International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 01, 2020
ISSN: 1475-7192

Autism Kits App: Interactive Mobile Game for Visual Impairment among Autism Spectrum Disorder

Che Ku Nuraini Che Ku Mohd, Faaizah Shahbodin,
Helmi Adly Mohd Noor, Suriawati Suparjoh and
Gede Pramudya Ananta

Abstract--- *The objective of this study is to report on the development of an Android based application using serious games technique. Autism Kits is a developed mobile application which will act as a learning-based application for autism spectrum disorder. ADDIE methodology has been applied in the development. The testing has been conducted to participants which consist of autism students, teachers and parents. A survey has been conducted after they have gone through the application. Results have shown that the teachers and parents are willing to use the application for autism student and the usage of mobile phones will benefit children with autism.*

Keywords--- *Android Application, Autism Tool, Serious Games, Visual Perception.*

I. INTRODUCTION

Approximately 52 million cases of autism spectrum disorder (ASD) have been reported globally (Baxter et al., 2015). It was estimated that 1 in 150 children has been diagnosed with Autism Spectrum Disorder (ASD) (NASM, 2013). Then, the rate of ASD prevalence rose up to 1 in every 110 children in the year 2009 and doubled in the year 2013. The causes of autism are still poorly understood (Noor, 2019). In Malaysia, a developing, middle income country with a multi-ethnic population comprised of three ethnicities as well as indigenous tribes, very limited awareness and support resources for raising a child with ASD are available (Clark et al., 2012; Neik et al., 2014; Toran, 2011).

Given the limited ASD research in South-East Asia and in particular Malaysia, researchers have noted that there is a tremendous need for more investigation (Clark et al., 2012; Golden & Liaw, 2015; Ilias et al., 2008; Neik et al., 2014). The Ministry of Health Malaysia (2011) has urged that more studies be conducted on children with disability and their caregivers. Construction of a national autism centre, Permata

Kurnia, was recently completed, and study findings could inform policy development. In Malaysia, autism is still not clear to what extent the general public is informed about this disorder. The people seems to lack good information or experience with individuals with ASD (Dolah et al., 2011) although autism term has gained much attention in the media. A lack of knowledge can lead to the negative attitudes towards autistic individuals and families. The problems such as emotions, behaviors, thoughts and other of parents (Jiar, & Xi, 2012) will contribute

Che Ku Nuraini Che Ku Mohd, Centre for Research and Innovation Management, Universiti Teknikal Malaysia Melaka, Durian Tunggal, Malaysia. E-mail: cknuraini@utem.edu.my
Faaizah Shahbodin, Universiti Teknikal Malaysia Melaka (UTeM), Melaka, Malaysia.
Helmi Adly Mohd Noor, Technical Foundation Section, Universiti Kuala Lumpur, Johor Bharu, Malaysia. E-mail: helmiadly@unikl.edu.my
Suriawati Suparjoh, Senior Lecturer in the Department of Intelligent Computing & Analytics.
Gede Pramudya Ananta, Universiti Teknikal Malaysia Melaka (UTeM), Melaka, Malaysia.

DOI: 10.37200/IJPR/V24I1/PR200164
Received: 15 Nov 2019 | Revised: 20 Dec 2019 | Accepted: 05 Jan 2020

to the higher levels of stress and distress in the family especially mothers can be affected for anything happens to their autistic children (Shamsudin, & Rahman, 2014).

Autism is a developmental disorder characterized by troubles with social interaction and communication, and by restricted and repetitive behavior. Autism spectrum disorders (ASD) are characterized by social-interaction difficulties, communication challenges and a tendency to engage in repetitive behaviors. Parents usually notice signs in the first two or three years of their child's life. These signs often develop gradually, though some children with autism reach their developmental milestones at a normal pace and then worsen. Autism developmental disabilities represent a serious challenge, not only to the individuals diagnosed with autism, but also to the family which is lifelong (Norhidayah et al., 2018).

Challenging behaviors represent some of the most concerning and stressful features of autism. These behaviors can often cause harm or damage, family and staff stress, isolation, and caregiver burnout. Autism is categorized as a pervasive, life-long developmental disorder in which the child affected experiences severe and pervasive impairment in several areas of development (Camarata, 2014). The initial awareness of ASD individuals' social-communicative abnormalities, often manifested behaviorally, usually starts relatively early at their infant stage though the exact onset of autism greatly varies among individuals (Chin et al., 2019). According to chairman of National Autism Society of Malaysia (The Star, 2017), autism should no longer be considered a rare disease, instead it should be recognised as a developmental disability that needed urgent support. Autism spectrum disorder specific knowledge deficits contribute to current disparities in the timing and quality of autism spectrum disorder services throughout Malaysia and globally. Information about ASD is conveyed not only through scientific journals, but also through mass media such as television, films, blogs, advocacy websites, newspapers, and word-of-mouth (Bain et al. 2009), which can be used to aggressively educate the people about the autistic child and their characteristics (Shamsudin & Rahman , 2014).

There are three main characteristics of autistic children: impairment with social interaction, impairment in communication and the presence of restricted, repetitive and stereotypical patterns of behavior (WHO, 2013). According to children with autism are experiencing in language ability which make them hard to express what they need. Therefore, it is essential to help these children in creating their relational abilities (Gudu, 2015). According to (Voorn & Kommers, 2013), autistic children have difficulties with abstract concepts and have greater ability to learn by rote than symbolism and analogy.

II. CHARACTERISTIC OF VISUAL IMPAIRMENT

The visual perception dysfunction affects the school function skills in autism especially in handwriting, reading, fixation with the object and maintaining eye contact (Jayachandran et al., 2015). Based on the early studies reported that foundation of visual perception and imitation linked to school performance of autism, but limited studies conducted in this area (Milne & Griffiths, 2007; Nurul et al., 2014). Social processes are shaped in the first year of a child's life and eye contact is the basic function in their development. Lack of direct stimulation of blind children may result in establishing improper behaviors, such as atypical movement of arms, wobbling, putting their fingers into their eyes etc. Negative experience associated with social contacts or their lack may lead to low self-esteem,

DOI: 10.37200/IJPR/V24I1/PR200164
Received: 15 Nov 2019 | Revised: 20 Dec 2019 | Accepted: 05 Jan 2020

social immaturity, egocentrism, shyness, isolation, passivity, withdrawal and dependence (Smith 2011; Celeste 2010; Celeste 2006; Magdalena 2003). Lack of social contacts in childhood and the inability to read non-verbal communications by children with visual impairment may be the reason why such children have difficulties in understanding social behaviors, in assuming assertive attitudes, in remaining calm and reasonable when playing with their peers (Smith, 2011 & Papadopoulos, 2011). Children learn about the daily living activities by imitation and use their motor skills to perform them. Due to the lack or limited verbal communication children with visual impairment can only perform 44% out of 101 daily living activities on their own and show delays in acquiring basic skills, such as walking, washing, eating (Papadopoulos, 2011 & Lewis. 2002). Children with poor eyesight or blind children play with the symbolic toys. Due to a limitation of their mobility and spatial orientation, children with visual impairment are less likely to change places and toys while playing compared to children with no disabilities. Another characteristic phenomenon in children with visual impairment is echolalia, which is associated with an increased acoustic sensitivity (Brambring, 2011).

However there is still much to be done to improve the general social understanding of ASDs even though the people knowledge regarding autism has increased in recent years (Martin, 2012). Yet, there is a big lack of knowledge about autism in Malaysia (Dolah et al., 2011) and something needs to be done to raise this knowledge concerning ASD among individuals outside of the education sphere (Dolah et al., 2011; William et al., 2011) because many individuals remain to be unaware about signs of threatening concerning the disorder or disregard these early signs of threatening before taking action (CDC, 2014). Hence because of lack of education in Malaysia to see those with autism from mentally ill or special-needs individuals (Shamsudin & Rahman, 2014), the autistic children be view similar as an ordinary people. In fact, more general public do not actually identify the specific characteristics of children with autism (Shamsudin, & Rahman, 2014). Therefore, general public who could not understand often perceive these children as selfish, slow and odd (Dolah et al., 2011) and some of them think autism is similar to hyperactive children (Shamsudin, & Rahman, 2014).

III. OBJECTIVE

The objective of the study to develop android based on visual impairment for autism students' as early detection detect tool using serious games. Serious games for education were designed to help teacher or student during the teaching and learning process (Marylene et al., 2016). Even though there are many of autism studies were conducted by various researchers, but most have focused only on autistic children and families of the children with autism.

IV. METHOD

A. Ethics

The data are kept confidential for the purpose of this study with no access to public.

B. Procedure

The data was collected by employing the quantitative method and the opinions of the sample population were gathered using a questionnaire.

DOI: 10.37200/IJPR/V24I1/PR200164
Received: 15 Nov 2019 | Revised: 20 Dec 2019 | Accepted: 05 Jan 2020

C. Respondents

The main participants were a group of five (5) special education teachers who participated in the study. Ten (10) autistic students from special education class were those from the experiment group and control group who participated in the pre-test and post-test procedures. The sample of students were provided by SEAMEO SEN Melaka Malaysia and the testing conducted at computer lab.

D. Instrument

The instrument used such as mobile apps for the experiment in this study.

V. Development of Android Based

The development of the Autism Kits apps involved five fundamental phases including Analysis, Design, Development, Implementation and Evaluation (ADDIE). There are five (5) main modules in Vi-Per Games which are i)Game 1: Let's Go Fishing 1 (*Visual Discrimination*), ii) Game 2: Let's Go Fishing 2 (*Spatial Relationship*), iii) Game 3: Let's Go Fishing 3 (*Form Constantly*), iv)Game 4: Let's Go on a Safari (*Form Visual Memory*) and v)Game 5: Jigsaw Puzzle (*Visual Closure*). Figure 1 shows the login interface of the games. User need to login with user ID and password. The teachers and guardians need to help students to key in their details such as student name, mykid, gender and teacher's name.

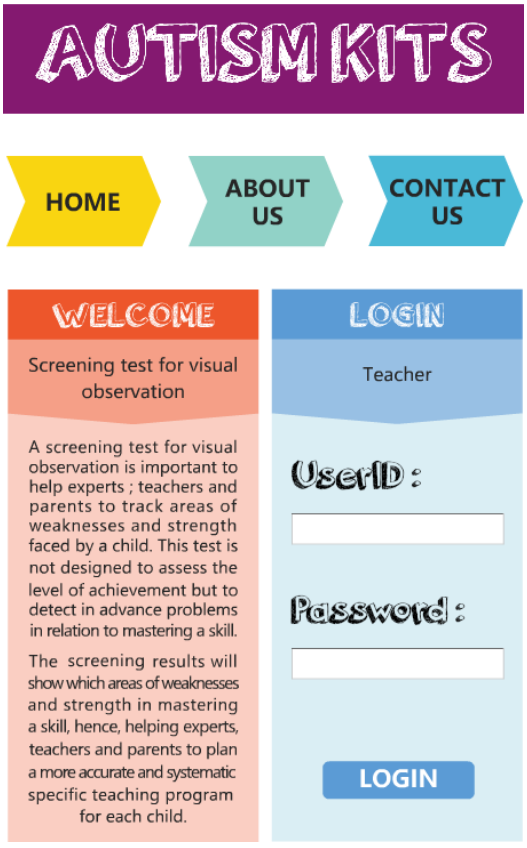

Fig. 1: Login Interface

Once click login, it will go to the montage as shown in Figure 2.

DOI: 10.37200/IJPR/V24I1/PR200164
Received: 15 Nov 2019 | Revised: 20 Dec 2019 | Accepted: 05 Jan 2020

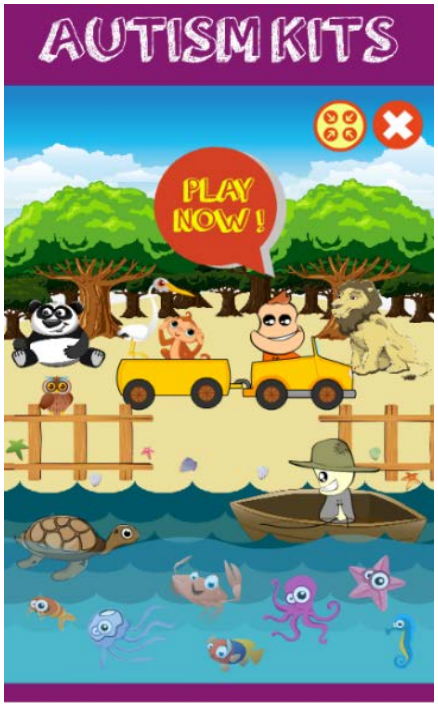

Fig. 2: Montage of Autism Kits

Figure 3 shows Game 1 which is Visual Discrimination. The aim of this game is to detect the similarities in the given images.

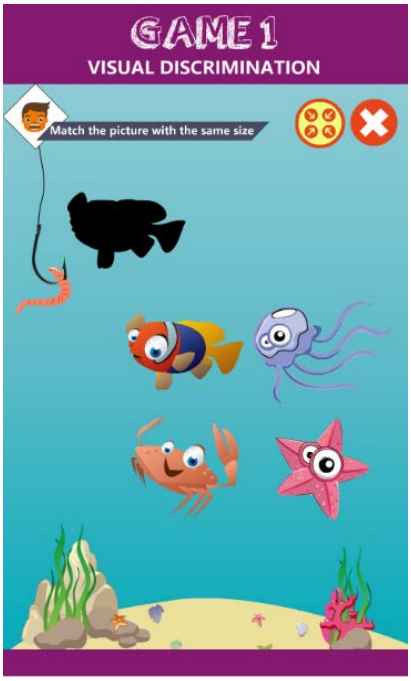

Fig. 3: Game 1 Visual Discrimination

Figure 4 shows Game 2, Let's Go Fishing Game 2 which is for Spatial Relationship. The aim of this game is to identify differences between the images.

DOI: 10.37200/IJPR/V24I1/PR200164
Received: 15 Nov 2019 | Revised: 20 Dec 2019 | Accepted: 05 Jan 2020

Fig. 4: Game 2 Spatial Relationship

Figure 5 shows Game 3 which is for Form Constantly. The aim of this game is to identify the different sizes of the given images.

Fig. 5: Game 3 Form Constantly

Figure 6 shows Game 4 which is Form Visual Memory. The aim of this game is to identify the different sizes of the given images.

DOI: 10.37200/IJPR/V24I1/PR200164
Received: 15 Nov 2019 | Revised: 20 Dec 2019 | Accepted: 05 Jan 2020

Fig. 6: Game 4 Form Visual Memory

Figure 7 shows Game 5, Jigsaw Puzzle which is for Visual Closure. The aim of this game is to identify the problems of visual closure and complete the given picture. Game 5 is the last game.

Fig. 7: Game 5 Visual Closure

VI. RESULTS

All scores obtained from five (5) games were calculated then totaled based on the percentile scoring system. This scoring system is one of the methods that are suggested by Kurtz (2006). Table 1 shows display the diagnostic score level, which is based on the result of the percentage score:

DOI: 10.37200/IJPR/V24I1/PR200164
Received: 15 Nov 2019 | Revised: 20 Dec 2019 | Accepted: 05 Jan 2020

Table I: Diagnostic Score Level

Score	*Level*
0-29	Low
30-79	Medium
80-100	High

Table 2 shows before and after using the apps which is based on the result of the percentage score. The teacher or the parent can view or check the progress of the child's performance through the application. They would have the records of the child's passed activity trials. Based on results, students positively shown from low to medium and low to high. But more students are highly motivated after the game was deployed.

Table II: Before and After the Treatment

Autistic Students	*Before*	*After*
Student 1	Low	Medium
Student 2	Low	High
Student 3	Low	Medium
Student 4	Low	High
Student 5	Low	Medium
Student 6	Low	Medium
Student 7	Low	Medium
Student 8	Low	High
Student 9	Low	High
Student 10	Low	High

This experimental study had some limitations that are recommended to be addressed in future research. Findings from the current experiment provided for the broader study's design as well. The methodology of using ADDIE model in the first phase of a small quantitative method. This experimental study had some limitations that are recommended to be addressed in future research. Findings from the current experiment provided for the broader study's design as well. The methodology of using ADDIE model in the first phase of a small quantitative method. Additionally, the participants' identification of behavior and functioning difficulties as challenges informed selection of additional, specific quantitative measures for the broader project. The research team was expanded to include multidisciplinary researchers such as in the special education field in recognition of the perspectives offered from diverse professionals and the frequent parental concerns regarding schooling.

VII. CONCLUSION

Autism Kits games which is an early detection tool towards children with autism. The students focus more on the game rather than the traditional methods. The main goal of this is to help and assist the autistic children that would enhance their understanding and capabilities by developing a learning game application specifically in their daily life. It can be concluded that with the development of the game application, this has become more promising in terms of its efficiency and usability. It is because when more people have a better understanding about autism, it is hoped that people may feel accountable to foster relationships among individuals and lengthened help with full sincerity. There may be ways of a collaborative work between all parties to ensure treatment for ASD is successful and to provide the best life possible for individuals with autism. The collaboration should include clinicians, teachers, graduate school workers, agents from outside support groups or foundations, the family and the autistic

DOI: 10.37200/IJPR/V24I1/PR200164
Received: 15 Nov 2019 | Revised: 20 Dec 2019 | Accepted: 05 Jan 2020

individuals themselves (Norhidayah et al., 2018). A diagnosis of autism not only affects the life of the autistic child but also affects the lives of family members in different ways.

ACKNOWLEDGMENT

Authors would like to express deepest gratitude towards Universiti Teknikal Malaysia Melaka (UTeM), Center for Research and Innovation Management (CRIM), Centre for Advanced Computing Technology (C-ACT), Pervasive Computing & Educational Technology (PET) and everyone who have helped and participated in this study. Thanks for sponsor the publication fees from Research Grant PJP/2019/CRIM (3D) S01686, Universiti Teknikal Malaysia Melaka (UTeM).

REFERENCES

[1] Bain, S.K., Brown, K.S., & Jordan, K.R. Teacher Candidates 'accuracy of Beliefs Regarding Childhood Interventions. The Teacher Educator, 2009, 44(2), 71-89.

[2] Banach, M.; Iudice, J.; Conway, L.; Couse, L.J. Family support and empowerment: Post autism diagnosis support group for parents. Soc. Work Groups, 2010, 12, 69–83.

[3] Baxter, A.J., Brugha, T.S., Erskine, H.E., Scheurer, R.W., Vos, T., & Scott, J.G. The epidemiology and global burden of autism spectrum disorders. Psychological Medicine, 2015, 45, 601 - 613.

[4] Brambring M. Response to Hobson's letter: congenital blindness and autism. J. Autism Dev. Disord. 2011; 41: 1595–1597.

[5] Camarata, S. (2014). Early identification and early intervention in autism spectrum disorders: Accurate and effective? International Journal of Speech-Language Pathology, 16(1), 1-10.

[6] Celeste M, Grum DK. Social integration of children with visual impairment: a developmental model. Elem. Educ. Online 2010; 9(1): 11–22. 11.

[7] Celeste M. Play behaviors and social interaction of a child who is blind: in theory and practice. J. Vis. Impair. Blind. 2006; 100(2): 75–90. 356.

[8] Centers for Disease Control and Prevention. Prevalence of Autism Spectrum Disorder among Children Aged 8 Years - Autism and Developmental Disabilities Monitoring Network, 11 sites, United States. Morbidity and Mortality Weekly Report, 2014, 63, 1-21.

[9] Chin-Po Chen, Susan Shur-Fen Gau and Chi-Chun Lee. Toward differential diagnosis of autism spectrum disorder using multimodal behavior descriptors and executive functions. Computer Speech & Language, 2019, 56 (2019) 17-35.

[10] Clark, M., Brown, R., & Karrapaya, R. (2012). An initial look at the quality of life of Malaysian families that include children with disabilities. Journal of Intellectual Disability Research, 56, 45–60.

[11] Dolah, J.B., Yahaya, W.A.J.W., & Chong, T.S. A preliminary investigation: Potential of interactive multimedia learning awareness (IMLA) in enhancing awareness of autistic characteristics among parents and society in Malaysia. Electronic Journal of Computer Science and Information Technology: eJCIST, 2011, 3(1).

[12] Golden, K.J., & Liaw, J.H.J. Understanding neurodevelopmental disorders in context: Autism spectrum disorder in the family system. In S. Haque & E. Sheppard (Eds.), Culture and cognition: A collection of critical essays (pp. 83–108), 2015, Bern, Switzerland: Lang.

[13] Gudu, B.O. Teaching Speaking Skills in English Language Using Classroom Activities in Secondary School Level in Eldoret Municipality, Kenya. Journal of Education and Practice, 2015, 6(35), 55-63.

[14] Ilias, K., Ponnusamy, S., & Normah, C.D. Parental stress in parents of special children: The effectiveness of psychoeducation program on parents' psychosocial well beings. Paper presented at the Simposium Sains Kesihatan Kebangsaan ke 7 [7th National Health Symposium], 2008, Kuala Lumpur.

[15] Jayachandran Vetrayan, Mohd Fadil Mohd Zin, Smily Jesu Priya Victor Paulraj. *Relationship between Visual Perception and Imitation in School Function among Autism*. Procedia - Social and Behavioral Sciences 202, 2015, 67 - 75.

[16] Jiar, Y. K., & Xi, L. Parenting stress and psychological distress among mothers of children with autism in Johor Bahru and Hangzhou. Journal of Educational Psychology & Counseling, 2012, 6, 129-153.

[17] Lewis S, Inselin SA. A comparison of the independent living skills of primary students with visual impairment and their sighted peers: A pilot study. J. Vis. Impair. Blind. 2002; 96(5): 335–344.
[18] Magdalena Wrzesińska, Tinto C. Spontaneous facial expression in congenitally blind and sighted children aged 8-11. J. Vis. Impair. Blind. 2003; 97(7): 418–428.
[19] Martin, D. M. (2012). The Ever-Changing Social Perception of Autism Spectrum Disorder in the United States. Project completed in partial fulfilment for graduation from the Honors College of East Carolina University.
[20] Marylene S. Eder, John Maruel L. Diaz, Joanne Ruth S. Madela, Marife U. Magusara and Dhally Dith M. Sabellano. Fill Me App: An Interactive Mobile Game Application for Children with Autism. iJIM – Volume 10, Issue 3, 2016.
[21] Ministry of Health Malaysia. Country health plan: 10th Malaysia plan 2011–2015. Retrieved from http://www.moh.gov.my/images/gallery/Report/Country_health.pdf,2011.
[22] Milne E., Griffiths, H.J. Visual Perception and Visual Dysfunction in Autism Spectrum Disorder: A Literature Review. Br. Irish Orthopt. J, 2007, 15-20
[23] National Autism Society of Malaysia. what is Autism? [Online]. Available: http://www.nasom.com.my/ index.php, 2013.
[24] Neik, T.T.X., Lee, L.W., Low, H.M., Chia, N.K.H., & Chua, A.C.K. Prevalence, diagnosis, treatment and research on autism spectrum disorders (ASD) in Singapore and Malaysia. International Journal of Special Education, 2014, 29, 82–92.
[25] Noor B. Almandil, Deem N. Alkuroud, Sayed Abdul Azeez, Abdulla Al Sulaiman, Abdelhamid Elaissari and J. Francis Borgio. Environmental and Genetic Factors in Autism Spectrum Disorders: Special Emphasis on Data from Arabian Studies. Int. J. Environ. Res. Public Health 2019, 16, 658.
[26] Norhidayah Mohd Salleh, Noorhaneyza Mat Noor & Julianti Samsudin. A Survey of Knowledge of Autism Spectrum Disorder among Malaysia Polytechnic Communities. International Journal for Studies on Children, Women, Elderly and Disabled, Vol. 5, (Oct.), 2018, ISSN 0128-309X.
[27] Nurul, S., Smily, V., Jayachandran, V., Ruwinah, A., & Dewi, A. Effect of Occupational Performance Visuo-Auditory Imitation Intervention (OPVAII) on Visual Perception among children with Autism: Pilot Study. Research Journal of Recent Science, In Press, 2014.
[28] Papadopoulos K, Metsiou K, Agaliotis I. Adaptive behavior of children and adolescents with visual impairments. Res. Dev. Disabil. 2011; 32: 1086–1096.
[29] Shamsudin, S., & Rahman Abdul, S.S. A preliminary study: awareness, knowledge and attitude of people towards children with autism. Proceeding of the Social Sciences Research ICSSR. 9-10 June 2014, Kota Kinabalu, Malaysia.
[30] Smith DD. Pedagogika specjalna. Vol. 2. Warsaw: Polish Scientific Publishers PWN; 2011. 10.
[31] The Star Online. Giving support to children with autism. Retrieved from https://www.thestar.com.my/metro/community/2017/04/29/giving-support-to-children with-autism-it-is-an-uphillstruggle-for-those-diagnosed-with-the-disorde/, Retrieved 30 May 2018.
[32] Toran, H. Experience and challenges in setting up a model demonstration classroom for children with autism in Malaysia. International Journal of Educational Administration and Development, 2011, 2, 37–47.
[33] Voorn, R.J., & Kommers, P.A. Social media and higher education: introversion and collaborative learning from the student's perspective. International Journal of Social Media and Interactive Learning Environments, 2013, 1(1), 59-73.
[34] Williams, K.L., Schroeder, J.L., Carvalho, C., & Cervantes, A. School personnel knowledge of autism: A pilot survey. The School Psychologist, 2011, 65, 7-14
[35] World Health Organization. Autism Spectrum Disorders & Other Developmental Disorders. From raising awareness to building capacity. Geneva: WHO Document Production Services, 2013.

DOI: 10.37200/IJPR/V24I1/PR200164
Received: 15 Nov 2019 | Revised: 20 Dec 2019 | Accepted: 05 Jan 2020