

Early Stage in Identifying Autism Spectrum Disorder (ASD) Through Screening and Diagnosis

Che Ku Nuraini Che Ku Mohd, Helmi Adly Mohd Noor, Faaizah Shahbodin, Suriawati Suparjoh, Aliza Che Amran

Abstract –The objective of the paper was to evaluate developed screening tools on autism students' as early detection detect early signs especially on visual for ASD children. The outcomes of early intervention in ASD can be improved but it depends types of the treatment. Method of collecting data was using tool, observation and interview. In design, flowchart and storyboard are produced. While in development stage, learning media and materials are presented with visualization in the form of sound, text, videos and pictures. The results of this study are a positive score and feedback from children with ASD. They are easy to focus in using this tool instead of conventional screening tool. The students really attract to something that related to technology. However, the suggestion of a screening for ASD when concerning from their parents or family. The quality of the instruments and screening procedure are the challenges faced during the process. The advantages of early screening and detection among ASD is very to avoid parents unnecessary worry among parents.

Keywords - Autism Tool, Serious Games, Visual Perception, Screening, Technology.

I. INTRODUCTION

Autism is a developmental disorder that affects an individual's communication and social interaction which called Autism Spectrum Disorder (ASD). The people with ASD have restricted repetitive behavior, activities and interests. Their spectrum for these characteristics is ranging from mild to severe. In other to perform their daily activities, the individual may be will have the symptoms that impair her or his ability. Besides that, for any functional impairments, the individual may have mildly noticeable differences. In United States, 1 in every 59 children are affected by autism spectrum

disorders (ASD) [1]. In order to improve the outcomes, having an early treatment will help and greatly improve patients and guardian functional independence [2][9][10]. However, early ASD presentations are heterogeneous. The early signs of having ASD are the

differences in cognitive abilities and language. Based on the study literature the levels of social attention and interaction and enhanced repetitive behaviors can be decreased. That is the indicators within the first two years of life [11]. The professionals such as pediatricians and clinicians who can see in a routine that the children are well trained in during screening and detection procedure. They are very familiar with the signs and symptoms of autism with community resources, educational, developmental and medical clinics [3][5][7]. However, when making referral decisions there are no existing research regarding early childhood professionals. Some of parents are concerning about the evidence of screening and observations.

It is thought that early childhood professionals reference choices are a significant area for studies because they are able to observe symptoms and to decide on original references. Since early identification are complicated, so the decision factors and processes are very important regarding referrals deserves greater scrutiny. To identify a large gap in the knowledge of early childhood workers, the literature has been thoroughly searched for a thorough autism assessment. Current exercise in autism referrals decision-making to improve understanding. Early childhood professionals from all fields were asked to create judgements based on findings on autism danger. They will ask if a children had early indications of autism and required a referral for further evaluation or not. Video assessments are carried out for children with and without autism. They are focused possibilities for observing limited repetitive behaviors.

The age of 24 months was diagnosed with most autism. Unfortunately, the majority of autism kids are not thoroughly evaluated until after 36 months of age. There is nevertheless no normal method or method, even if there are many possible explanations for delayed assessments. By finding an important gap in the knowledge of early infancy experts, you can make an extensive autism assessment search for the literature. Typically, autistic children are diagnosed before 3 years of age. Autism was not considered a distinct disorder using the manual of psychiatric diagnosis to be biologically

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based until the 1980s. This review offers an extensive literature study on ASD by focusing on researchers in the Gulf region. In Arab countries, for instance, evaluation and therapy could eventually be improved.

II. AIMS

The aim of the present study was to evaluate developed screening tools on autism students' as early detection detect early signs especially on visual impairment. Children identified by ASD should be referred with doctors or clinicians for screening and diagnostic assessment.

III. EARLY STAGE IN IDENTIFYING ASD

Parents are become concerned about their children's development. They will see and make an appointment with pediatricians or clinicians are often the first contact. Basically, the pediatricians or clinicians will ask the questions about the children's development during your first visit. Parents at that moment often shared and concerned about their worries. Pediatric patients display ASD during 18 and 24 months and, as suggested in the American Academy of Pediatrics (AAP), a parent at any moment increases concerns. Pediatricians will ask the parent questions to assess their child's progress toward typical milestones. Modified Checklist for Autism in Toddlers (M-CHAT) or the Childhood Autism Rating Scale (CARS) will be utilized of the commonly used screening instruments for ASD. In order to determine if a reason to be worried and referred, a pediatrician should take into account the reactions of the parents on the screening tool. If a screening shows a number of red flags, the child's pediatrician shall recommend or propose participating in multidisciplinary evaluations. While the original diagnostic testing does not result, useful data for parents can be provided. Table 1 shows the developmental milestones for children.

Table- I: Developmental Milestones

By 12 months, most children will:	<ul style="list-style-type: none"> • When calling their name should respond or telling "no" • Use basic gestures like waving and pointing • Imitate simple actions like clapping
By 24 months, most children will:	<ul style="list-style-type: none"> • Use 2-4 words phrases such as "want juice" • Identify many different objects • Enjoy playing with other children
By 36 months, most children will:	<ul style="list-style-type: none"> • Speak in 4-5 words sentences • Follow complex instructions • Play imaginatively with a variety of toys

Source: *The Centers for Disease Control and Prevention (CDC) (2014)*

IV. SCREENING

Screening refers to the recognition of certain developmental and behavioral signs and symptoms that may be cause for concern to the caregiver or physician while the diagnostic assessment establishes if those concerns can be attributed to either ASD or a different cause. Early detection enables early intervention for better outcome. So, screening for ASD is very important. Parent should aware with the development of their children. During screening of individual or children for ASD, there are three reviews or checklist that will look into. The reviews are Checklist for Autism in Toddlers (CHAT), Modified Checklist for Autism in Toddlers (MCHAT) and Social Communication

Questionnaire (SCQ) are performed better in the screening. The small sample sized were inadequate during primary studies. When having large size, it will give negative results between screening and diagnosis because the doctors or clinicians did not follow up with the children. Any use of screening tests may delay correct diagnosis and can cause unnecessary parental anxiety. False positive or false negative results should be aware which is important. Further assessment and referral should be made on clinical grounds based on ultimate decision.

Screening is also can be defined as a formal, brief and standardized evaluation. Normal patterns of development are used to identify any unsuspected deviations. Concerns or conditions that may not be readily apparent without screening can be detected using screening instrument. It enables to determine whether further research does not usually offer a diagnosis. Clinicians with unique pediatric development knowledge need, for instance, to carry out screening and diagnostic assessment [2]. The standard screening tests can be regarded together with a clinical judgement in order to produce efficient screening outcomes.

According to American Academy of Pediatrics (AAP) in 2007, it gains attention regarding the issue of screening young children for autism spectrum disorders (ASDs). Before adopting screening tests, certain standard criteria and clinical practice should be met. In order to confirm disease weather, it is suspected or not, the screening should signify looking for disease in persons without symptoms and should not be confused with diagnosis. A screening test should be easy, safe, acceptable and accurate. Most cases of disease with minimal false-positive results should be detected.

Early detection in the asymptomatic patient leads to improve the effectiveness of proven treatment. The outcomes of clinical very important compared with later detection when the condition manifests and the patient is symptomatic. Patients should also outweigh the harms that can accrue to other patients that benefits from detecting the condition. Example of harms such as unnecessary workups, false-positive results, adverse effects of treatments and lost opportunities for more meaningful interventions.

ASD can be identified at or under 18 months of age. A proven professional can be very reliable for the screening and diagnosis at the age of 24 months. However, a lot of children do not receive a final diagnosis until much older. Screening is a brief test to see the growth of kids. It is important to teach the children's in learning some basic skills or they might have delays. Some questions may be asked by the doctor. Doctor may talk or play with children. During the screening process, the doctor will see the way she moves, learns, speaks and behaves. By having a screening, it helps the development delays of the children. The parents should follow up with the doctor regarding your children's health immediately if you think something is wrong even though it is a positive screening result.

A. Modified Checklist for Autism in Toddlers

A 23-point questionnaire Modified Checklist for Autism in Toddlers (MCHAT) autism checklist for kids aged between 18 and 24 months. A 23-point questionnaire. For the local use in healthcare centers in Malaysia, the MCHAT Questionnaire has begun in Malay and Chinese. On the basis of this, 98% MCHAT and a sub-set of 3.5 years old kids in a 100% awareness were recorded. Based on the results, 98% MCHAT and a subsequent survey of 3.5 years-old children were recorded in a 100 percent awareness. In a latest assessment, awareness and specificity have been identified in the range of 70% to 92%, 27% to 43%, and 5.8% to 76%. In kids aged 24 months and 18 months, MCHAT is also better at identifying autism. In early intervention program centers, high-risk individuals versus low-risk group in routine child clinics.

B. Social Communication Questionnaire (SCQ)

Social Communication Questionnaire (SCQ) is a parent questionnaire for children over four years old. Social Communication Questionnaire The possible autism or other ASDs are assessed in elements such as language, social interaction and communication and stereotype behaviors. In people over seven years, SCQ was better at identifying ASD. It includes sensitivity between 86% and 90% and specificity between 78% and 86%. Their awareness is 47% to 54% and their specialty is 89% to 92% compared to children between the years 2 and 3 years old.

C. Other Screening Tools

Below is the list of other screening tools:

- Checklist for Autism in Toddlers for Chinese Children (CHAT-23)
- Asperger Syndrome Diagnostic Scale (ASDS)
- Child Behaviour Checklist (CBCL)
- Social Responsiveness Scale (SRS)
- Modified Checklist for Autism in Toddlers, Revised with Follow-up17
- Gilliam Autism Rating Scale / Gilliam Autism Rating Scale Second Edition (GARS /GARS-2)
- Checklist for Autism in Toddlers (CHAT) 12
- Autism Spectrum Screening Questionnaire (ASSQ)

V. TREATMENT

In order to get the best outcome, prompt intervention and early diagnosis of children with ASD is crucial. This is very important in recognizing and initiating early referral to optimize the children's potential must be emphasized. A team composed of children with ASD should be managed:

- teachers
- psychiatrist/child and adolescent psychiatrist
- clinical/educational psychologist/counsellor
- pediatrician
- social welfare officer
- family medicine specialist
- occupational therapist
- speech-language therapist
- educational officers

VI. RESULTS AND DISCUSSION

In this study, a screening tool was developed to test a visual perception screening tool called Vi-Per Games. There are five phases which according based on ADDIE model. The phases stand for Analysis, Design, Development, Implementation and Evaluation. In creating and developing multimedia products, ADDIE model is used to guide through the process. Games developed namely as Visual Perception Games or Vi-Per Games. In order to ensure the effectiveness of the game, the phase such as testing, decisions and iteration. Figure 1 shows a Diagnostic Report Scoring. Student cannot skip the level of the games. Student needs to complete level by level for each game. Once students have finished their matches they will be shown with visual diagnostic outcomes. The report will propose recovery activities for each type of observation.

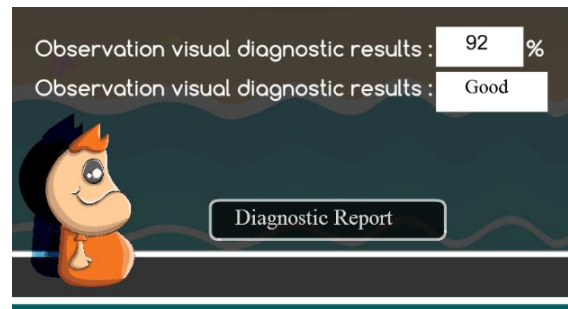


Fig. 1. Diagnostic Report Scoring

The Vi-Per Games student information interface is illustrated in Figure 2. It shows the games reports and diagnostic test reports for visual observation. In terms of skills, games name, types of observation, marks and level the report will be summarized.



Fig.2. Vi-Per Games Student Information Interface

It was noted that there is often unsatisfactory value in discrimination between ASD and Non-ASD in the child group with an atypical growth of available screening instruments based on parent observation abilities [11]. There is often unsatisfactory value to current screening devices based on parent observation skills. A short and simple to manage instrument evaluation for use in the primary health care scheme remains necessary, although some suitable test instruments have been created for early identification of ASD. In order to be time efficient, simple to administer and appropriate for kids under 3 years of age, the study team has created an Observation Scale for Autism (OSA) [8].

Early Stage in Identifying Autism Spectrum Disorder (ASD) Through Screening and Diagnosis

It was intended to provide cultural, linguistic and social backgrounds. The need was significant because in Malmo, a multicultural town, the diagnostic instrument should be used. During the current 30-month period, the tool was created. In addition, all kids were provided with a follow-up program at Swedish Child Health Care (CHC). It is proposed that kids with ASD should be discriminated against by kids with normal growth and by kids with Down's syndrome. The findings were based on an OSA pilot research [4]. The group was included to evaluate the performance of the OSA in a group of children with developmental delay.

VII. CONCLUSIONS

The experts always work closely together with patients and relatives in some of the leading Autism Centre. Efforts to enhance the quality of life and health are very essential. Besides that, the guidelines of the treatment for healthcare should be provided for those individual that having autism [6]. In order sharing expertise and experience, a lot of efforts taken for autism which is including autism medical education and teleconferencing programs [8]. Early testing and diagnosis may have an enormous effect on the life of kids and their relatives with autism (ASD). It's not always simple to make an ASD diagnosis. This is because, there is no lab test for autism children. The doctors or clinicians will rely through observing the behaviors of children and listening to the concerns of their parents or guardians. There are a very wide range of symptoms of ASD. Some people who are on the spectrum have severe disabilities as well especially for mental. Some of them are able to live independently and highly intelligent. Autism diagnosis is a two-stage process and it starts with pediatrician to determine your children falls on which spectrum. In developing a screening system, the awareness among parents and guardians regarding their children's development are important. A well-designed screening scheme should work for kids without suspicion of any high-demand abnormalities. To conclude, early ASD screening and detection offer many benefits. It can decrease the risk of beneficial outcomes that cause unnecessary concern for parents.

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REFERENCES

1. Baio, J., Wiggins, L., Christensen, D., Maenner, M., Daniels, J., Warren, Z., Kurzius-Spencer, M. Prevalence of autism spectrum disorder among children aged 8 years - Autism and developmental disabilities monitoring network, 11 sites, United States, 2014. *Morbidity and Mortality Weekly Report Surveillance Summaries*, 2018. 67,1-23.
2. Dawson, G., & Burner, K. Behavioral interventions in children and adolescents with autism spectrum disorder: A review of recent findings. *Current Opinion in Pediatrics*, 2011. 23(6), 616 - 620.
3. Filipek, P., Accardo, P., Ashwal, S., Baranek, G., Cook, E., Dawson, G., Volkmar, F. Practice parameter: Screening and diagnosis of autism: Report of the quality standards subcommittee of the American

Academy of Neurology and the Child Neurology Society. *Neurology*, 2000. 55(4), 468-479.

4. Haglund N, Dahlgren SO, Källén K, Gustafsson P, Råstam M. The Observation Scale for Autism (OSA): A New Screening Method to Detect Autism Spectrum Disorder before Age Three Years. *Intellect Disable Deign J*. 2015; 3: 230-237.
5. Johnson CP, Myers SM. American Academy of Pediatrics Council on Children with Disabilities. Identification and evaluation of children with autism spectrum disorders. *Pediatrics*. 2007; 120:1183.
6. Mazurek MO Vasa RA, Mahajan R. Assessment and treatment of anxiety in youth with autism spectrum disorders. *Pediatrics*. 2017. 137:S115-23.
7. Nadel, S., & Poss, J. Early detection of autism spectrum disorders: Screening between 12 and 24 months of age. *Journal of American Academy of Nurse Practitioners*, 2007. 19, 408-417.
8. Robins DL. Screening for autism spectrum disorders in primary care settings. *Autism*. 2008. 12: 537-556.
9. Rogers, S. J., & Vismara, L. A. Evidence-based comprehensive treatments for early autism. *Journal of Clinical Child and Adolescent Psychology*, 2008. 37(1), 8-38.
10. Warren, Z., McPheeters, M. L., Sathe, N., Foss-Feig, J. H., Glasser, A., & Veenstra-Vanderweele, J. A systematic review of early intensive intervention for autism spectrum disorders. 2011. *Pediatrics*, 127(5), e1303-1311.
11. Zwaigenbaum, L., Bauman, M., Choueiri, C., Fein, D., & Karr, S. Early identification and interventions for autism spectrum disorder: Executive summary. 2015. *Pediatrics*, 136(S1), S1-S9.

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