Augmentative Communication Systems as an Educational Alternative to the Autism Spectrum Disorders

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Abstract

Background: While circa one-third of persons diagnosed with an autism spectrum disorder will not develop functional natural speech by adulthood, augmentative communication systems, referred as an integrated group of symbols, aids, strategies, and techniques used by individuals to enhance communication, might be considered as a viable methodology for offering an alternative means of communication for individuals with autism spectrum disorders

Objectives: The purpose of the current research is to explore the representation of the autism spectrum disorders (ASD) as a nosology in which the reference parameter for determining gravity is related to the demand for continued support from the environment and especially from the development of innovative techniques of interdisciplinary treatment. Another equally important goal in this work is the exploration and analysis of the Alternative Communication Approach (AAC) and the Universal Design Learning Models (UDLA) that aim at improving the communication processes of subjects with low cognitive functionality for a multi-parametric intervention in the development of psycho-cognitive and social skills in ASD subjects.

Methods: The method design was of A-B-A typology, with assessment of baseline levels (A1), measurement of skills after the end of the training (B) and six months after its end (A2). The comparison between the two groups, conducted through the Vineland Adaptive Scales (VABS), highlights a significant increase in adaptive and communicative skills in the Experimental Group alone, confirmed by the regression towards baseline scores in phase A2.

The current study evaluates the effectiveness of a structured training of AAC for the increase of adaptive skills in a sample of young adolescents with autism spectrum disorders belonging to a specialized educational service (N = 8; range: 10-15; average age 10 years old). Participants were assigned with randomization to the Control Group (N = 4) or to the Experimental Group (N = 4). The Experimental Group followed an individual AAC and UDLA training for one year, and the Control Group followed the normal educational activity of the service with the association of an assistant teacher

Results of the current research demonstrate the effectiveness of a structured AAC training for the increase in communicative and adaptive behaviors (IRD= 0.90) of children with autism spectrum disorders and low cognitive function (IRD= 0.99) associated to the ASD 3rd level of gravity children. Indices of the overall scores lower than the average of the normative sample were observed in the Communication Scale of VABS (94.50 Control vs. 96.50 Experimental group), low scores on the Socialization Scale (93.50 Control vs. 91.50 Experimental group) and markedly lower scores were recorded in the Social Gaming subscales (Control Group Average = 85.50; Experimental Group Average = 85.25).Other significant indices of the follow-up phase revealed a significance for Expression (p = .040), Writing (p = .052), Game (p = .039) and Social Rules (p = .056) after the training phase.

Conclusions: Prototype displaying subjects, the systematic and combined use of AAC and UDLA training techniques for improving communication skills improve the contextual and environmental context in responding to the needs of a continuous education in subjects of ASD with intellectual disabilities.

Keywords: Autism Spectrum Disorders, AAC, UDLA, Educational alternative, training

1. Introduction

Autism Spectrum Disorders represent one of the most complex developmental disabilities to which training systems are required to provide answers. Only from the 1990s, has the effectiveness of ACC or the UCLA systems for educational intervention in infants with autism spectrum disorders been evaluated according to the criteria provided by the Evidence Based Education perspective to determine its effective validity in improving social and communication skills (Ganz et al., 2011; Ganz, 2015). AAC and UDLA systems represent an articulated set of assistive technologies, and not a structured intervention model in the form of traditional didactic protocols. Comparisons between these alternative systems and evidence-based intervention models such as those derived from the ABA approach or the PECS system, can therefore only be made in terms of the development of communication skills, even if the improvements of these skills have a positive effect on the reduction of repetitive behaviours and oppositions of the subject (Ganz, 2014; 2015). In other words, AAC and UDLA systems do not represent a specific model of intervention, but rather an organized system to support the development of communication skills. The framework of research on these alternative educational systems can be further complicated by the typical difficulties of research on subjects with autism spectrum disorders. The variability of the cognitive profile, characterized by areas of impairment in communication and social skills that frequently vary according to the individual characteristics and the intensity of the spectrum alterations, make it difficult for

the composition of homogeneous groups for control and intervention (Hewitt et al., 2012; Matson, 2014; Ganz, 2014). Even the frequent association of the disorder with cognitive disabilities represents a data capable of influencing the variability of the individual response to augmentative interventions, with the consequent difficulties in comparing the performance of individuals who follow the traditional ABA method of addressing ASD (Ganz, 2014; Matson, 2014; Ganz, 2015). These difficulties were considered in the research design of the present article, the aim of which is to explore and evaluate the effects of AAC and UDLA training interventions in a population of subjects with complex communication needs, such as that represented by children with Autism Spectrum Disorders.

The Spectrum of Autism Disorders

The international diagnostic conceptualization and application have undergone evolutions which, in turn, have led to significant changes in the attribution of the diagnosis. The disturbances, according to the conceptualizations of the DSM-5, seem to be represented by a continuum in which the reference parameter for the definition of severity is represented by the request for support provided by the environment (APA, 2013). The DSM-5 TR on the other hand, turned the scientific view on the Neurodevelopmental categories, where the ASD and other neurodevelopmental disorders are included (APA, 2022), but there are not full validity data available to be used in the present research. Although the DSM is a categorical diagnostic manual (Gordon & Gosgrove, 2013) and there is not yet an all-inclusive manual that can describe the categorical and dimensional aspects of ASD in a unique and universally accepted manual, we will refer to the validated criteria of DSM-5 in our exploration and arguments of the current paper as the most known and used diagnostic manual of mental health in the Western Balkans. Previous categories of the DSM have been abolished and have been replaced by the macro-category of autism spectrum disorders in the DSM-5, defined by three levels of severity depending on the support required from the environment. The name of the current diagnostic category of the DSM-5 (APA, 2013) was based precisely on the recovery of the concept of Spectrum, which seemed to be more adequate to represent the disorder than the previous concept of Pervasive Disorder (Volkmar et al., 2012). The restructuring of the criteria for the diagnosis of autism spectrum disorders could therefore represent an example of the approach between the medical and biopsychosocial perspectives, given that both are oriented towards recognizing the commitment of society to provide adequate support to individuals with developmental disabilities. This macro-category is configured as an umbrella category of Neurodevelopmental Disorders in DSM-5, and includes all the alterations of the spectrum that were previously diagnosed in the sub-categories of Pervasive Disorders, such as Autistic Disorder, Asperger's Disorder and Disorders Not Otherwise Specified. The only exception concerned Rett's Syndrome, which is currently considered to be external to the Autism Spectrum. The criteria for diagnosis are based on two basic criteria, represented by the deficit of communication and social interaction and by limited and repetitive behaviours and interests. The first basic criterion is based on the deficit of communication and social interaction, specified by four sub-criteria. The second basic criterion is based on the restriction of interests and behaviours, and is specified by four sub-criteria that describe the stereotyping of language and motor behaviours and the intensity of concentration on restricted interests. These aspects

also represent a typical behavioural profile generally found in the disorder. The subdivision of the levels of support required from the environment must be considered at the end, and it should be considered as indicators of the level of severity of the disorder. The levels of DSM-5 replaced the previous antinomies between Autistic Disorder and Asperger's Syndrome, and between Autism with low or high cognitive function. The DSM-5 criteria for quantifying the required environmental support include implicit references to Social Participation skills, given that communication deficits represent the areas of functionality most subject to evaluation. Similarly, in the criteria considered there are references to the impairment of Personal Activity skills, which in the alterations of the Autistic Spectrum present significant levels of impairment, represented by the restriction of interests and the presence of repetitive and stereotyped behaviours (APA, 2013). The subdivision of the levels of support request is based on three levels of intensity: significant, moderate and mild, as specified in the following table.

Tab. 1 Levels of intensity of the support required from the environment in ASD

Level 3: Requires relevant support Social communication. Deficits in social communication cause severe limitation to functioning. Minimum response to the initiative of others. Restricted interests and repetitive behaviours. Worries or repetitive behaviours interfere with adaptation. If they are interrupted, evident stress reactions appear.
Level 2: Requires moderate support Social communication. Marked deficits in communication. The impairment is evident even when there is support. Limited social initiative Restricted interests and repetitive behaviours. Worries or repetitive behaviours interfere with adaptation in different contexts. If they are interrupted, stress reactions appear.
Level 1: Requires mild support Social communication. Without support, communication deficits cause limitations that can be noticed. Difficulty in initiating social interactions. Reduced interest in social interaction. Restricted interests and repetitive behaviours. Repetitive worries or behaviours cause interference in one or more contexts. If they are interrupted, resistance reactions appear.

Source: Adapted from APA, DSM-5 (2013)

As such, the DSM-5 is characterized by much more restrictive criteria than the previous ones for issuing the diagnosis of autism spectrum disorders, different from those the interpretations of the DSM-5 TR. The different forms between Autism with low (Low Functioning) and high cognitive function (High Functioning) were supported by Schopler (1987), who proposed the distinction based on the severity levels of impaired cognitive functions, and considered Autistic Disorder and Rett Syndrome as expressions of low functionality. The introduction of the diagnosis of Asperger's Disorder was not considered appropriate, since it could be considered

as a form with high cognitive functionality (Schopler & Mesibov, 1995) and considered only the nosology of ASD as a unique profile of intellectual disability.

Augmentative and Alternative Communication Systems

As an alternative to the previously considered global management models, Augmentative and Alternative Communication (AAC) does not make up a specific intervention model for the treatment of ASD, but rather an assistive technology capable of providing support for complex communication disabilities. Following the experiences of the Toronto group conducted on subjects with Infantile Cerebral Palsy, the applications of the systems have been extended to Intellectual Disabilities, Genetically Based Syndromes and Autism Spectrum Disorders, which represent situations characterized by the presence of significant impairments of communicative skills. The use of AAC systems, starting from the foundation of the ISAAC (International Society of Augmentative and Alternative Communication) in 1983, has progressively invested a range of applications of the systems throughout the world and recently either in Albania. The introduction in the DSM-5 of the category of Communication Disorders, in which the basic diagnostic criterion is represented by the impairment of communication skills, testifies to the relevance of the deficit in developmental disabilities and the corresponding need for adequate educational responses (APA, 2013). The restructurings of international nosography present explicit references to the scientific perspective (WHO, 2001), in which the enhancement of environmental factors represents a significant aspect that society in general and educational or mental health system in particular, must fulfil towards every person with disabilities. Research have confirmed the role of AAC interventions in promoting communication skills and the consequent decrease in maladaptive behaviours and the reference to these systems could be decisive for Special Education interventions aimed at the main neurodevelopmental disorders, such as those represented by autism spectrum disorders (Beukelman & Mirenda,2013). The contextual enhancement of the learning environment, in this case, is favoured by the multiplication of communication opportunities provided to the person with disabilities, for the promotion of which augmentative techniques are decisive (idem). The knowledge of the basic techniques of AAC by the communicative peers increases the possibilities of the child's social participation, with the consequent increase of the communicative opportunities presented to the child (idem). Another line of the AAC approach can be related to the assessment of functional skills. The preliminary assessment processes of the subject's communication skills represent an indispensable component for any AAC intervention. The tool considers communication skills to be dominant over those language skills, and attributes a greater adaptive value to non-verbal communication skills rather than to the learning of verbal language. Data relating to the functional communication deficit typical of autism spectrum disorders support the idea that many autism subjects develop language skills, but are not able to use them in contexts suitable for functional purposes without a further assistance (Mirenda & Iacono, 2009). All forms of AAC, regardless of the level of technology, are based on an initial awareness training conducted in the student's Life Environment, based on experiences of joint attention and shared use of symbols (Wetherby & Prizant, 2000; Mirenda & Iacono, 2009; Beukelman & Mirenda, 2013). The typical AAC intervention developed for subjects with severe communication disabilities related to autism spectrum disorders is based on initial

communication strategies aimed at creating motivating situations, in which objects of specific interest can be used. The child must learn to ask the partner or a peer to do something for him by selecting the correct symbols for shared use. The request represents the foundation of communicative intentionality, and reveals the development of the student's skills (Iacono et al., 2009). The object should be located within the pupil's reach, to stimulate him to issue a request by indicating his symbolic image (Sigafoos et al., 2007; Sigafoos et al., 2011). In other words, the communicative partner must provide the child with opportunities to exercise control over the environment by issuing requests, with the dual purpose of favouring the emergence of latent skills of communicative intentionality and sharing attention on objects or activities of common interest (Mirenda & Iacono, 2009). The possibility of sharing attention on an activity of common interest allows the student to use the expressions of "Enough" or "Stop" by selecting the corresponding symbols. Any request made through the shared symbolic code must be immediately satisfied in the requested form, in order to experience the satisfaction of the request when it is expressed in the correct way (Sigafoos et al., 2007; Lancioni et al., 2007; Mirenda & Iacono, 2009; Beukelman & Mirenda, 2013). Each sequence of 2-3 symbols represents a communicative table that indicates specific contexts and activities (Sigafoos et al., 2007; Beukelman & Mirenda, 2013). The need for immediate reinforcement reflects the correlations with other alternative trainings (Koegel, 2000) and, more generally, with Modeling and chaining techniques derived from the ABA perspective (Matson et al., 2012). The use of the communication table in its most elementary form represents the indispensable background for the evolution towards the competence of spontaneous functional communication, characterized by the understanding of the evocative abilities of symbols and indicative gestures. A simple communicative table could consist, for example, of the photographic image of the student, followed by the "I want" symbol and the symbol of the desired activity object. Evocative behaviours based on symbols appear in contexts characterized by the presence of motivating situations, in which the role of the communicative partner is decisive for the development of occasions for the use of symbols (Iacono et al., 2009; Mirenda & Iacono, 2009). The discovery of communicative power has positive effects on the decrease of maladaptive behaviours and on the development of emotional and cognitive self-regulation skills (Mirenda & Iacono, 2009; Steiner et al., 2013; Tyson et al., 2013; Anagnostou et al., 2014).

Tab. 2 ACC interventions in the motivational features of individuals with intellectual disabilities

Negative attitudes towards strangers
Lower expectations of success
Dependence on adults

Source: Own elaboration from Zigler & Bennet-Gates model (1999)

Universal Design for Learning Approach (UDLA)

The analysis of the theoretical background behind the alternative education perspective could make intuitive the opportunities presented by the systems towards inclusive education. The AAC systems, in addition to providing communication opportunities to all students with

communication deficits, also allow the development of an inclusive climate in educational contexts, which in turn favours the involvement of peers in the educational intervention aimed at the student with Disorders of the Autism Spectrum. The experiences of sharing the communication codes based on AAC with peers allow the student to share messages aimed at expressing their preferences and needs (Mirenda & Iacono, 2009; Stasolla et al., 2012). The UDL approach is derived from the Universal Design movement, developed in the United States in the 2013, in the fields of design and architecture. The basic objective of the approach is to develop inclusive contexts characterized by the highest levels of accessibility. The living contexts where human activities take place, in other words, should be made accessible to anyone through the design of suitable learning, work or socialization contexts (Geake, 2009; Hall et al., 2012). The inclusive process, in this perspective, should be behind the design of buildings furniture, in order to develop contexts accessible to all users, including those with disabilities (Hall et al., 2012). The principles that have influenced the Universal Design approach have been progressively extended from the design of inclusive learning contexts, in order to provide all students, the same opportunities for learning and participation in community life. The extension of the principles of Universal Design to teaching and learning processes has developed the UDL perspective, according to which the principles relating to universal accessibility must include every component of the processes, from the design of the educational intervention to its implementation in didactic contexts (Rose, Meyer & Hitchcock, 2005). Any educational intervention should therefore be designed to be adapted to the widest possible range of users, and its contents must be adapted to the learning potential of all pupils, typically developing with disabilities. Any obstacles to the accessibility of learning content must be eliminated from the school context or from the educational intervention starting from the design stages (Rose et al., 2005; Geake, 2009; Hall et al., 2012). From the perspective of Universal Design for Learning, the principles that guarantee universal accessibility are represented by three basic concepts, relating to the use of multiple modes of presentation, expression and involvement (Hall et al., 2012). The multiple presentation modes allow to offer multiple options for the representation of learning contents to all users; the relative information is presented through multiple perceptual modalities, relating to the visual, auditory or tactile channels, and can be modified by the user at any time. The multiple modes of expression allow each student to express their knowledge based on their cognitive abilities, through the use of multiple visual, auditory or tactile expressive channels. The use of the Interactive Multimedia Board could represent a way of involvement oriented to all students, through the simultaneous presentation in textual and symbolic format of the learning contents (Geake, 2009). The use of the device could favour the involvement of all students in learning the most appropriate communication methods to address the student. Data relating to the presentation of contents in ways comprehensive to the student with ASD must also be considered, a presentation that allows the reduction of his cognitive effort and the maintenance of his attention skills, within the limitations imposed by the disorder (Odom et al.,2010; Sigafoos et al., 2011; BPS, 2012; Beukelman & Mirenda, 2013).

The following table gives an overview of the basic principles of the UDLA approach:

Tab. 3 Basic principles of UDL

Fairness: the product must be usable by everyone
Flexibility: the product must be flexible in use to suit different abilities.
Simplicity: the product provides a simple and intuitive use for all users
Perception: the product presents immediately perceptible accessibility in relation to any users with disabilities
Error tolerance: the use of the product must minimize risks for the user or unwanted actions
Containment of physical effort: the product must be usable with minimum physical effort and with minimum possible number of movements

Source: Own elaboration form Hall, Meyer & Rose (2012)

Starting from the basic principles of UDL, researchers suggested that collaborative Teaching strategies through multimedia ways represent one of the most effective contextual strategies for designing inclusive learning environments (Mitchell, 2008; Giangreco, 2009; Sigafoos et al., 2011). The inclusion of the student with ASD is favored by the multi-contextual intervention, which implies the collaboration between different subjects, such as education professionals, parents, support teachers, speech therapists (Mitchell, 2008; Sigafoos et al.,2011). The possibility of being involved in the learning experiences aimed at all students promotes the self-esteem of the student with communication disabilities (Lancioni et al., 2002; Giangreco, 2009; Sigafoos et al., 2011). Another strategy that can include the reference to AAC systems is represented by the development of a positive school culture (Mitchell, 2008; Sheey & Rix, 2009; Sigafoos et al., 2011). The development of school culture provides the dissemination of inclusive culture among all components of the training system. The adaptation of educational contexts to make them accessible also to students with ASD based on Augmentative and Universal Learning systems represents an example of their role in the development for the promotion of inclusive school culture (Sigafoos et al.,2011; Cottini, 2011).

2. Objectives

The purpose of the present article is to provide a rationale that the implementation of an Augmentative Alternative Communication training results in a significant improvement in the communication skills and daily life skills of the participants.

3. Methods

The experimental design selected for the purpose of the present research is that A-B-A, in which the verification is based on three phases: measurement of the basic functioning (A1), introduction of the independent variable (B) and inversion with withdrawal of the treatment phase (A2). The A-B-A design was privileged over the A-B one since the absence of the inversion phase could affect the validity of the procedure due to the incidence of historical factors. Any observed changes, in other words, could be attributed to the personality patterns of the participant or to the influence of other factors unrelated to the treatment (Siegel & Castellan, 1988; Barlow, Nock & Hersen, 2009). The AB-A drawing is structured in three phases, schematized in tab. …

Instruments and Procedures

The tool for assessing the subjects' adaptive skills is the Vineland Adaptive Behaviour Scales (VABS, Sparrow et al., 1984). The VABS Scales consist of a series of structured interviews conducted with parents and educators who have the opportunity to observe the participant's behaviour on a daily basis. The Scales are based on a general interview (297 items) and on an in-depth interview (577 items). They allow an objective assessment of the subject's social and adaptive skills, and represent the most used tool in research on the effectiveness of training developed for educational intervention in autism spectrum disorders. The areas of investigation of the VABS are divided into 4 Scales: Communication, Daily Activities, Socialization and Motor Skills. Each Scale is divided into three subscales, with the exception of the Motor Skill Scale, for a total of 9 Subscales. The methods of responding to the interview items are divided into 4 levels, each of which provides for specific methods of assigning the score, according to a standardized scheme. Following the conversion of the raw scores into the Deviation IQ score, the Scales have an average of 100 points and a standard deviation of 15 points (Sparrow et al., 1984). The indicator used to evaluate the effectiveness of the intervention is the IRD (Improvement Rate Difference) by Parker et al. (2009). The indicator allows the evaluation of the extent of change between the two phases of an experimental condition on the basis of the difference between the two phases or between the control group and the experimental one. The method chosen for verifying the effectiveness of Augmentative Alternative Communication training is based on the comparison between randomly assigned Experimental and Control Group (Barlow et al., 2009). The relationship between the independent variable (participation in structured training provided by appropriately trained practitioners) and the dependent one (improvement of social and communication skills) is highlighted by comparing the responses issued by the members of the Control Group and the Experimental Group before and after the introduction of the independent variable (Sieger & Castellan, 1988; Barlow et al.,2009). The participants were divided into an Experimental Group, subjected to training, and a Control Group, which followed the normal activity implemented in the educational centre attended; the assignment to the groups was randomized on the basis of a lottery. Both groups underwent the assessment of adaptive and social skills for the detection of the baseline before the start of the training (Phase A1), immediately after its end (Phase B) and 6 months after its conclusion (Phase A2).

Sample

The sample of the current study include young adolescents with autism spectrum disorders belonging to a specialized educational service in Tirana (Albania) (N = 8; range: 10-15; average age 10 years old). Participants were assigned with randomization to the Control Group (N = 4) or to the Experimental Group (N = 4). The range of the total age was 10-15 with an average age 10 years old for the total sample.

Training Description

The proposed training model was developed to meet the educational and communication needs of younger participants with autistic spectrum disorders with low cognitive function, intellectual disabilities associated and with a request for level 3 environmental support

according to the criteria of DSM -5 (see Table 1) (APA, 2013). The training was conducted by us, as professionals in mental health and educational services, every two weeks in individual learning sessions of 2 hours for each participant. The overall duration of the training extended to a calendar year, from January to December 2021. The typical communicative learning session was represented by a table in a soundproofed room in which volumes, illustrated texts, game and everyday objects that were known to the subject. The examiner sat next to the subject in front of a cardboard communication table on which the plasticized symbols were applied. Pre-packaged and photocopied communication tables were available also, on which, according to the preferences of the subject, further expansions could be made by varying the symbols and their positions. Due to the variability of the cognitive profile of each subject, the training consisted of a basic structure (Schlosser, 2003; Mirenda & Iacono, 2009; Sigafoos et al., 2011), on which variations and insights could be carried out depending on the special educational needs presented by each participant. The basic structure consisted of the presentation of the main symbols relating to the participant's daily activities, in order to facilitate the composition of an agenda for understanding the daily routine (Schlosser, 2003; Lancioni et al., 2005; Mirenda & Iacono, 2009). The symbols used were those relating to the PCS (Mayer Johnson) set, which represent those most used for the development of AAC systems in the international arena, integrated with photos of the subject and his favorite peers. The form used related to low-tech communication tables, made up of paper supports with communication strings of minimum complexity of 2-3 symbols. The set of symbols was kept in a special binder album with pockets; in accordance with the principles of AAC, the introduction of new symbols was performed only if the examiner was sure of their understanding by the participant (Schlosser, 2003; Lancioni et al., 2007, Cafiero, 2009; Sigafoos et al., 2011; Beukelman & Mirenda, 2013). The activities proposed in the basic training focused on the description of daily events through symbols and on the invitation to formulate requests to the operator and companions through the presentation of communication tables (Lancioni et al., 2005; Sigafoos et al., 2011). A fundamental component of the basic training was the description of the participant's mental states through the indication of facial expressions of emotions. The use of communication tables based on the understanding of before-after concepts, internal to the development of agendas or diaries, represented in fact a basic component of the training, given its compensatory possibilities for the difficulties of temporal orientation, frequently responsible for the maladaptive behaviors associated with autism spectrum disorders (Sigafoos et al.,2011; Mirenda & Iacono, 2009). The training was conducted individually in thematic sessions in which the pauses were requested by the participant, according to his attention skills.

Ethical Issues

Based on the approval of Commission of Ethics of the Clinical Directorate of Albania and the Ethical Board for Scientific Research of “Albanian University”, data collection began with the case studies.

A detailed Informed Consent was introduced to school Directories, Teachers and Parents regarding the Purpose, Research Design, ACC and UCL General Instructions and Expected results of the training.

At the end, a full copy of the treatment outcomes Report was delivered to each interested part in the study.

Special attention by the examiners were given to:

Maintaining the confidentiality and anonymity of subjects under which subjects were informed about the treatment of personal data of children and minors.

Collected data would be used only for research purposes respecting the principle of anonymity and confidentiality under the European Data Privacy Protection Act for Research Issues.

4. Results

To understand the influence of the ACC's profile to the level of cognitive and social competences, we used the Multiple Comparison Test for the factor Communication in the VABS. Statistical data, not presented in this article for technical space necessities, revealed that there is a significant impact of the ACC's profile over the cognitive and social competences between Experimental and Control Groups regarding their acquired skills and competences. In particular, subjects who revealed a better Communication competency ($r = .92$; $p < 0.05$) and social abilities ($r = .86$; $p < 0.05$) had a greater chance to be assessed toward an improved and facilitated cognitive profile. It means that the ACC basic-teaching technologies can have a greater impact on communication competencies and social abilities if accurately trained in ASD subjects. The analysis of the IRD index for the effects of AAC and UCLA on the cognitive and social skills of subjects with ASD confirmed how the highest levels of effectiveness were detectable in the areas of communication (IRD = 0.99) and social skills (IRD = 0.90). Indices show that the effectiveness of AAC systems is higher in relation to the development of language skills (IRD = 0.95) and restrictive behaviours (IRD = 0.80). The effect size indicator in relation to the types of intervention, on the other hand, highlighted high levels of effectiveness for the mixed AAC systems (IRD = 0.99) rather than other supportive methods (e.g., PECS or VOCA). The average scores of the Daily Skills subscale from the current research are in line with those of the normative sample of VABS (91.75 Control vs. 93.25 Experimental) for the Personal and Household subscales, while in the Community subscale the scores research revealed lower than the average. The variability of the participants' cognitive profiles, typical of autism spectrum disorders, is highlighted by the individual scores of some participants, despite the presence of an IQ lower than 50 in all subjects. Similar variability in the performance of the same subject is in line with the cognitive profile typically associated with the disorder with low cognitive function that on the one hand reflect the influence of daily routines on personal hygiene skills. On the other hand, the intra-individual variability of the scores highlights the difficulties in understanding the community rules and the related activities for the maintenance of the life context, activities that involve the recall of long sequences of instructions. This ability is in fact compromised in the cognitive profile associated with the disorder (Matson, 2014) and could not be statistically verified by the current study. In the Social Rules Subscale of the VABS, aimed at detecting the ability to understand the rules that guide social interaction, the highest scores were recorded on the Socialization Scale (Control Group Average = 94.50; Average Experimental Group = 96.50). The values indicate a marked impairment of social skills in all participants: the data is in line with the social deficit typically

associated with the disorder, permanent even in adulthood (BPS, 2012). Markedly lower scores were instead recorded in the Social Gaming subscales (Control Group Average = 87.0; Experimental Group Average = 88.25), which assess the skills of sharing playful activities with peers. Similarly, the skills of understanding social rules, essential for participation in community life, which guide social interaction are lacking, as shown by the average scores of the Control Group (88.67) and the Experimental Group (96.00). The values can be interpreted in relation to the difficulties of sharing attentional processes with the interlocutors, a deficit that various authors (Wetherby & Prizant, 2000; Prizant et al. 2006; Mirenda & Iacono, 2009; Ganz et al, 2011, 2012; Matson, 2014; Ninci et al., 2015) indicate as a typical feature of the cognitive and social profile associated with the ASD. The role of AAC systems, in this perspective, could be significant for the development of sharing skills of attentional processes, since their use implies the sharing of a symbolic code with a communicative partner (Ganz et al., 2011; Light & McNaughton, 2014; Ganz, 2012; 2015). Based on these arguments, the use of interactive training based on the sharing of AAC and UCLA systems could lead to an increase in scores in the Cognitive, Socialization and Social Communication Subscales. The sharing of attentional processes on elements of common interest, such as those represented by symbols, is in fact an element of not marginal importance in all educational interventions aimed at subjects with severe alterations of the Autistic Spectrum (Wetherby & Prizant, 2000). In order to evaluate the effectiveness of the training, the scores recorded in the various subscales in phase B had to be considered. The analysis allowed the evaluation of the increase in the individual and average scores of the Experimental Group compared to those of the Control Group in the Communication subscales of the VABS. The analysis of the reception scores highlights a significant increase in the scores of the Experimental Group (Average 111.25) in relation to both those of the Control Group (Average 84.25), and to the average values of the same Experimental Group (94.50). This means a significant improvement in language comprehension skills following exposure to AAC training.

The analysis of the scores recorded in daily skills immediately after the conclusion of the AAC training showed it had determined significant effects in relation to the Personal Subscale (Control = 94.59 vs. Experimental = 100.25). The use of AAC systems therefore seems to have positively influenced individual daily skills competences. Increases in scores were also recorded in the Domestic (Experimental Group Average 1120) and Community (Experimental Group Average 87) subscales. The comparison with the mean scores of the Control Group (Home = 85; Community = 96) could indicate how the use of visual agendas widely used in training has favored the development of the skills of understanding the sequences of instructions necessary for both maintenance of the domestic life contexts, and for the understanding of social rules. A highly significant index is that relating to the Relations subscale, which presents an average score of the Experimental Group of 120. The comparison with that of the Control Group (86) shows how the AAC training has had decidedly positive influences on the relational skills of the subjects, and in particular on those relating to the ability to initiate and maintain conversational shifts. The data is partially linked to the improvements of the Reception and Expression subscales, and could reflect the greater motivation of the participants in the social relationship following the discovery of the communicative power related to the use of highly transparent symbolic codes typical of AAC systems (Light, 1989;

Mirenda & Iacono, 2009; Ganz, 2014; Light & McNaughton, 2014). The effects of generalization of the relational skills acquired following participation in the AAC training have been progressively attenuated by the processes underlying the subscale are in line with the social skills deficits associated with low cognitive functions in ASD subjects (BPS, 2012; Ninci et al., 2015. To verify the effects of the training on the participants of the Experimental and Control Group, a comparison was then made between the average ranks of the three-time measurements carried out (pre-test A1, post-test B and follow-up A2) on the three Basic and the nine Subscales of the VABS. The comparison between the ranks for the three surveys was carried out using the Friedman non-parametric test (Sieger & Castellan, 1988; Barlow et al., 2009) to check for significant differences between the mean ranks of each group's scores. The presence of significant differences between the scores of the Experimental Group and the Control Group was instead verified on the basis of the Mann-Whitney non-parametric U test, always conducted on the three basic scales and on the nine subscales of the VABS. Statistically significant differences were found in the subscales of Expression [Friedman (2) = 6.50, p <.05], of Writing [Friedman (2) = 6.33, p <.05], of Game [Friedman (2) = 6.50, p <.05] and the Social Rules [Friedman (2) = 6.53, p <.05]. In the other subscales the scores, although not significant, were increased in the Phase B, configuring themselves at the limits of significance for p <.05 in the Reception, Domestic and Community subscales [Friedman (2) = 7.00]. These results confirm a significant effect of AAC training in relation to the global improvement of the Basic Communication, Socialization and Daily Skills Scales. The regression of the scores in the A2 follow-up phase determines however a maintenance of the skills learned by the Experimental Group, if the mean ranks of the pre-test and post-test scores are considered (1.25 versus 2.12, [Friedman (2) = 7.2, p <.05]). Although almost all subscales have scores at the limits of significance for p <.05, the most relevant effects were recorded in the Expression (p = .040), Writing (p = .052), Game (p = .039) and Social Rules (p = .056). The Control Group has statistically significant differences between the mean ranks of the three readings on the Communication [Friedman (2) = 7.69, p <.05], Socialization [Friedman (2) = 6.50, p <.05] and Daily Skills scale [Friedman (2) = 7.50, p <.05]. The indices, relating to the summations of the scores of the individual subscales, could be traced back to the dissemination of the skills learned by the Experimental Group, whose participants were not isolated from those of the control but interacted for the entire time of attendance at the Center. Significant differences were recorded between the findings in the Communication Scale [Friedman (2) = 9.00, p <.05], in the Socialization Scale [Friedman (2) = 9.00, p <.05] and in the Daily Skills [Friedman (2) = 9.00, p <.05]. In the present study, the test U of Mann-Whitney was used to search for significant differences between the Experimental and Control Group scores based on pre-test A1, post-test B and follow-up A2 for all VABS subscales. Indices revealed statistically significant differences between the two groups at post-test B in the Personal (ZU = -3.522, p <.05), Domestic (ZU = -1.02, p <.05) subscales, Game (ZU = -2.65, p <.05) and Social Rules (ZU = -3.14, p <.05). Particularly relevant, in this order of results, is covered by the data relating to the personal (6.50 vs. 2.50), Domestic (6.25 vs. 2.85), Game (6.75 vs. 2.15) and Social Rules (6.82 vs. 2.35) subscales, in the which the Experimental Group has mean ranks significantly higher than those of the Control Group, with significantly lower levels of significance than p <.05 and close to the level p <.01. Participation in a structured AAC training therefore seems to have favored the development of personal care skills, care of the life context, participation

in social game situations and the ability to follow social rules in the Experimental Group, whose scores in the respective subscales are all significantly higher than those of the Control Group. Other statistically significant differences between the two groups in the Basic Scales were recognized only in the Daily Skills Scale, in which the Experimental Group showed a higher average rank (RM = 7.50) than that of the Control Group (RM = 4.50) both at post-test (ZU = -1.43, p <.05) and at follow-up (ZU = -2.32, p <.05). However, the values of ZU relating to the follow-up of the Communication (ZU = -1.86) and Socialization (ZU = - 2.390) scales must also be considered. Data show an increase in scores in all the basic scales of the VABS by the Experimental Group, with particular reference to the Daily Skills Scale and Social Communication. In other words, the skills learned during the training are reflected in the significant increase in the scores of the Home, Personal and Community subscales in relation to those of the Control Group which, despite the previously reported dissemination of knowledge, have significantly lower scores.

5. Discussion

The use of multiple ways of presenting learning contents, in order to multiply their representation options for all users, represents a further instance of the Universal Model, to which the CAA approach can provide truly meaningful tools for modification of the code through which the information is transmitted. Given the enhancement of adaptive behaviors, now considered more relevant than the level of Intellectual Communication needs, closely related to socialization needs, represent an educational need common to all students. Referring also to the criteria of DSM 5 (APA, 2013), the need to refer to a set of techniques capable of facilitating language learning through codes should be evident. The very foundations of the Universal Design for Learning perspective, which will probably represent the reference system for the development of educational models based on experimental evidence, implicitly refer to tools capable of increasing the expressive possibilities of students, based on their cognitive skills. By ensuring accessibility to the training system through compensatory tools such as those represented by the AAC approach, the communication rights of each individual are satisfied, such as those represented by the Charter of Communication Rights. The possibility of using multiple modes of communication (Geake, 2009) allows respect for communication rights relating to expressive potential, rights to which the environment is required to provide adequate responses. Social participation and communication opportunities represent one of the fundamental dimensions of the perspective of the International Classification of Functioning, Disability and Health (WHO, 2001), which considers the barriers and facilitating factors capable of hindering or facilitating the adaptation of the individual to the context. In this sense, AAC tools could represent a range of tools for facilitating the accessibility and social participation of the subject. In other words, the approach could constitute a bridge between inclusive education promoted from the perspective of Universal Design for Learning and the need for contextual enhancement expressed from the perspective of the World Health Organization (WHO, 2001). The previous considerations on cooperative learning didactics could indicate further heuristic possibilities of the AAC approach. The possibility of sharing a communication code with the interlocutors allows the development of the motivation for communication and the understanding of the rules that guide social interactions in a natural

context with high ecological validity, such as that represented by the subject's living environment.

The overall analysis of the present study results highlights significant increases for $p < .05$ in a considerable share of the VABS scales following the implementation of AAC and UCLA training. Of particular interest are the increases in the skills of the Experimental Group in the pre-test A1 and post-test B in relation to the Expression, Writing, Social Game and Social Rules subscales, in which wide variations of the average ranks were observed based on the Test Friedman's non-parametric. The changes, all significant for $p < .05$, imply increases in the social communication and adaptive skills of the Experimental Group in the basic scales of VABS, and in particular in those of Daily Skills and Socialization. The data is confirmed by the Mann-Whitney non-parametric U test, which showed variations at the limits of significance for $p < .01$. Significant indices were revealed by the Daily Skills Scale, in which the Experimental Group showed a higher average rank (RM = 7.50) than that of the Control Group (RM = 4.50) both at post-test (ZU = -1.43, $p < .05$) and at follow-up (ZU = -2.32, $p < .05$). Significant values were revealed by ZU relating to the follow-up of the Communication (ZU = -1.86) and Socialization (ZU = - 2.390). In the Communication Scales specifically, variations at the limits of significance were detected for $p < .05$ at follow-up (ZU = -1.73). Even the variations between the average ranks of the Socialization Scale, although not significant, are configured at the limits of significance for $p < .05$ at follow-up (ZU = -1.90), indicating an increase in social skills. These effects, not recorded in the Control Group, can be attributed to the participation in the annual CAA training by the participants of the Experimental Group. Following the withdrawal of the training variable, the scores of the subscales have significantly decreased, even if in some cases a tendency has been recorded towards the conservation of the skills acquired. [Repeated A-B-A-B, in which sequences of withdrawal and reintroduction of the independent variable alternate with the detection phases (Barlow et al., 2009)]. These results may offer confirmation to the reference literature, according to which AAC and UCLA interventions can favor the development of social skills of children with autism spectrum disorders with low cognitive function (Ganz et al., 2011; 2012; Bishop- Fitzpatrick et al., 2013; Ninci et al., 2015).

Conclusions

In the current study, some of the main applications of AAC or UCLA methods for educational and competences interventions were considered, according to the specific educational needs related to young subjects with autism spectrum disorders. Although not exhaustive, we guess that this article can alleviate the understanding of the role played by the assistive technology and inclusive approaches. The same bridge of contact between the perspective of the International Classification of Functioning and the previous edition of DSM-5 are centered on the role of the environment in maintaining or removing the barriers that exclude the subject with cognitive and communicative disabilities from accessing learning. The AAC and UCLA approaches, in this perspective, could be regarded as elements of mediation capable of orienting educational interventions towards the macro-category of improving communication. It does not represent a mere intervention centered on the subject, but rather a social act involving the active involvement of the environment in providing partners and communication opportunities.

Similarly, the involvement of the environmental system, and in particular of the training contexts, represents the recognition of the rights to communication, which in turn are indispensable for the social participation of the subject. The reference to the spectrum of models and techniques of the AAC and UCLA approaches can represent an extremely important tool to facilitate accessibility to learning and socialization opportunities provided by training systems. In the absence of augmentative communication opportunities, individuals with complex communication disabilities risk compromising accessibility and understanding of environmental issues. It is in this context that the reference to alternative educational and psychological tools should represent an element of mediation for the understanding of the requests and opportunities presented by the training systems. Such awareness could guide the reflections of educators who are daily required to provide answers to the educational needs of those with severe communication disabilities. The present study aimed to explore and represent an indicator of the need for the development of educational opportunities aimed at responding to the communication needs of young subjects with moderate cognitive functionality. The privileged use of the ACC and UCLA visual scheme in the development of individualized didactic contexts, oriented at the learning of new activities and the development of personal autonomy skills, represents a highly relevant mediating element between the opportunities of AAC and the preservation of visual memory. The design of interventions oriented to the development and maintenance of cognitive and communicative skills in adulthood, prompted by the same systems of international guidelines for educational intervention in young subjects (BPS, 2012), could represent an adequate resource for the response of the company to the previously considered requests. The increase in functional life skills, underlying the use of training based on AAC systems, could represent a goal for future research lines. The development of individual autonomy skills could determine both the reduction of environmental support by the adult with ASD, and the reduction of the social cost associated with forms with moderate cognitive function (Bishop-Fitzpatrick et al., 2013; Baron, 2016). The possibility of integrating forms of assistive technology training, represented by AAC or UCLA systems, in the educational intervention for adults could thus represent a research guideline on AAC systems (Wright, 2016). The results of the present study confirm a significant effect of AAC training in relation to the global improvement of the Basic Communication, Socialization and Daily Skills Scales. The regression of the scores in the A2 follow-up phase revealed a significance for Expression ($p = .040$), Writing ($p = .052$), Game ($p = .039$) and Social Rules ($p = .056$) for $p < .05$ (1.25 versus 2.12, [Friedman (2) = 7.2, $p < .05$. Other statistically significant differences between the two groups in the Basic Scales were recognized only in the Daily Skills Scale, in which the Experimental Group showed a higher average rank (RM = 7.50) than that of the Control Group (RM = 4.50) both at post-test (ZU = -1.43, $p < .05$) and at follow-up (ZU = -2.32, $p < .05$). However, the values of ZU relating to the follow-up of the Communication (ZU = -1.86) and Socialization (ZU = - 2.390) scales must also be considered. These results are in line with several research Matson (2014), Ganz (2015) and Wright (2016). Thus, the opportunities presented by AAC systems should always be considered in the development of educational interventions aimed at developing communicative and social skills. Training of educators and operators could play a significant role, both for the support teachers belonging to the training systems of the Primary and Secondary School, and for the educators who manage the educational relationship with the

adult subject in residential and semi-residential contexts. Recent developments in augmentative systems, and particularly those relating to high-tech systems, allow the use of systems through the methods of speech synthesis and communication software as an alternative to the inclusive-education and children psychology.

References

[1]. Anagnostou E., Zwaigenbaum L., Szatmari, P., Fombonne, E., Fernandez, B.A., WoodburySmith, M., Brian J., Bryson, S., Smith, I. M., Drmic, I., Buchanan, J. A., Roberts, W. & Scherer S.W. (2014). Autism Spectrum Disorder: advances in evidence-based practice. Canadian Medical Association Journal, 186 (7), 509-19.

[2]. APA - American Psychiatric Association. (2022) Diagnostic and Statistical Manual of Mental Disorders – DSM 5 Revised. Washington: APA

[3]. APA - American Psychiatric Association. (2013) Diagnostic and Statistical Manual of Mental Disorders – DSM 5. Washington: APA.

[4]. Barlow, D.H., Nock, M. & Hersen, M. (2009). Single-case experimental designs: Strategies for studying behavior change (3rd Ed.). New York: Allyn & Bacon

[5]. Baron, M. (2016) Ageing with Autism. Improving health, improving rights. In: S. D. Wright, op. cit., pp. 91-104.

[6]. BPS- British Psychological Society. (2012). Autism. Recognition, Referral, Diagnosis and Management of Adults on the Autism Spectrum. National Clinical Guideline Number 142. London: Hunt.

[7]. Beukelman, D. R. & Mirenda, P. (2013). Augmentative and Alternative Communication. Supporting Children and Adults with Complex Communication Needs, Fourth Edition. Baltimore: Brookes

[8]. Bishop-Fitzpatrick, L., Minshew, N. & Eack, S. (2013). A Systematic Review of Psychosocial Interventions for Adults with Autism Spectrum Disorders. Journal of Autism and Dev. Disord., 43,687–694.

[9]. Cafiero, J. M. (2005). Meaningful exchanges for people with Autism. An introduction to Augmentative and Alternative communication. Bethesda: Woodbine House. Tr. it: (2009) Comunicazione aumentativa e alternativa. Strumenti e strategie per l'autismo e i deficit di comunicazione. Trento: Erickson.

[10]. Cottini, L. (2011). L'autismo a scuola. Quattro parole per l'integrazione. Roma: Carocci.

[11]. Ganz, J. B. (2015) AAC Interventions for Individuals with Autism Spectrum Disorders: State of the Science and Future Research Directions. Augmentative and Alternative Communication, 31(3): 203–214.

[12]. Ganz, J. B. (2014) Aided Augmentative and Alternative Communication for people with ASD. In: J. Matson (eds.) Autism and Child Psychopathology Series. New York: Springer, 127-138.

[13]. Ganz, J. B., Earles-Vollrath, T. L., Mason, R. A., Rispoli, M. J., Heath, A. K. & Parker, R. I. (2011) An aggregate study of single case research involving aided AAC: Participant characteristics of individuals with autism spectrum disorders. Research in Autism Spectrum Disorders, 5, 1500 – 1509.

[14]. Geake, J. G. (2009). The brain at school. Educational Neuroscience in the classroom. London: Open University Press

[15]. Giangreco, M. F. (2009). Opportunities for children and youth with intellectual developmental disabilities: Beyond genetics. Life Span and Disabilities, 2, 129-39.

[16]. Gordon, R.M. & Cosgrove, L., (2013) Ethical Considerations in the Development and Application of Mental and Behavioral Nosologies: Lessons from DSM5, *Psychological Injury and Law*, *6*, 4, 330-335, DOI 10.1007/s12207-013-9172-9.
[17]. Iacono, T., West, D., Bloomberg, K., & Johnson, H. (2009). Reliability and validity of the revised Triple C: Checklist of Communicative Competencies for adults with severe and multiple disabilities. Journal of Intellectual Disability Research, 53, 44-53
[18]. Hall, T., Meyer, A. & Rose, D. H. (2012). Universal Design for Learning in the Classroom. Practical applications. New York: Guilford
[19]. Hewitt, A. S., Stancliffe, R. J., Johnson Sirek, A., Hall-Lande, J., Taub, S., Engler, J. & Moseley, C. R. (2012). Characteristics of adults with autism spectrum disorder who use adult developmental disability services: Results from 25 US states. Research in Autism Spectrum Disorders, 6, 741 – 751.
[20]. Lancioni G., O'Reilly M., Cuvo A., Singh N., Sigafoos J. &Didden, R. (2007). PECS and VOCAs to enable students with developmental disabilities to make requests: An overview of the literature. Research in Developmental Disabilities, 28, 468-488
[21]. Lancioni G., Singh N., O'Reilly M., Oliva D. & Basili G. (2005). An overview of research on increasing indices of happiness of people with severe/profound and multiple disabilities. Disability and Rehabilitation, 27, 83-93.
[22]. Lancioni, G., O' Reilly, M., Singh, N., Oliva D., Marziani, M. & Groeneweg, J. (2002). A social validation assessment of the use of microswitches with persons with multiple disabilities. Research in developmental disabilities, 23, 309-318.
[23]. Light, J. & McNaughton, D. (2014). From basic to applied research to improve outcomes for individuals who require augmentative and alternative communication: Potential contributions of eye tracking research methods. Augmentative and Alternative Communication, 30, 99 – 105.
[24]. Light, J. (1989). Toward a definition of Communicative Competence for Individuals using Augmentative Alternative Communication Systems. Augmentative Alternative Communication, 5, 137-44.
[25]. Koegel, L. (2000). Interventions to facilitate communication in Autism. Journal of Autism and developmental Disorders, 30, 383-91
[26]. Matson, J. (2014). Autism and Child Psychopathology Series. New York: Springer.
[27]. Matson, J., Turygin, N., Beighley, J., Rieske, R., Kimberly, T. & Matson, M. (2012). Applied behavior analysis in autism spectrum disorders. Recent developments, strengths and pitfalls. Research in Autism Spectrum Disorders, 6, 1, 144-50.
[28]. Mirenda, P., & Iacono, T. (2009). Autism Spectrum Disorders and AAC. Baltimore: Brookes
[29]. Mitchell, D. (2008). What really works in special and inclusive education. London: Routledge
[30]. Ninci, J., Leslie, Hong, E. R., Margot, B., Boles, Gilliland M.D., Ganz J. B., Davis, J., Kimberly, J. &Vannest, K. (2015). Meta-analysis of Single-Case Research on Teaching Functional Living Skills to Individuals with ASD. Review Journal of Autism and Developmental Disorders, 2, 1884-98
[31]. Odom, S., Collet-Klingenberg, L., Rogers S. J. & Hatton, D. (2010). Evidence-Based Practices in Interventions for Children and Youth with Autism Spectrum Disorders. Preventing School Failure, 54 (4), 275–282.
[32]. Parker, R. I., Vannest, K. J. & Brown, L. (2009). The improvement rate difference for single case research. Exceptional Children, 75, 135–150
[33]. Prizant, B. Wetherby, A. Rubin, E., & Rydell, P. J. (2006). The SCERTS Model: A comprehensive educational approach for children with Autism Spectrum Disorders. Baltimore: Brookes.

[34]. Rose, D. H., Meyer, A., & Hitchcock, C. (2005). The universally designed classroom: Accessible curriculum and digital technologies. Cambridge: Harvard Education Press.
[35]. Schopler, E. (1987). Specific and nonspecific factors in the effectiveness of a treatment system. American Psychologist, 42, 376-383.
[36]. Schopler, E. & Mesibov, G. (1995). Learning and cognition in autism. New York: Plenum Press
[37]. Schlosser, R. W. (2003). The efficacy of Augmentative and Alternative Communication: Toward evidence-based practice. New York: Academic Press.
[38]. Sheey, K., & Rix, J. (2009). A systematic review of whole class, subject-based pedagogies with reported outcomes for the academic and social inclusion of pupil with special educational needs. London: EPPI-Centre, Institute of Education, University of London
[39]. Siegel, S. & Castellan, N. J. (1988). Non parametric statistics (2nd edition). New York: Mc Graw Hill
[40]. Sigafoos, J., Schlosser, R.W. & Sutherland, D. (2011). Augmentative and Alternative Communication. In: Stone, J. &Blouin, M. (Eds.). International Encyclopedia of Rehabilitation. The Center for International Rehabilitation Research Information and Exchange (CIRRIE). New York: Buffalo University.
[41]. Sigafoos, J., O'Reilly, M. &Green, V. (2007). Communication difficulties and the promotion of communication skills. In: Carr, A., O'Reilly, G., Walsh, P., &McEvoy, J. (Eds.). The handbook of intellectual and clinical psychology practice. London: Routledge
[42]. Sparrow, S. Balla, D. & Cicchetti, I. (1984). Vineland Adaptive Behavior Scales. Circle Pin. Tr.it. (2003): Balboni S. & Pedrabissi, L. e Pedrabissi L. Scale Vineland per il Comportamento Adattivo. Adattamento italiano. Firenze: Giunti, O. S
[43]. Stasolla, F., Picucci, L., Caffò, A., Signorile C., Lo Storto, L., Mazzarelli, A., Signorile, M., Lancioni, G. & Bosco, A. (2012). Supporti tecnologici per l'inclusione e la comunicazione in bambini con disabilità multiple. TD Tecnologie Didattiche, 20 (3), 178-184.
[44]. Steiner, A. M., Gengoux, G., Klin, A., & Chawarska, K. (2013). Pivotal response treatment for infants at-risk for autism spectrum disorders: A pilot study. Journal of Autism and Developmental Disorders, 43, 91-102
[45]. Tyson, K., Kelley E., Fein D., Orinstein A., Troyb E., Barton M., Eigsti I. M., Naigles L, Schultz R. T., Stevens M., Helt, M. & Rosenthal, M. (2014). Language and verbal memory in individuals with a history of autism spectrum disorders who have achieved optimal outcomes. Journal of Autism Dev. Disord., 44, (3), 648-63.
[46]. Volkmar, F. Mc Partland, D. & Reichov, B. (2012) Sensitivity and specificity of proposed DSM-5 diagnostic criteria for autism spectrum disorder. Journal of Academy Child and Adolescent Psychiatry, 51, 368-83.
[47]. Wetherby, A. & Prizant, B. M. (2000). Autism Spectrum Disorders. A transactional developmental perspective. Baltimore: Brookes.
[48]. WHO- World Health Organization (2001). International Classification of Functioning, Disability and Health (ICF).Geneva: WHO.
[49]. Wright, S. D. (2016). Autism Spectrum Disorders in mid and later life. London: Kingsley
[50]. Zigler, E. & Bennet-Gates, D. (1999). Personality in individuals with Mental Retardation. Cambridge: University Press.