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An HCI-Based Shadow Teacher Application for Autistic Children in Egypt: Review Paper

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Abstract

Autistic children's education is a complex process that requires robust professional support. The success of their teaching and learning is impeded by their mental and social impairment. Paraprofessional assistance has raised skeptic concerns regarding the quality of their ambiguous qualification and training in relation to the expected outcomes. Previous studies revealed that autistic children represents 3% of all special needs young patients, however, no accurate Egyptian records can actually define the true prevalence of autistic children. This could be attributed to the lack of sharp clinical presentations carrying a clear differentiation, peculiar to this mental disability, which prevents reaching an accurate diagnosis leading to a clear allocation to their specific autism group. The emergence of the mobile technology strongly impacted the daily life and the communication pattern of people worldwide with specific emphasis on the business world.

Keywords: Autism, Human Computer Interaction, Paraprofessional, friendly user interface, Mobile User Experience (UX), Child Computer Interaction, Shadow Teacher

INTRODUCTION

Research in the field of mental illness has gained tremendous popularity in the last decade. One of the most popular existing mental disorder is Autism, a subclassification of Autism Spectrum Disorder (ASD). It is defined as a developmental disorder exhibiting mental and intellectual disabilities, which main characteristics are deficiency in social communication, impaired reciprocal social interaction, disturbed emotional regulation and limited flexibility of thoughts.

Learning and education for the autistic children require strong professional support to overcome the complex mental and social disabilities that impede the process.

Paraprofessionals have frequently played a substantial role in providing support for these students in their school settings. However, their limited training or qualifications with no clear standards or criteria raised concerns on the eventual unexpected outcome. Skeptical considerations were all linked to their sensitive role with uncertainty to their abilities, which might lead to unexpected opposite effect on these mentally disabled learners. Their presence might even interfere with the role of the professional educators and the interaction with their peers. Furthermore, the high cost of paraprofessionals consists an additional financial burden on the overwhelmed parents. Mobile technology has revolutionized the people's behavior with impact on their daily life, education, communication patterns and even their business world. The effect of the rapid advancement of this technology expanded to involve these mentally disabled patients. Their computing functions should be user friendly and be supplied and equipped with a broad spectrum of features that would support and facilitate their functionality for both normal or mentally deficient patients.

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AUTISM IN EGYPT

Throughout the literature, there is an increase proportion of autistic children constituting 3% of all children with special needs. Egyptian statistics lack an accurate record of the true proportion of autism in relation to other disabilities. This results from the confusing clinical and behavior presentations that might impede an accurate diagnosis, which led to their allocation to other mental disabilities (Hammed, 2015).

The incidence of Autism depicted an increasing prevalence pattern. However, in Egypt controversies were recorded where SeifEldin, et. al. (2008) reported an estimated high prevalence rate of ASD to be 33.6% among children with developmental disabilities, while Taha & Hussein 2014 and Alnemary, et. al., 2017 , reported a non-epidemiological pattern, followed by an estimation of 800,000 people with ASD in Egypt as officially recognized by the Social Solidarity Ministry (Al-Masry Al-Youm, 2017).

Health care providers and parents of autistic children in Egypt, are faced with big difficulties specially when compared to Western communities. Patients are facing great challenges ranging from limited accessibility to specialized , yet few, rehabilitation services with lack or almost absence of competent health services in suburban areas. Rich Egyptians parents rely on private clinics and highly paid services for granting their children the required appropriate care (Gobrial, 2018; Omar, 2014; Taha & Hussein, 2014).

This is particularly reflected on their education particularly with the increased number of ASD children enrolled in schools. Their condition is frequently overlooked by the education authorities and ignored by their families which eventually leads to their dropping out of the schooling mainstream (Mendoza, 2010; Omar, 2014).

RELATED CONCEPTS

Several terminologies and terms have previously been used to identify specific differences in behavior all diagnostic of Autism such as, Asperger syndrome, Autism Spectrum Conditions (ASC), ASD, classic autism, Pathological Demand Avoidance (PDA), Kanner autism and Pervasive Developmental Disorder (PDD) (Autism progress, 2016).

Autism varies from an affected patient to another in terms of behavior, differences in thinking patterns and processing their acquired information. A thorough understanding of these individual peculiarities is required to manage each case. However, all ASD patients exhibit specific developmental deficits related to four main aspects; *Communication; Social interaction; Flexibility of thought and Emotional regulation.*

COMMUNICATION IN ASD

Chawarska, &Volkmar, 2008 reviewed the reported autistic communication limitations and comprehensively identified an number of key characteristics including; deficits in attention and response to speech even the child' s own name (Osterling& Dawson, 1994; Paul, 2007); limitations in joint attention skills as reported by (Dawson, et al., 1991; Wetherby, et al., 1998) with inability to coordinate between objects and people and failing to capture attention to events and previous experiences, incapability to follow or shift gaze between people and objects in atrial to direct attention; reducing communication rates (Wetherby, et al., 1998) and intentions in requesting or protesting (Wetherby, et al., 1998; Mundy & Stella, 2000); incapacity of compensating the failure of verbal and language communications by other forms such as basic symbolic forms such as showing and pointing (Wetherby, et al., 1998;Goldson, 2004; Schoen, et al., 2009).

Difficulties experienced by autistic patients due their delayed comprehension and poor language development leading to failure of expressing their basic needs urged the discovery of new skills to address these incompetency. (Autism progress, 2016) advocated different activities ranging from; enhancing physical function to help expressing and receiving information and cognitive skills using fine motor control; grasping attention and improving language structure and composition, improving social capacities while responding to body language. (Fig. 1)

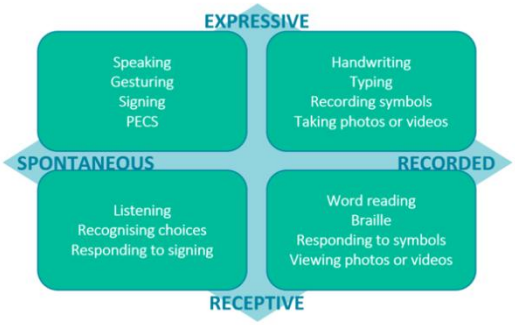

Figure 1: Communication development (Autism progress, 2016)

Social Interaction (Fig. 2)

Autistic children have delayed formation and sustainability of social relationships and suffer social anxiety and poorly respond to conventional standards of behavior. Several activities and exercises have been developed to improve these deficiencies (Autism progress, 2016). Among these skills are training on independent personal activities such as routine toilet care and the

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need to hand themselves food when hungry; encourage their engagement in dealing with people; introduce them to awareness of the wider environment through interacting with a familiar music and people interrelations.

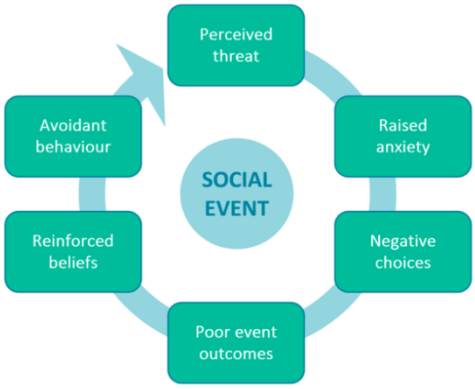

Figure 2: Social interaction (Autism progress, 2016)

CATEGORIZATION OF SOCIAL INTERACTIONS:

There are four main intended categories for basic social interactions; Foundation; Interaction, Affective and Cognitive skills (Canney, & Byrne, 2006).

Foundation Skills is peculiar to the capability of maintaining eye contact and suitable personal space and to recognizing facial expressions and gestures.

Interaction Skills related to interactive activities learning the initiation and termination of a conversation, choosing specific topics, resolving and handling conflicts, taking turns and ability to interact with authority figures.

Affective Skills concerned with the needs to understand self-own feelings and others, ability to empathize, understanding and correlating facial expressions and body language to determine the level of trust.

Cognitive Skills directed to a higher level of more complicated social interactions such as making choices, perceiving social activities and interactions, understanding normal community behaviors, and proper behavior and interaction with variable social situations.

FLEXIBILITY OF THOUGHT

It is mainly related to coping with potential changes, appropriate exploration of new concepts and developing rescue plans. This is particularly directed to overcome the deficiency of the autistic patients in controlling their repetitive behavioral thoughts or patterns, or the application of acquired concepts while facing unfamiliar situations, or coping with new circumstances.

New skills were applied to address and develop this incompetency among which are:

Enhancing the capacity of predicting and planning possible outcomes including pattern recognition such as perceiving familiar events such as weekends; applying strategies directed towards awareness and adapting strategies to unusual change such as recognizing a modification in a familiar story; exploring the progression of imagination and creativity skills such as appreciation of esthetics or feeling pride while presenting their work (Fig 3).

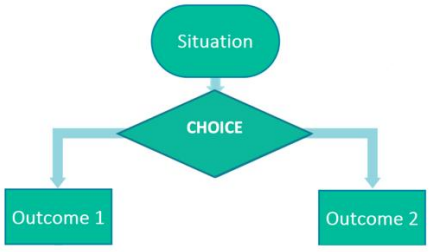

Figure 3: Flexibility of thought (Autism progress, 2016)

EMOTIONAL REGULATION

ASD lack several abilities including: the awareness of their emotional perception; expressing their own feelings and controlling their reactions. They may be aggressive with unjustified temper outburst, highly irritable, exhibit self-injurious actions and elevated anxiety levels. These may individually or collectively reflect an adverse negative effects on their well-being, safety and quality of life. New trends in applying new skills became mandatory (Autism progress, 2016) ranging from: raising their level of self-awareness through helping them understand their feelings by encouraging them to select their preferable objects and recognize their anger triggering factors; guiding them in moderating and controlling their reactions by training them to think

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before reacting through demonstrating reception of instruction quietly and eventually coping with any potential conflict with peers; coaching their self-expression practices such as exhibiting satisfaction by dancing and understanding the urge to apologize when making mistakes (Fig. 4).

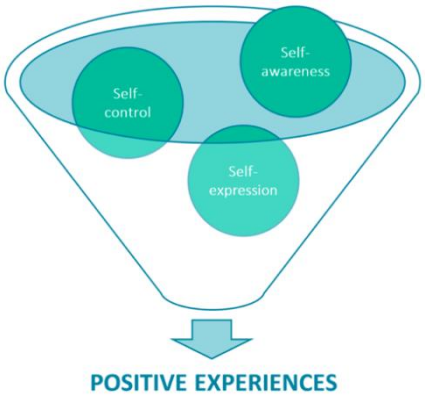

Figure 4: Emotional Regulation (Autism progress, 2016)

MOBILE USABILITY FOR AUTISTIC CHILDREN

ASD educators stressed on the fact that those individuals need diversified learning and teaching modalities to assist in overcoming their disabilities (Amudha, et al., 2015). In response to this ever-growing need mobile technology invaded the field with applications providing multisensory interactive learning opportunities (Puccini, et al., 2013; Reid, et al., 2013).

ASD students suffering from deficient communication can benefit from interaction with people and environment through mobile technology, this will eventually reinforce their communication skills (Goulart, et al., 2014; Marco, et al., 2013). In this aspect a friendly user interface (UI) characterized by good visibility, and appropriate design plays a crucial role in deploying a precision amount of information while reducing software complexity and eventually succeeds in enhancing learning for those peculiar learners (MohdHanifa, R., et al., 2015; Al-Zeer, et al., 2014).

Several researchers further reported that the existing mobile application and interfaces are still ineffective for ASD due to insufficient and inaccurate guidelines. Accordingly, usability guidelines and relevant dynamic application is absolutely mandatory in developing a mobile application with feature specific for autistic children (Hussain, et al., 2016; Baharuddin, et al., 2013; Chittaro, 2011).

ASD being visual learners, may show a warranted positive response to visual interaction if the interface for mobile application is properly designed in respect to this important element of usability guidelines (Khan, et al., 2013).

Kamaruzaman, et al., 2016, recognized thirty-one elements through reviewing ten articles, meeting the requirements specific for designing mobile application interface. Among these domains the mostly commonly identified were ease of use, satisfaction, efficiency and effectiveness. The authors emphasized on the most relevant elements to ASD children to be appearance, understandable and memorability.

Accordingly, Sofian et al in 2018, identified the frequently used elements of mobile application with a provision of being *objective*, concerned with usability based quality and with specific *scope*, particularly covering the needs of ASD children. These formulated usability guidelines are based on the disabilities of the cognitive domain which require additional and variable usability factors: *easy to use, effectiveness, understandable, satisfaction, appearance, and efficiency* and are individually discussed and summarize the accuracy allowing the completeness of the required task.

Effectiveness, which requires that the interface exhibits ability of displaying expected and desired outputs, through specific characteristics including: large enough interface *button*, reduced *features and words*, *allowing repetitive actions* to freely take place.

Efficiency, to secure the accuracy and speed to achieve the required action, through implementing these characteristics: *ability to reduce time* through setting appropriate symbol easy for selection and supplied by an *automatic update capacity* of the last version.

Satisfaction, the user should feel comfortable while using an application that fulfills his needs through specific characteristics: *easy to use* as perceived by the users and *ability to provide feedback* that would help the team monitor the user's progress.

Ease of use: simplicity of functional performance that could be achieved through adopting specific characteristics: *ability to quickly and easily* provide information; *ease of navigation* through single clickable button; *clear colored button* readily identified.

Understandable: this mainly relies on providing the icons and button with special characteristics: easily *learnable icons* that are understandable; *recognizable icons*and; *buttons with catchy pictures.*

Appearance: this is based on supplying the user with cues showing how to interact and behave through special characteristics: appropriate *font color and size;* suitable image and picture *size*; acceptable *background* color.

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MOBILE USER EXPERIENCE (UX):

A conflict in reaching a consensus on a specific definition in this domain UX resulted in broad vague definitions despite extensive researches over the last decade. The Dagstuhl Seminar of Demarcating User Experience (Roto, et al., 2011), adopted 27 definitions. Tokkonen, &Saariluoma in 2013, described UX as being a multidimensional phenomenon, present for several years and influenced by many factors (Dirin, 2016). Carlos et al. in 2011, identified the key elements of success of UX to be; user identification, artifacts and interaction. On the other hand, Hassenzahlin 2008, referred to UX as "quality of interactive technology", which mainly focuses on the human element rather than the product. Again, Hassenzahl and TractinskyHassenzahl (2006) stressed on the fact that advancement of technology will inevitably lead to modifying the usefulness and usability of the interactive services to become fashionable and trendy. Dirin in 2016, elaborated a more precise definition as the emotions encountered by the users, during using an application or a service. He deduced this definition, from the ultimate consequence of development in design thinking, recognizing the key factor to be emotional engagement in sustainability of mobile application.

The limitations associated with mobile devices such as the screen size as well as the context- awareness pertained by the embedded sensors, attracted the UX required attention. Several trials and attempts were carried out to promote and develop mobile UX through design and evaluation metrics approaches. Yong in 2013, proposed that the evaluation methods should monitor the users emotional responses on several dimensions; behavioral, visceral and reflective.

BACKGROUND:

Autism is an acronym of autism spectrum disorders (ASD), occurring during brain development as multiple complex disorders, with varying degrees in severity characterized by problems in social interaction, different communication inabilities whether verbal or nonverbal as well as repetitive behaviors (Frith, 1991). It can be categorized as a neuropsychiatric disorder, which persistent symptoms which are mainly impaired social interaction, communication anomalies with limited patterns of interest and behavior, stereotyped or even both. It can be discovered by the 3rd year of age, with male preponderance of a 4:1 gender ratio as reported by Eastern Regional Health Authority in 2002, while females are more severely affected. (Kanner, 1992; World Health Organization [WHO], 1993; American Psychiatric Association [APA], 2000, 2013; Shriver, 2005; HasnahToran, 2013; (Newschaffer et al., 2007; Lord et al., 2006; Prior et al., 1998).

In 2003, Yeargin-Allsopp et al advocated that ASD is a composite developmental disorder, occurring in the early childhood with inconsistent expression , while Gillberg and Billstedt in 2000, further added that besides all previous composite characteristics these symptoms are complemented by other deficits including cognition, attention and sensory processing in some cases.

There were no evidence supporting or explaining environmental or genetic components to ASD (Gilman et al., 2011; Hallmayer et al., 2011; Levy et al., 2011; Liu et al., 2010), despite a possible reported heritable component (Bailey et al., 1995; Folstein and Rutter, 1977; Lichtenstein et al., 2010; Weiss, 2009).

Frith in 1991 and Adams et al in 2011 stated that this neuropsychiatric disorder originating during early brain development could be manifested as a group of disorders as the aforementioned autistic characteristics or as an isolated entity or could be further diagnosed with schizoid personality, obsessive-compulsive disorder, affective disorder, simple schizophrenia, mental retardation, or even brain damage. It is worth mentioning that this autistic deranged behavior could be manifested in daily life as disturbed speech functions, poor skills achieving daily requirements, playing activities, or could be limited to minor dysfunction not impeding independent functioning or achievement of college degrees. Associated gastrointestinal problems have been reported in autistic children with higher incidence and severity specially when compared with healthy children. (Adams , 2011).

Studies related to the neurobiological brain distorted functions revealed association between specific cognitive dysfunction and disturbed brain functions altogether influencing a particular pattern of behavior (Lai, et al., 2013). This typical phenomenon as a main characteristic feature of ASD gained special interest in the last decades (Rane et al., 2015).

It is of utmost importance to identify the association of impaired social interaction and processing with attention shifting patterns reflecting retarded attention skills development (Saleh and Adel, 2017). One additional remarkable feature is the dissociation of autistic children's emotional responses to the surrounding social events. Their negative emotions usually override their positive ones without a rational interpretation for stimulating any of the two emotional responses (Hutman, et al., 2011).

Bernas, et al. in 2018, advocated that there is a relation between executing social functions and impaired brain connectivity. The definition of social processing is based on social motivation and social cognition. This later represents the state of mind and its related activities such as memory and attention, through which the person realizes and reacts to the internal status of other persons. On the other hand, social motivation is described as focusing person's attention, interaction and enjoyments on social behaviors in ASD (Hutchins, et al., 2012).

Autistic children could be injurious to self and others. Their actions have a repetitive pattern of consistent sensory motor behavior in a typical stereotypic pattern. They are usually resistant to daily familiar routine. The toys seldom stimulate their

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creativity, since their cognitive rigidity keeps their attraction to be focused on parts of the toys or unusual mobile objects (Kim and Lord, 2010).It is assumed that this ASD developmental disability causes problematic delay in the child's acquisition of skills affecting his life and eventually his social entourage as parents and relatives. Edwards in 2001, further added that certain special senses as vision and hearing could be affected with different degrees and may affect their ability of self-expression, compassion and empathy. Management of these deficits in ASD child should be a priority in their supportive treatment through instructions and training planned for better response to senses to enhance their alertness and perception of information (Edwards, 2001). Research reported that ASD children when exposed to activities equivalent to their peers, show less interactions, more time in performing or not achieving this activity with noticeable physical distance and preservation from colleagues (Goldstein, et al., 2014).

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM- 5) focused on describing the characteristics of ASD including all the previously mentioned symptoms with special emphasis on sensory deficits which can be overlooked and masked by the communication and social disabilities. The sensory disorders may be classified as decreased or increased input, appearing separately or concomitantly in the same or different times and periods of the patient's life (American Psychiatric Association, 2013). This below table carries the description of behavioral examples in reaction to sensory anomalies in ASD children.

Table 1: Sensory abnormalities

Sensory modalities	Examples of behaviors related to sensory abnormalities
Visual	• Attraction for light sources • Staring at spinning objects such as washing machine centrifuge, wheels, and propeller fans • Impaired recognition of face expressions • Gaze avoidance • Refusal of foods because of their color
Auditory	• Apparent deafness: the child does not turn to the verbal call • Intolerance to some sounds, different from case to case • Emission of repetitive sounds
Somatosensory	• High pain tolerance • Apparent insensitivity to heat or cold • Self-aggressiveness • Dislike of physical contact, including certain clothing items • Attraction for rough surfaces
Olfactory	• Smelling non-edible things • Refusal of certain foods due to their odor
Taste, oral sensitivity	• Oral exploration of objects • Food selectivity due to refusal of certain textures
Vestibular	• Iterative rocking • Inadequate balance
Proprioceptive/ kinesthetic	• Walking on toes • Clumsiness

Grandin &Scariano (1996); Jones, et al. (2003); Williams (1998); Baranek, et al., (2006); Leekam, et al. (2007); Dickie, et al. (2009), reported their concerns regarding sensory abnormalities related to ASD ranging from hyper reaction to bright light, noisy sounds, penetrating odors or hypo reaction to special senses such as hearing, touch and vision. These sensory responses could help identify the level of autistic severity and traits (Robertson & Simmons, 2013).

DSM-5: American Psychiatric Association in 2013 extended the ASD diagnostic criteria related to the standard "sensory reactivity" to include a new subcategory "restricted and repetitive behaviors'.

Subsequently, in 2015, Donnellan, et al. further added several criteria to McGee, et al description of ASD children problems; struggling in comprehending and learning a word's meaning, constantly repeating the same action, special physical movements, difficulty in adaptive changes to routine life events, early signs of mental inabilities, lacking eye contact, never responding to smile, poor recognition of familiar voices even while calling own names, impairment in visual tracking of objects, inability to express functions with gestures as waving hands, never reacting or seeking for snuggling, deficiency in following facial expression and in making help request and never playing with other children.

1.1. Daud, et al. in 2018 classified Autism in different types:

1.1. Types of ASD

Autistic Disorder: Impairment in social interaction as well as limitation in interests and activities evidentially noticed in the early years of life; *Asperger Syndrome:*Though no substantial clinical retardation in language abilities and acquisition are noticed, yet deficient social interaction remains severe with repetitive type of behavior and persistent patterns in activitiesand interest; *Rett's disorder:* It is occurring only in females with normal function and development after birth till the fifth month, followed by distinct regression; *Childhood disintegrative disorder:*regression occurs after two years of normal growth and

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development affecting several functional areas; *Pervasive Developmental Disorder not otherwise*: The development social interaction impairment is pervasive and severe but no criteria for a specific disorder.

1.2. The severity of ASD has been presented in three levels regarding the social communication and behavior in terms of required supporting services:

1.2.1. Level 1: "Requiring support"

Social communication; impairments in social communication, with no effective responses or interest to any social advance from other persons, with no support in place. Inability to conduct or engage a communication or conversation and unsuccessful or failed attempts to make friends.

Behavior: Characterized by rigidity hindering the switching between functions and activities with disorganization inhibiting any independence or planning. (Sanchack& Thomas, 2016).

1.2.2. Level 2: "Requiring substantial support"

Social communication; deficient skills in either verbal or nonverbal communication even in the presence of support. Obvious limitation in initiating a social interaction, with unusual reduced responses or interest to any social advance from other persons.

Behavior: Characterized by behavioral inflexibility, inability to handle changes, with obvious evident repetitive behaviors, affecting variety of functions and impaired focusing on specific action (Sanchack& Thomas, 2016).

1.2.3. **Level 3: "Requiring very substantial support"**

Social communication; severe deficits and disabilities in social communication skills either verbal or nonverbal, resulting in severe functional impairments, and absence of initiation of social interaction with minimal response to any social advances from others.

Behavior: Severebehavioral inflexibility with absolute hindering actions towards handling change and evidence of repetitive and restricted behavioral patterns impeding normal functions in all aspects. Inability to change action or focus in all scopes. (Sanchack& Thomas, 2016).

1.3. Social problems for autistic children

Challenges related to impaired social and communication skills increase the risk of limited social interactions and the eventual risk of hinderance in performing important daily life actions and interactions (Bauminger& Shulman, 2003; Humphrey & Lewis, 2008).

Providing support for these ASD students in their school settings, alongside their normal colleagues could improve their social and communication skills. The growing role of paraprofessionals in one-to-one settings has gained special attention and importance with the increasing number of ASD children enrolled in general schools (Giangreco, 2010).

However, those paraprofessionals are invited to this highly sensitive role with minimum required certainty training programs and continuous education (Carter & Hughes, 2006; Carter, et al., 2015; Giangreco, et al., 2003; Patterson, 2006). This might lead to unexpected opposite effect on the patients resulting in delayed social and communication developments. Moreover, their constant presence may impede peers interaction as advocated by Anderson, et al., 2004; Brock & Carter, 2016; Giangreco, 2010; Humphrey & Lewis, 2008; Koegel, et al., 2014).

1.4. Characteristics of autism spectrum disorder fall into three categories:

Social deficits and communication problems:

Communication deficits involve several aspects, the language disability, the limited social attention, the impaired attention skills and the negative emotional reactions, their solitary playing patterns, anomalies in facial perception, inactive emotional expression and unusual gaze.

The patient suffers from clear understanding or usage of the language, ranging from undergoing limited conversation on specific topics, to just repeating some words or phrases to very deficient speech functions (Daud, et al., 2018). Lack of development of attention skills leads to affected social attention (Saleh & Adel, 2017). Irrational mainly negative emotional reactions and responses irrelevant to the surrounding environment stimulating factors. Solitary playing patterns with inabilities to undergo normal interactive social playing (Hutman, et al.,2011).

One of the main core features manifested in ASD is the abnormal face perception, unchangeable features such as eye gaze directions and emotional reactions and expressions. Those children avoid face and eye contacts and could not understand or react to different facial expressions. The anecdotal scientific evidence of experimentally producing activation in fusiform gyrus for averted rather than for direct look in autism opposing what occurs in healthy developing children. The term "covert attention," is used to describe the typical autistic visual perception and attention in an atypical manner (Marwa& Aya, 2019).

The social processing depends on the function of face processing, since it depends on social cognition and motivation. Processes involved in social cognition include memory, attention, theory of mind all through which the internal state of people is recognized. On the other hand, social motivation is an attentive response to social stimuli and relevant enjoyable social activities (Hutchins, et al., 2012). Abnormalities in connectivity regarding social functions is a characteristic of ASD (Bernas, et al., 2018).

Difficulty relating to people, things and events:

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The difficulty in identifying facial expression, interacting with people, lack of eye contact (Daud, et al., 2018).

Repetitive body movements or behaviors:

One of the main characteristic of autism is their persistent resistance to change within their familiar entourage and environment as well as their repeating sounds movements and even phrases (Daud, et al., 2018). Solitary playing is a main trait and toys do not constitute an area of stimulation or creativity but they rather focus on a certain object and remain distracted by the same unusual movement or object. This repetitive behavior is a stereotypic motor sensory action that can constantly be injurious to self and others (Kim & Lord, 2010).

1.5. Definitions of a Paraprofessional

Young autistic children require extensive work and time devoted by parents and rehabilitative paraprofessionals in direct contact with those patients. (Rispoli, et al., 2011). The extended contact hours required for providing suitable professional support constitutes an economic burden on the family and community of ASD children. Paraprofessionals present a cost-effective support service and intervention (Hughes & Valle-Riestra, 2008).

However, the number of competently trained specialist as paraprofessionals does not meet the ever growing number of ASD children with these intensive needs for qualified interventionists needs (Harchik, et al.,1989, Killoran, et al.,2001).

It is worth emphasizing that those paraprofessionals should receive effective training and experience required for qualified personnel to ensure safe delivery of supporting services that could become challenging and problematic if those service providers areineffectively prepared.

PARAPROFESSIONAL RESPONSIBILITIES

Paraprofessionals training is often non-specific and their qualifications sometimes do not meet their required roles (Howard & Ford, 2007). There is no special framework or job description according to which a training could be designed and respond to their challenging roles (Stephenson & Carter, 2014). Their employment is frequently unofficial and they are immediately facing their instructional role of gradually supporting these students (Giangreco, et al., 2011; Howard & Ford, 2007; Webster & Blatchford, 2015).

1.5.1. Influence on student learning

Throughout the literature reviewed there is contradiction regarding the impact of the paraprofessional on ASD children's education and academic outcomes, regarding learning, social inclusion, independence, their parents' perception, and the misuse of those paraprofessionals.Blatchford, et al., 2009, recorded better autistic children engagement with strong indication in favor of specific aspects of the learning process specially performing a task.Webster & Blatchford, 2015 further described paraprofessional as "experts" in supporting students with deficiencies and disabilities in the academic life.Radford, et al., 2015 in support of the positive impact of the paraprofessional on the student's learning process emphasized the importance of professional training research based for improving their critical role in this intervention. However, Howard & Ford in 2007, reported a remarkable improvement in the level of interaction but unfortunately in response to their assistants rather than their teachers. This was further advocated by (Radford, Blatchford, and Webster 2011), who verbally stated that the combined teachersparaprofessional association gave fair impact in task achievement on the expense of engagement in learning.

On the other hand, studies conducted by Blatchford, et al., 2011; Webster, et al., 2010 reported negative academic outcomes in relation to the amount of supportive services provided by the paraprofessional.Among these negative impacts Webster & Blatchford, 2013; Webster & Blatchford, 2015 stressed on the remarkable increased student's isolation, due to the logistic attachment of the student to his paraprofessional in the back or side of the class.

1.5.2. Influence on social inclusion

Training of paraprofessional specifically targeting the social interaction of these disabled children with their normal colleagues is mandatory to avoid adverse effect of their role (Tews&Lupart, 2008).

Parafunctional may shelter those students with an exaggerated support that can eventually lead to a comfort zone of social and physical detachment from their peers (O'Rourke & Houghton, 2008), limiting their intended interactions and their opportunities to overcome this disability (Hemmingsson, et al., 2003). Some of the students feel intimidated by the companionship of their paraprofessional. Although they may prevent the devastating bullying these students might face, yet the ASD child disability might not be addressed due to the branding effect they experience through the presence and overprotection of their peers (Saggers, et al., 2011).

1.5.3. Influence on student independence

It requires a great balance and meticulous application of a paraprofessional enthusiasm in delivering the required supportive care for addressing the ASD child impaired independence (Asbjornslett, et al., 2014; Whitburn, 2013). Opposite effect can occur where children become too independent on their assistant in the class (Giangreco, 2010). Children are not triggered to perform their needed own effort but rather lack self-confidence and motivation and feel comfortably sheltered with no needs to make any effort (Broer, et al., 2005).

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1.6. Effects of the Misuse of Paraprofessionals

The abuse of overreliance on paraprofessional may lead to detrimental effect that turns this planned supportive care to unexpected negative impacts on the child. Among these unintended effects, students experiences isolation or interreference from their peers, sole relation with the paraprofessional with poor interaction and engagement with the experienced class teacher, improper easily provoked behavior, (Giangreco, et al., 1997, Marks, et al.,1999, Mueller & Murphy, 2001).

Researches and studies of qualitative nature revealed that paraprofessionals training is limited and overlooks the social interaction in favor of the academic life of their students (Bossaert, et al., 2015). Professionally planned programs are lacking for those paraprofessionals and no solid framework of competencies are designed to evaluate and benchmark their competencies in dealing with those special needs children (Carter & Hughes, 2006; Carter, et al., 2015; Giangreco et al., 2003; Patterson, 2006).

A study measuring the paraprofessionals' perception about their training in dealing with ASD children reported that it is academically based and more psychosocial care is needed to socially support these students and balance without hinderance, their one-to-one constant presence with their social development and interactions with peers (Anderson et al., 2004; Brock & Carter, 2016; Giangreco, 2010; Humphrey & Lewis, 2008; Koegel, et al., 2014).

The inadequate paraprofessional service secondary to modest training strongly affected their main objectives specially with their peers social relation with poor friendship building and quality relations, and isolation and loneliness (Anderson et al., 2016; Copeland et al., 2004; Guralnick et al., 2007; Kasari et al., 2011; Locke et al., 2010).

1.7. Interventions for Social Skills Development of Children with ASD

It is generally believed there are no cure for Autism, however full recovery has been recorded in some cases (Helt et al., 2008). Early interventions and specific treatments can control the severe outcomes with varying degrees and help those impaired children to develop self-care, social interaction and better communication skills (Scott & Chris, 2007; Bölte, 2014).
The core problem of the ASD children is the social deficit. The long time spent at school makes this academic setting an important environment for developing social skills Harrower and Dunlap (2001); White et al. (2007); (Rogers & Vismara, 2008).

1.8. Human Computer Interaction (HCI) for children

The community of Human Computer Interaction is ever-growing and evolving. Its first emergence was linked to the ergonomics, and was particularly planned guided by the socio-technical research advances, requirements and results. The work-based system responds to the continuous progress and development of related processes. The impact of the users methods of communication, work, learning and playing affects its design to meet their experience rather than usability, and communication more than control and playfulness as a priority over productivity.

A new research area Child Computer Interaction (CCI) developed from within HCI and gained interest and is born from the technology based education interests, where it is introduced in the early school years, preparing the child to mature in HCI areas.

1.9.1 Child Computer Interaction (CCI)

The first published work in this domain was carried out by byPapert in 1980 . Considerable studies followed in the late 80s to 90s, all were directed towards increasing the ability of the children to use computers. Published researches were frequently found in education journals, where the original work was mainly concerned of developing reading capabilities from computer screens and speech functions recognition (Kafai, 1990; Resnick,1991; Ackermann, 1991; Mills and Weldon 1987; Mostow, Hauptmann et al. 1995).

An important research entitled "*Learner Centered Design***",** focused on the roles of adults in accessing technologies for their children (Guzdial et al. in 1994's). A work carried out by Bers and Cassell in 1998 reported an important role of the influence of technology in extending and improving the activities related to the children's language.

CCI towards the end of the 20s century burst out of the school and education boundaries in parallel with the publication of two important books by Druin, (Druin and Solomon 1996), (Druin 1999). These, together with an influential publication by Hanna, Risden et al. in 1997 that outlined how best to involve children in usability evaluation, lead the field to broaden its scope to consider the direct involvement of children in the design and evaluation of their own technologies.

FINDINGS AND CONCLUSION

Throughout the reviewed literature no consensus was reached by researchers through their extensive work aiming at helping those mentally and emotionally compromised children to overcome their difficulties and face the social life with its challenges and difficulties.

Accordingly, a new era of a technological innovation, through recruiting the artificial intelligence should be designed to invade the world of autistic children. By developing a mobile application to replace paraprofessionals. It will daily assist ASD child, this will further hypothetically allow the independent children reaction and eventually increase their communication and social skills.

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