verbal coding and hence the use of inner speech to convert pictorial material into a verbal code, they also examined "visual similarity effects" to check for the stage prior to verbal coding.

WRAML (Wide Range Assessment of Memory and Learning)

According to Encyclopedia of Autism Spectrum Disorder, this is a clinically approach to evaluate memory and learning in children and adult with age range 5 to 90. In the book of Evidence-Based Assessment in Autism Spectrum Disorder has stated that this assessment has been used widely in ASD studies, the pro of this assessment is said to be well produced, well validated and evidence base used in Autism research. This Assessment is said to have 9 core tests with optional subtests, these subsets includes Finger Windows (Verbatim and Gist Measures), Design Memory, Picture, Number/Letter, Sentence memory, Story Memory, Verbal learning, Sound symbol and Visual learning (Hartman, 2007). This assessment has high reliability, internal validity and moderate external validity, therefore this assessment may be highly useful in evaluating children with learning disability and also help clarify the contribution of attention, learning and memory problem (Encyclopedia of Autism Spectrum Disorder, 2013).

In research done by Goldstein (2006), the researcher adapted WRAML in his study to evaluate the profile of memory function in Autism Spectrum Disorder. Researcher had carried out some of the sub-sets in WRAML with 38 high-functioning children with autism. The assessment were, for verbal memory scale, number and memory task in which child repeats a random mix of auditorily presented numbers and letters; a sentence memory task in which the child repeats progressively longer meaningfully sentences; Story Recall task which involves recalling details of story; Visual memory scale assesses recall of geometric designs, picture scenes and sequence; Design memory subsets re-quires the child to draw one of four designs, in picture memory subtest, the child views of complex meaningful scene, the compare with the second one and say the difference. The result was poor but there is difference between adult autism and child autism as this may due to background changes.Next, Hill et.al (2015) also used this scale for their studies to determine memory related to language among early school age children. In this study, researcher have taken two subtests from WRAML, Picture memory and Finger Window. In Picture Memory, subset involves instructing children

to look at a complex scene then look at a second and identify difference in second picture and in Finger Window, the research run a demonstration of poking a pencil eraser through a series of holes in plastic card, then researcher ask children to immediately place the finger in each hold in the same hold as the researcher. The study revealed that Autism children perform better than children with specific language impairment.

B. Visual Spatial of Autism

In previous research done by Shah& Frith (1983), researcher used Children's Embedded Figures test to identify the cognitive function in autism kid's. Re-searcher gives cardboard models with a triangle and rectangle and ask the kid to find out the hidden shape in the tent and house figure. The result of study shows autism kid have been more competent in this task than other control group and concluded the uneven ability on two factors of spatial skills specifically good orientation ability but poor visualization ability.

Followed by another research by O'Riordan & Plaisted (2001), studies on the superior visual search using Raven's CPM scale. Research carry out two different experiment and the result indicates that autism children are better than normally developing children and general ability at difficult visual search task.

According to Shakil Ahmed et.al (2016), in the research they have developed a smart communication system for the autistic and the disabled to bridge the communication gap between autism people and family member. In his research, he had visited autistic school and have identify that one way to educate autism is through visual support. Re-searcher have adopted Augmentative and Alternative Communication(AAC) for his device which help autism people to share their thought with people around and also convey visual directly into them to make autism people to understand the situation better.

Wechsler Preschool and Primary Scale in Intelligence Third Edition (WPPSI-III)

According to Encyclopedia of Autism Spectrum Disorder, this scale is used to accessing intelligence of children aged 2years to 7 years. There is number of text in this scaling method, it said to have high reliability and internal consistency. In the book of Evidence-Based Assessment in Autism Spectrum Disorder has stated that this assessment is well known, well standardized and are standardized in United Kingdom.

In Eikeseth et al. (2002), the research has used the scale to identify the treatment effectiveness in autism. After one year of Applied Behavior Ana-lytic (ABA) treatment of cognitive, WPPSI were use as one of the

test to determine the cognitive skills in term of verbal and visual aspect, the result was a large gain and the ABA treatment has been suggested to be implement in schools.

According to Rinehart et al. (2001), in their study they figure out deficit in shifting attention in high functioning autism not Asperger's disorder, they used WPPSI-R including performance subsets (picture completion and block design) to test their study and result indicates that the autism individual has slower shifting processing.

III. METHODOLOGY

This section employs Prototyping as the methodology and presents result on two analyses of the Autism Parenting App Survey. A survey is conducted in The Child (The Therapy Tree) Centre on Autism Parenting Application Survey. The survey was carried out with 16 respondents where all parents having the autism child. The questionnaire was developed in Google form and the questions was referred from (Oshu, 2015). A proposal was developed to Child Center for the visit and an interview session was carried out with The Child President to present the proposal for the visit. As for the demographic of analysis, the gender of children was 10 males and 6 females. 11 children were under age 5 and 5 of children were above 6 years.

A. Analysis of the Autism Parenting App Survey

Mobile Usage among Autism Child
In Fig. 1, mobile usage among autism kid is determined. 62.81% (10 children) uses mobile application while remaining 37.9% (6 children) do not use or maybe using mobile application to play games. Finding suggests that autism kid do play mobile games and developing a game section for them can be implemented.
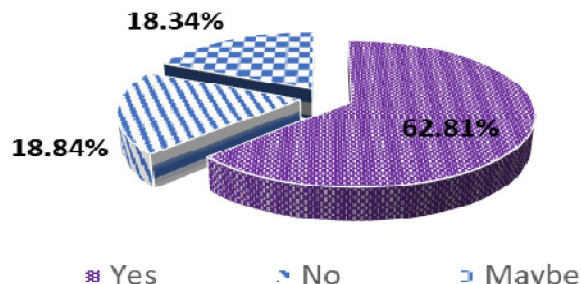

Fig. 1: Statistics on autism children playing mobile games.

B. Analysis on Awareness of Parents on Autism child's remarkable skills
In this part, Awareness of parents on remarkable skills and assumption on which skills their child is analyzed. From the survey, we can figure out that

75% (value of 12) of the parent do aware that their child has this remarkable skill and remaining 25% of parents just feel that their child maybe has the remarkable skills. This proves the literature review finding that autism child may have rote memory or spatial visual. In Fig. 2, parents also give assumption on which skill may their child have, 8 (50.7%) of them said their child may have rote memory skill from their observation and experience of their children daily activity, 43.07% of parent feels that his/her child may have spatial visual skills while only one parent (6.23%) have no idea either their child is having rote memory or spatial visual. This analysis gives a basement to the project that, there will be medium (Autism Parenting Apps), where parents can have to confirm which remarkable skill their kid have instead of assuming.

Besides, usage of mobile application by parent in educating their child also taken into consideration during the survey. 56.25% (value of 9) of them said no and the remainder of 43.75% claimed they use mobile application in educating their child as shown in Fig. 3. The analyze shows that parents do use mobile application to aid them in parenting their child.
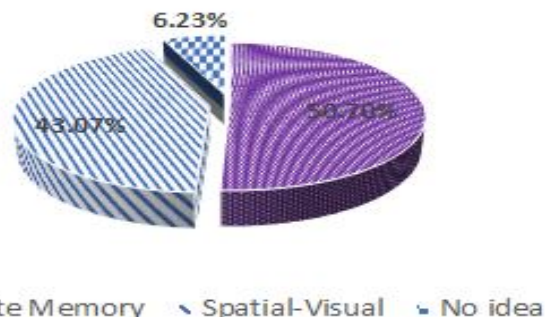

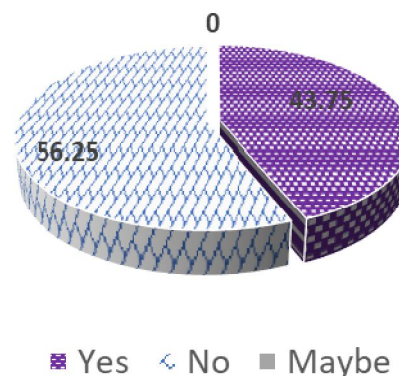**Fig. 2: Statistics on parent assumption on remarkable skills.**

Fig. 3: Statistics on mobile usage of parents in educating their child.

C. Analysis on LetMeTalk App's
LetMeTalk Apps is an app which will be released in this year is expected to assist in communication of

autism child. Majority of the respondents in Fig. 4 shows a positive feedback towards on having this application. The reason for selecting this application is that this apps offer user-friendliness and functionality of the feature is easy to use.
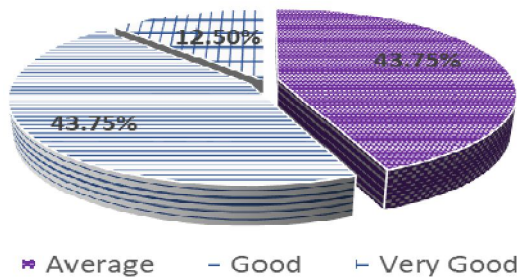
Opinion on Apps

Fig. 4: Statistics on opinion apps.

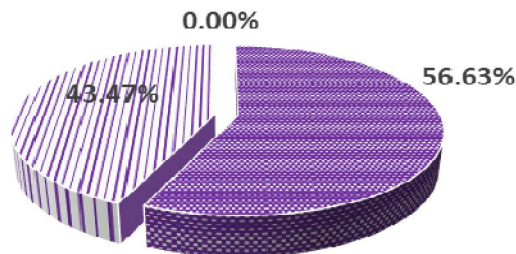## Usage of App's in Educating Child

Fig. 5: Statistics on usage of app's in educating child.

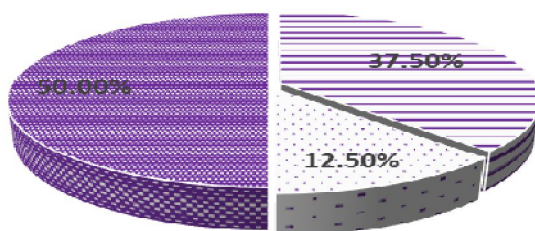## Does the App's Application Helps in Determining Remarkable Skills

Fig. 6: Statistics on finding whether the application helps in determining remarkable skills.

Fig. 4 analyses feedback about the suggested application. Overall 43.75% (value of 7) of respondent felt the apps was good, 43.75 % prefer the application is average and 12.5% (2 respondents) have chosen that this application is very good. This analyze give the idea of inserting this feature in the projects suggestion module. Furthermore, survey was also conducted by breaking down into feature, such as educating child, determine remarkable skills and information exchange their view. For educating child 56.63% (Fig. 5) of parents felt the application fulfil this feature, while for determining remarkable skill only 37.50% (Fig. 6) of parents felt this feature is

fulfil and for information exchange only 43.75% (Fig. 7) of parents said yes. Overall, they still felt this application is more to educating their kid. This section suggests that the features of the application is limited, it does not let parents to exchange view, does not give real idea of which remarkable skill their child have and the application focus on only educating children. There is a need for application with more features to help parents.
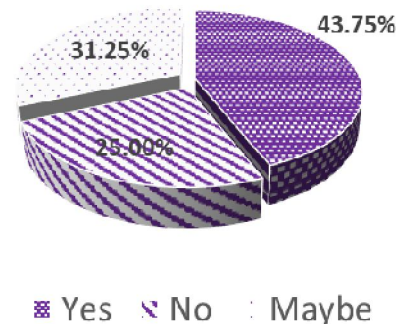
Does the application allows user to exchange views?

Fig. 7: Statistics on finding whether the application allows user to exchange views.

D. Analyze of Autism Parenting Apps development

This section investigates more on opinion and willingness of parent to use the upcoming application. 75.50% of parents are willing to use the new application where they prefer to use mobile application to determine their child's remarkable skills as shown in Fig. 8. In addition, majority of parents (68.75) prefer the application to be developed in English language as illustrated in Fig. 9. From this analysis, the parents encourage this project to be carried out as there is very less local people who developed autism application and some applications need to be purchased. They prefer this application to be designed in English or in bilingual language.

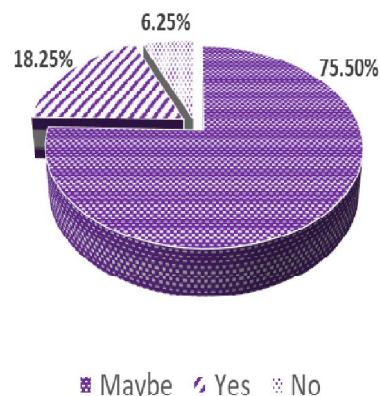## Would you like to use an application to determine child's remarkable skills

Fig. 8: Statistics on finding the application usage to determine child's remarkable skills.
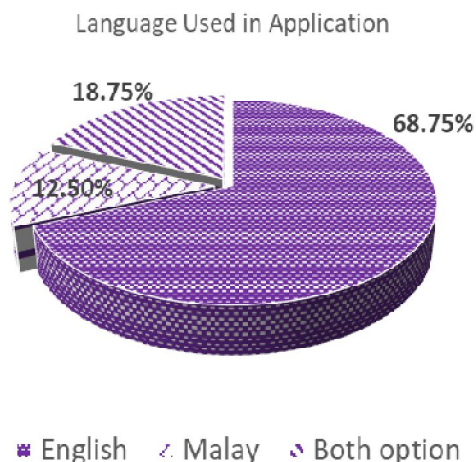
Fig. 9: Statistics on finding the most preferred language used for that application.

CONCLUSION

A study was carried out to produce a prototype mobile application for autism parents to discover their child's remarkable skills. Prototyping methodology was employed and the autism parenting apps is expected to help parents to discover their kid's remarkable skill. This proposed app highlights the important of extracting the hidden talent or strength by the autism kids. For the future development, implementation on mobile application which discovering the potential of autism child will be carried out and tested.

REFERENCES

[1] American Psychiatric Association. "The Diagnostic and Statistical Manual of Mental Disorder," (DSM-5), Fifth Edition, 2000.

[2] Baddley & Hitch, "Working Memory" University of Striling, Stiling, Scotland, 1974.

[3] Baker. "Incorporating the Thematic Ritualistic Behaviors of Children with Autism into Games: In-creasing Social Play Interaction with Siblings." Journal of Positive Behavior Interventions, vol. 2(26), pp. 64-84, 2000.

[4] Bellini & McConnell. "Strength-Based Educational Programming for Students with Autism Spectrum Disorders: A Case for Video Self Modelling. Preventing School Failure: Alternative Education for Children and Youth," 54:4, pp. 220-227, 2010.

[5] Berube, "Autism and the Artistic Imagination: The Link Between Visual Thinking and Intelligence", Journal on Teaching Exceptional Children Plus, vol. 3(5), May 2007.

[6] Capal, Horn, Murray, Byars. A, Bing, Kent, "Utility of the Autism Observation Scale for Infants in Early Identification of Autism in Tuberous Sclerosis Complex" Pediatric Neurology, vol. 75, pp. 80-86, Oct 2017.

[7] Constantino and Marrus, "The Early Origin of Autism. Child Adolescent Psychiatric Clinal," pp. 555-570. 2017.

[8] Davis & Carter. Parenting Stress in Mothers and Fathers of Toddlers with Autism Spectrum Disorders: Associations with Child Characteristics, Vol. 38, pp. 1278-1291, 2008.

[9] Dumas, Wolf, Fisman and Culligan, "Parenting Stress, Child Behavior problems, and dysphoria in parents of children with autism, down syndrome, behavior disorder and normal development," Exceptionality: A Special Education Journal, vol. 2(2), pp. 97-110, 1991.

[10] Eisenberg, "Therapies for Children with Autism Spectrum Disorder: A Review of the Research for Parents and Caregives," Agency for Healthcare Research and Quality (AHRQ) and the Effective Health Care Program, 2014.

[11] Gau, Chou, Lee, Wong, Chou, Chern, Soong and Wu, "Behavioral problems and parenting style among Taiwanese children with autism and their siblings," Psychiatry and Clinical Neuroscience, pp. 70-78, 2010.

[12] Govardhan & Nabil Munassar, "Comparison Be-tween Five Models of Software Engineering," IJCSI International Journal of Computer Science Issues, vol. 7, pp. 1694-0814, 2010.

[13] He, Guo, Wang, Chen, Li and Zheng, "Socioeconomic status and childhood autism: A population-based studying China," Psychiatry Research, 2017.

[14] Health Council of the Netherlands, "Autism Spec-trum Disorder: A lifetime of difference. The Hague: Health Council of the Netherlands," 2009.

[15] Ingersoll and Schreibman, "Teaching Reciprocal Imitation Skills to Young Children with Autism Using a Naturalistic Behavioral Approach: Effect on Language, Pretend Play, and Joint Attention," Journal of Autism and Development Disorder, vol. 36, 2017.

[16] Jama, Prevalence, Severity, and Unmet "Need for Treatment of Mental Disorders in the World Health Organization World Mental Health Surveys," vol. 291(21), pp. 2581-2590, 2004.

[17] Kasari and Sigman, "Linking Parental Perceptions to Interactions in Young Children with Autism," Journal of Autism and Development Disorder. vol 27(1), pp. 39-57, 1997.

[18] Lau, Peterson, Attwood, Garnett and Kelly, Parents on the Autism Continuum: Links with parenting efficacy, 2016.

[19] Turkington & Anan, "Encyclopedia of Autism Spectrum Disorder. Springer Science New York," 2007.

[20] Liu, Conn, Sarkar & Stone, "Physiology-based affect recognition for computer-assisted intervention of children with Autism Spectrum Disorder," 2008.

[21] Mason, "Qualitative Researching," 2nd edition, Sage Publications, 2002.

[22] Moscovitch, "Memory and Working-with-Memory A Component Process Model Based on Modules and Central Systems," Journal of Cognitive Neuroscience, vol. 4 1992.

[23] Neik, Lee, Low, Chia and Chua, "Prevalence, Diagnosis, Treatment and Research on Autism Spectrum Disorders (ASD) In Singapore and Malaysia," International Journal of Special Education, vol. 29, 2014.

[24] Newschaffer, Falb & Gurney, "National Autism Prevalence Trends from United States," Special Education Data. Pediatrics, vol. 115, p.p 2004-1958, 2005.

[25] Ornitz and Ritvo, "The Syndrome of Autism: A Critical Review," The American Journal of Psychiatry, vol. 133(6), 1976.

[26] Ozonoff, South and Miller, "DSM-IV-defined Asperger syndrome: cognitive, behavioral and early history differentiation from high functioning autism," The National Autistic Society, vol 4, 2000.

[27] Pottie and Ingram, "Daily Stress, Coping and Well-Being in Parents with Autism: A Multilevel Modelling Approach. Journal of Family and Psychology," vol. 22, p.p 855-864, 2008.

[28] Rutgers, Ijzendoorn, Kranenburg, Swinkels, Daalen, Dietz, Naber, Buitelaar. J and Eugeland, "Autism, Attachment and Parenting: A Comparison of Children with Au-tism Spetrum Disorder, Mental Retardation, Language Disorder, and Non-Clinical Children," vol. 35, p.p 859-870, 2007.

[29] Shalom, "Memory in Autism: Review and Synthesis. Zlotowski Center for Neuroscience," Ben Gurion University of the Negrev, 2003.

[30] Sheinkop and Siegel "Home-Based Behavioural Treatment of Young Chidren with Autism," Journal of Au-tism and Development Disorder, vol. 28, 1998.

[31] Shirley Angie, Amily Fikry, Zulhadbri Ismail & Norashikin, "Work-Family Conflict among Working Parents of Children with Autism in Malaysia," IEEE Int. Symposium on Robotics and Intelligent Sen-sors, IRIS, 2016.

[32] Silva and Schalock, "Autism Parenting Stress Index: Initial Psychometric Evidence," vol. 42, pp. 566-574, 2012.

[33] Simpson, "Evidence-Based Practices and Students with Autism Spectrum Disorders," Focus on Autism and other Developmental Disabilities, vol. 20, pp. 140-149, 2005.

[34] Solari, Grimm, Mcintyre, Swain-Lerro, Zajic, Mundy, "The relation between text reading fluency and reading comprehension for student with autism spectrum disorders," Research in Autism Spectrum Disorders, pp. 41-42, 2017.

[35] Steiner, "A Strength-Based Approach to Parent Edu-cation for Children with Autism," Journal of Positive Behavior Intervention, vol. 13(3), p.p 178-190, 2011.

[36] Syamimi, Hanafiah, Luthffi Ismail, Fazah Akhtar, Salina and Hanizah Ali Piah, "Initial   Response of Au-tistic Children in Human Robot Interaction Therapy with Humanoid Robot NAO," IEEE 8th Int. Colloquium on Signal Processing and Its Application, 2012.

[37] Williams, Goldstein and Minshew, "The profile of Memory Function in Children with Autism," American Psychological Association, vol. 20, 2006.

[38] Wolff, "The history of Autism. Europe Child Adolsec Psychiatry," vol. 13, pp. 201-208, 2004.

[39] Wu, An, Tseng, Chen, Chan, Cho and Tsai, "Fear of being laughed at with relation to parent attachment in individuals with autism," Research in Autism Spectrum Disorder, 2014.

[40] Yates and Conteur, "Diagnosing autism/autism spectrum disorder," Pediatrics and Child Health, 2016.

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