Giornale Italiano di Educazione alla Salute, Sport e Didattica Inclusiva / Italian Journal of Health Education, Sports and Inclusive Didactics - Anno 5 n. 3 - ISSN 2532-3296 ISBN 978-88-6022-420-0 - luglio - settembre 2021 - CC BY-NC-ND 3.0 IT - https://doi.org/

LEARN AND COMMUNICATE VIA IMITATION. EDUCATIONAL TEACHING STRATEGIES AND APPROACHES FOR CHILDREN WITH AUTISM SPECTRUM DISORDERS

APPRENDERE E COMUNICARE ATTRAVERSO L'IMITAZIONE. STRATEGIE E APPROCCI EDUCATIVO-DIDATTICI PER BAMBINI CON DISTURBO DELLO SPETTRO AUTISTICO

Emanuela Zappalà[1]
University of Salerno
ezappala@unisa.it

Michela Galdieri
University of Salerno
mgaldieri@unisa.it

Abstract

Il processo imitativo, sin dalla primissima infanzia, può rappresentare per il bambino un'opportunità di crescita e di apprendimento di nuove azioni, un'occasione per stabilire relazioni sociali e comunicare con l'altro. Tuttavia, le difficoltà nell'imitazione manifestate dai bambini con Disturbo dello Spettro Autistico, possono ostacolare lo sviluppo comunicativo, linguistico e dell'intersoggettività. Diventa indispensabile individuare strategie che, precocemente, stimolino ciascun bambino sul piano imitativo a partire da situazioni di gioco e di vita quotidiana molteplici e diversificate, nelle quali i partner e gli oggetti svolgano una *funzione attivante*. Il lavoro sulle abilità di imitazione, in tal senso, costituisce un tassello significativo per migliorare le abilità sociali e comunicative del bambino con Disturbo dello Spettro Autistico sfruttando anche le potenzialità di approcci come la CAA, il PECS e il Video-modeling.

The imitative process may represent an opportunity for a child's development to learn new actions, as well as to establish social relationships and communicate with each other at an early age. Nonetheless, difficulties in imitation shown by children with Autism Spectrum Disorder may hinder communication, language and intersubjectivity development. Hence, it's essential to identify strategies that stimulate each child on an imitative level starting from multiple and diversified situations of play and daily life where partners and objects act as an activating function. Therefore, working on imitation skills constitutes a significant step to improve both social and communication skills of the child with Autism Spectrum Disorder by exploiting the potential of some educational approaches such as AAC, PECS and Video-modeling.

Keywords

Imitazione, didattica speciale, Disturbo dello Spettro Autistico, CAA
Imitation, Special Didactics, Autism Spectrum Disorder, AAC

1 The article is the result of a joint collaboration between the authors. However, Emanuela Zappalà wrote paragraphs "1. *Homo imitans et socialis*", "2. *The role of perception and interaction in the learning process of children with ASD*", "5. *Conclusions*"; whereas Michela Galdieri wrote paragraphs "3. *The AAC strategy to support the imitative process*" and "4.*PECS, video modeling and symbolic games to encourage imitation and gestures*".

1. Homo imitans et socialis

The imitative mechanism has always interested developmental psychologists because it is considered a powerful tool of learning new actions and developing social skills, as well through non-verbal communication, over a lifetime. To date, there are several interpretations of this process as multiple researchers who try in vain to attribute a univocal meaning to this mechanism. Based on the traditional conception of imitation as pure emulation of an act performed by someone else (Thorndike, 1898), or as the response to a specific gratification that conditions the behavior of who learns (Guthrie, 1952; Millard, Dollard, 1941) [1]. To begin with the interpretation of the imitation process as a kind of learning (Miller, Dollard, 1941; Bandura, 1962); in addition, many other definitions include a form of symbolic representation (Wallon, 1942; Piaget, 1972), a variety of non-verbal mother-child interaction (Stern, 1977; Trevarthen, 1993), a type of cultural knowledge transmission (Tomasello, 2004); furthermore, a precursor of the theory of mind (Gopnik, Meltzoff, 1993) and communication skills (Nadel et al. , 1999; Nadel, Pezé, 2017; Vivanti et al., 2017). But most of the scholars agree on the occurrence of essential prerequisites of this process, such as the coupling between perception and action, oriented by the processes of attention and motivation and considered pivotal for child's motor repertoire development; the ability to understand the actions of others and to predict the correlation between action and its effects.

Some of these characteristics are highlighted in the works of Guillaume (1926), Wallon (1936; 1967), Piaget (1972) and Bandura (1962; 1982). For Guillaume (1926), perceptions regulate actions, so the imitative mechanism is the result of a learning process that gradually develops by building *hierarchies of habits* that, initially, take no account of their purposes. That's why, at an early age, children are inclined to imitate the action only when he/she is repeatedly exposed to the same stimulus. Furthermore, such exposure would allow them to enrich their repertoire of actions and acquire the appropriate skills to be able to consciously imitate those patterns in the future.

On the contrary, Wallon (1936; 1967) has a sensory-motor and emotional concept of this mechanism. He lays the foundations for the recognition of the other self, considered as an individual, and of himself, reckoned as an agent; but he also tries to bridge the gap between emotions and joint actions by addressing the issue of *emotional mimicry* and introducing that of degrees of freedom. According to the psychologist, during the first months of life, children experience an emotional contagion while interacting and observing an adult (the model). This mimesis and state of tonic-emotional fusion will give the children the opportunity to merge their own experience with that of others and begin a process of understanding others' actions when their motor potentials and the degree of freedom allow it. Even though it may be limited, this freedom of movement would let the children be free to explore and experiment within a physical and social environment full of stimuli. Moreover, according to Bandura (1982), it may improve children's "self-efficacy" and their confidence in replicating actions or engaging in activities for which one feels skilled. To some extent, it has also been demonstrated by Stevens' (2000) research group, who use functional neuroimaging technologies to prove the degree of activation of certain brain areas when the subjects involved observe a series of movements that they are able to emulate and others they are not able. The scholars found out that the parietal and premotor cortex of the sample activate only when physically achievable actions are observed and never in contrary cases (for example, bending the arm to 145°). Therefore, it is clear that the motor potential is not enough. In addition, the imitative mechanism also requires direct attention (visual or auditory) towards the event, the object or the model, depending on the situation (Bandura, 1982; Vivanti, 2021),

Although it is initially reduced in children or in those who show attention difficulties, it has been demonstrated that when the adult encourages a behavior the children showed, with

1 For example, Bandura himself (1962) avoids using the term "imitation" and states that one can talk about "observational learning" when the subject learns a new action by looking at the other.

reciprocal imitations or exaggerating attitudes, he/she is using a good strategy in order to keep and maintain children's attention during reciprocal modeling sequences and social interaction (Papousek, P., Haekel, 1987; Papousek, Papousek, Harris, 1987). Therefore, motivation (intrinsic and extrinsic) also plays a fundamental role during this process. At an early age, children are mainly motivated and reinforced by immediate sensory and social effects. Throughout their development, symbolic incentives become ever more motivating, thus expanding the range and complexity of stimuli that encourage children to acquire knowledge through modeling and capitalizing what they learned (Bandura, 1962). Human behavior is extremely determined by its effects; reinforcement generates specific beliefs about the possible effects of one's actions under certain circumstances (Brewer, 1974; Rivoltella, 2014). These beliefs, alongside the ability to predict the effects of specific actions in a particular context, are the result of the ability to mentally represent an object, an event or a situation. This skill would allow to anticipate the effects of our choices and create multiple solutions in connection with an action or task, simplifying its complexity (Aiello, Di Tore, n.d.).

However, to develop their mnemonic skills of representation, children should first learn to transform modeled information into symbolic forms and organize them into easily recoverable structures (Bandura, 1962). Hence, do not neglect the ability to intermodal transfer of one type of sensory information (mainly visual, auditory and proprioceptive) to another. Caregivers should consider it in order to define and personalize educational-didactic strategies to their pupils' learning styles, but also supporting them in developing comprehension skills relevant to recognize both the purpose and the way to reproduce an action. Piaget (1972), in "The role of imitation in the development of representational thought", points out that the replication of a behavior is not a mere mechanical reproduction of an action, but it is a consequence of children understanding and awareness of the action itself, because it also fosters the connection of the signification of an observed action to its meaning. This association takes place throughout an internalization of the observed movements and stimuli, and it is "voluntarily" evoked in the form of a mental image and deferred imitation as soon as there is a lack of simultaneous perceptions (Piaget, 1972). The same concept of representation will be verified, at the neural level, by Gallese and his research group at the University of Parma. They identify neural correlates of some systems of movement representations, plus morphological and functional correlates of vocal articulation (Gallese, 2007; Borghi, Scorolli 2009), that are usually activated when the subject observes or performs the action in a synchronous or deferred mode (motor/gestural or vocal). This is achieved thanks to an embodied mental process that takes place sub-personally at the cortical level and using pre-existing models of body/world interactions; it allows us to simulate, anticipate, understand and predict others' actions whose patterns we have already experienced in the past (Gomez Paloma, Damiani, 2021). Likewise, it has been found that each partner also synchronizes at the neural level during imitative interactions, between observer and model (Nadel-Brulfert, Baudonniere, 1982; Nadel, Butterworth, 1999) with an oscillatory coupling among the rhythm *alpha-mu*, in the right centro-parietal cortex[2], the *beta* band oscillations, between the right occipital central and parietal cortex, and *gamma*-type[3], between the centroparietal and parieto-occipital cortex (Figure 1; Dumas et al., 2010).

2 Tognoli's research group (2007) hypothesizes that this oscillatory rhythm, with a frequency between 9.2 and 11.5 Hz, is a neural correlate to the mirror neuron system and a neural marker of social coordination.

3 The alpha band is associated with visual processing and attentional processes; that range is activated when different perceived sensory information is connected to each other and both would appear to be altered in people with Autism Spectrum Disorder (Beker, Foxe, Molholm, 2018).

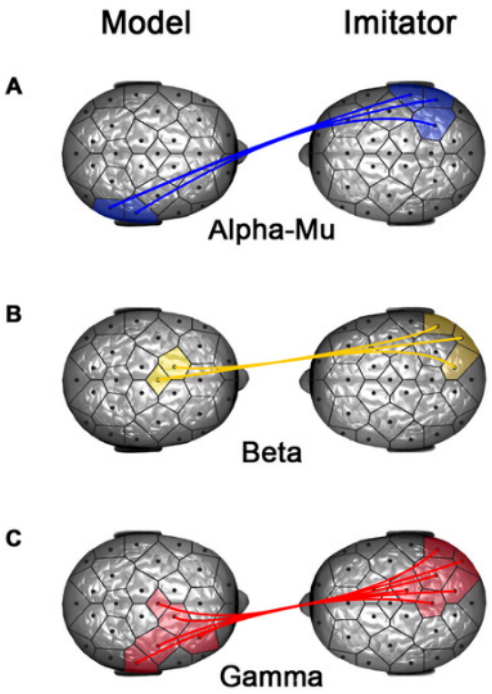

Fig. 1. *Representation of intersubjective neural synchronization during social interactions* (Dumas et al., 2010)

These neurophysiological discoveries could «represent a new area that didactic research and, in general, educational and pedagogical research could source forthcoming the enlargement of the teaching-learning process interpretative space» [author's translation] (Sibilio, 2020, p. 189). In fact, the representation and motor coordination skills of young children are sufficient to make them able to imitate elementary sounds and actions, within the limits of their physical possibilities, as explained before, and after the acquisition of other basic prerequisites. A fundamental role is played by the model; actually, social interaction and reciprocity are the cornerstone of gaining pivotal skills to observational learning (Bandura, 1962; Uzgiris, 1984; Nadel, Potier, 2002; Nadel, 2014). By imitating gestures, movements, ways of using an object or facial expressions, we create a bond between ourselves and the other that favors the process of learning, of understanding others actions and of sharing experiences by tuning into the other.

Many developmental difficulties and disabilities, such as the Autism Spectrum Disorder (ASD), may hinder some forms of imitation in a more or less pronounced or invasive way. As a matter of fact, there are children with ASD who prove to be able to understand simple communication signals, during imitative tasks, and that struggle in those with a complex nature; others may appear socially motivated to imitate, but not under all the circumstances, or may have great memory skills to remember simple actions but then they may not be able to remember all essential micro-actions to achieve a goal (Peeters, De Clercq , 2012; Xaiz, Micheli, 2001; Vivanti, 2021). In the end, social experiences may represent a very big challenge for many of these children with ASD, due to impaired sensory integration in multiple domains (perceptual, motor, auditory, visual) that may impact on their social functioning (Posar, Visconti, 2018) and, more generally, on the knowledge and learning process (Sibilio, 2020). The integration of multisensory stimuli creates unpredictable social environments and inevitably influences the way an individual socially interacts within that environment. These impairments could, therefore, hinder the development of the imitative mechanism and explain some of the deficits characterizing the disorder.

2. The role of perception and interaction in the learning process of children with ASD

At an early age, the possibilities of communication and social impact of the newborns are very limited but, from the very first days, they learn that mutual imitation is an effective way to encourage and maintain a relationship with their caregiver, and to understand their actions. Adults tend to imitate newborns' gestures and vocalizations using expressive modalities that favor the imitative process (Papousek, Papousek, 1977; Pawlby, 1977; Kugiumutzakis, 1977). Taking the child as a model, the adult usually reproduces the acts performed by the infant spontaneously to capture his/her attention and establish a bond. This emulation allows the child to interact using motor patterns already present in his own repertoire, to recognize himself in the other and to understand his/her actions (Meltzoff, 2007). Afterwards, once a reciprocal imitation mechanism has been established, the caregiver begins to provide new response patterns for imitation sequences, helping the child to expand his/her skills (Pawlby, 1977). Hence, during the interaction, caregivers realize that mutual imitation is useful to attract interest and share experiences, that's why they usually act in this way, sometimes even unintentionally. At once, the child learns to coordinate his/her own motor, perceptual, cognitive and emotional acts, but also to develop the first social relationship skills and the phenomenon of intersubjectivity (Trevarthen, 1979). The latter would originate as a result of a synchronization between the agent and the observer and of a state of identification with the other, a process defined by Gallese as an *intentional consonance* (Gallese, 2005; 2007). The scholar (2003; 2007) argues that the quality of our experience of the external world and its content are not limited to the sensory part of the human brain, but also depend on the motor system and the presence of other individual, while maintaining their own otherness. Gallese (2003) writes:

> «Much of what happens during our interpersonal relationships would be the result of the ability to create a "we-centered" space shared with others. The creation of this shared space would be the effect of the activity of "embodied simulation", defined itself as a sub-personal activity of neurons that allow to map both performed and observed actions, sensations and emotions on the same nervous substrate […]. In other words, the observation of an action implies the simulation of the action itself» [author's translation] (p. 24).

According to this perspective, the experiences (emotions, body patterns, ...) are simulated internally since they recognize it as other than themselves, contrary to what Wallon states. And on top of that, the reciprocity that is established during this type of early imitation would allow the child to learn the basic rules of every form of communication (joint attention, synchronization, turn taking, sharing a theme and its variations) even before being able to use verbal language. Based on these considerations, imitation turns out to be both an important tool of knowledge acquisition, and a relationship and communication medium (Winnykamen, 1990; Nadel, Potier, 2002; Nadel, 2014). However, an altered *intentional consonance*, also caused by a multilevel deficit of this simulation mechanisms, could be at the origin of many of the social problems typical of some children with Autism Spectrum Disorder (Hobson, Lee, 1999; Gallese, 2006; García-Pérez, Lee, Hobson, 2007).

This hypothesis fits into those of other scholars who gave rise to a great debate on the issue of dysfunction in the process of imitation and observational learning of children with ASD: this alteration is considered as the cause of the developmental alteration in these pupils and of the neural systems organization responsible for perceptual and representational process of social and linguistic information (Iacoboni et al., 2001; Keller et al., 2011; Taylor, & DeQuinzio, 2012; Foti et al., al., 2019; Lidstone, Mostofsky; 2021). The multitude of explanatory theories is due to the variability of this dysfunction, along with the incidence of the degree of severity of the disorder and the type of gesture the child needs to imitate (Nadel et al., 2011; Iavarone et al., 2017; Vivanti, 2021). In fact, imitation may sometimes be limited by the restriction of the motor

repertoire which is characterized by a poor finalization of the movement and a little diversity in the use of functional gestures that affect the objects. In particular, Rogers (1996) notes a poor ability to plan action due to a malfunction of the frontal lobe and executive functions that hinder the use of cognitive representations stored in memory and which should guide the action. Furthermore, other studies have found that the sensory-motor rhythm *mu* (9-13 Hz in humans), and sometimes the mirror system, appears to be desynchronized both during execution and during observation of motor behaviors (Fabbri-Destro, Gizzonio, Avanzini, 2013; Dumas et al., 2014). According to these researchers, such anomalies would compromise the possibility of creating mental representations of the observed action, a difficulty in synchronizing with the other and affect the learning and understanding process of others' actions.

Nadel (2014), on the contrary, found out that non-verbal children with ASD, between 35 and 104 months of age, are able to create a motor representation and to simulate an action when observed and not performed, even with a low functioning. The procedure used in the study requires to present a box with multiple openings and a tool, which is used to unscrew and grab a candy contained in the container, to the child. Then, he/she should watch a video demonstration with a specific strategy that may help to solve the problem. Children with autism usually prove to be skilled in achieving the goal (getting the candy in the box) by adopting the strategies shown in the video, later than a second viewing of the record. This is because the observation allows him/her to memorize the micro-actions necessary to achieve the goal, in the same way, the second demonstration let him/her understand the purpose of achieving the sub-goals and to build and correct ongoing their motor representation. These outcomes are in line with many of the evidence-based practices suggested at national and international level which involve the breakdown of a target behavior through a task analysis, in order to identify micro-objectives and micro-actions that need to be to be taught (Vivanti et al., 2020; Odom et al., 2021). For this purpose, the teacher should define educational objectives and purposes, following an initial assessment of what the student with Autism Spectrum Disorder can do, in order to select the behavior to be modeled and provide for the integration of known actions, or already experienced, and then add more complex didactic objectives as set out in the Bloom's Mastery Learning taxonomy. After all, identification with the model is fundamental (Bandura, 1962) and the teacher may favor it by presenting typical situations, where the behavior to be taught require the use of micro-actions that the pupil is already able to perform, by trying to "synchronize" with the child through structured interactive sequences or taking advantage of the resource of peers (Xaiz, Micheli, 2001; Dawson, Vivanti, Rogers, Duncan 2019).

Among the most functional educational-didactic strategies for promoting attunement, social reciprocity and learning by imitation, Rogers and Dawson (2020) argue that it is possible to gain attention from the child with autism simply by faithfully reproducing what he/she is doing, using the same materials right in front of him. Gradually, the teacher will be able to approach and try to make the two autonomous actions a shared game, and then introduce variations by showing other possible functional manners that material may be used. Thereby the teacher will share learning opportunities that may expand the motor, cognitive and social repertoire of the pupil with Autism Spectrum Disorder, by starting from what he/she can do and leading him/her to a *zone of proximal development* by means of a *scaffolding action*.

Likewise, Smith and Bryson (1994) believe that imitative difficulties translate into a more basic deficit of perception and representation of events in the external world. What appears to be common are atypical behavioral responses to sensory information (Marco et al., 2011; Stevenson et al., 2014; Posa, Visconti, 2018). Over 96% of children with Autism Spectrum Disorder report hyper and hyposensitivity in multiple domains, although the sensory behavioral differences vary from mild to severe and these behavioral differences may not always last into adulthood. From a functional persective, an individual should be able to select certain sensory inputs by filtering or suppressing others for the purpose of more advanced processing and storage. On a neurological level, this is clarified through an anomaly in multisensory processing which is reflected in atypical activations of the *alpha* and *gamma* bands. Inadequate activation of *alpha*

waves results in poor visual processing and attention to these stimuli (Beker, Foxe, Molholm, 2018); vice versa to an alteration of the *gamma* band activity in both children and adults with Autism Spectrum Disorder manifested when they are exposed to complex visual stimuli such as faces, images and visual and auditory illusions (Beker, Foxe, Molholm, 2018).

To avoid an overload of information, the sensory stimuli should be carefully controlled and the action must be broken down into micro-actions. Taking it into account, the teacher may promote learning by imitation by carefully selecting and using some didactic mediators (Damiano, 2013) considering the individual learning styles and sensory processing modality preferred by the student with ASD. It will be necessary to be clear when explaining a procedure or an action and to match the utterance to the gestures performed or the symbols used since the visual aspect is what predominates. Therefore, it is considered appropriate to examine some educational-didactic strategies that can be used in the classroom to favor both the process of representation and an intentional consonance using multisensory didactic mediators, in particular iconic, symbolic and active ones.

3. The AAC strategy to support the imitative process

Child natural readiness to imitate and his/her ability to reproduce other's gestures highlights a proper relational and communicative character of the imitative process during a constant game of exchanges with caregivers since early childhood (Tomasello, 2003; Armstrong *et al*., 1995), as emerges from the theoretical framework previously described, but it also emphasize its configuration as an opportunity for the child to learn and develop; through the imitative process he/she can perform tasks that push it beyond its current level of development starting from the exposure and subsequent elaboration of stimuli sensory and social (Vygotskij, 2013; 1970). Although this mechanism occurs in an unconscious and uninterrupted way, and it is incisive in the evolutionary process of each child (Hurley, Chater, 2005; Meltzoff, Prinz, 2002); it implies a mental representation of reality (Gazzaniga, 1990), continuous references to action (Caruana, Borghi, 2016) and an interaction where the other, act as a "model" and a mirror (Gallese et al. 2013; Rizzolatti, Sinigallia, 2006; Kohler et al., 2002), but it also constitutes a catalyst to build intersubjective relationships strictly connected to simultaneous and embodied processes (Gallese, 2003; Gallese-Ammaniti, 2014).

According to the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-V), children with Autism Spectrum Disorder may have deficits in communication, interaction and social imaginative activity (Wing, Gould 1979) in association with stereotypies, limited interests or preference for repetitive activities as well as difficulties in the ability to process sense-perceptual data (Iavarone et al., 2017; Peeters & De Clercq, 2012). The qualitative impairments in social interaction are due to evident difficulties in the use of the non-verbal channel (gestures, gaze, facial expressions, posture), the inability to establish relationships age appropriate and the absence of emotional reciprocity (Quill, 2007). On the communicative level, the lack of verbal language, its delay or its repetitive and stereotyped use may also compromise spontaneous and structured play activities (APA, 2013; Freeman & Dake, 2007).

The work on imitation skills is an integral part of the Augmentative Alternative Communication (AAC) approach which, initially originates from the need to establish a conversation between medical staff and small patients unable to use verbal language in the pre and post operative and focuses on the reciprocal exchange of images (Costello, 2000). It is currently configured as a communication opportunity for all users with Complex Communication Needs (CCN) in every context of life, even when communication and cognitive skills are strongly compromised (Mirenda, Iacono, 2009). The use of systems based on the exchange of photos, images, objects and symbols (Goldaman, 2006) aims at supporting communication between communication partners and allow users to share emotions, express needs and make requests (Beukelman, Mirenda, 2013; Light, 2013; 1997), gradually understanding the direct symbol-referent association. Since exposure to the visual-symbolic code alone does not guarantee communication or interaction between the child with ASD and the adult/peer, it is necessary

to act on the environment (Blackstone & Berg, 2003). It requires to invest both in partners' training (educators, teachers, caregivers, medical staff, peers) and in the timely identification of barriers and facilitators, in line with the biopsychosocial model according to which disability is also closely connected to environmental and contextual factors as well as individual ones (WHO, 2001; 2007).

During the initial phase of the intervention, and throughout its duration, it is effective to create motivating situations (Koegel, 2000), strictly connected to the daily experiences lived by the child in familiar contexts and relevant to his/her interests (games, readings, foods, films, activities) by introducing in the symbolic reference set photos, images and pictograms representative of these specific themes (Miranda, Iacono, 2009). It aims at stimulating visual learning (Dyrbjerg, Vedel, 2008), to increase the probability of imitating behaviors that generally produce - or have determined in the past - positive and gratifying effects (Bandura, 1977; 1971) and ask the other for what one prefers the most. Current research shows that, since childhood, children with ASD show fewer imitative abilities than their peers of the same age and have several difficulties on imitating actions they do not know the results or the function that specific materials, used by the examiner, have. Vice versa, they better perform at imitative level during activities that involve the use of familiar objects, when they understand the objectives of the examiner, whenever they feel interest in the activity to be performed and when they ask them to imitate simple rather than complex actions (Vivanti, Hamilton, 2014).

Although children with Autism Spectrum Disorder may not have a clear understanding of the meaning of the exchange of pictograms and objects - at least in the immediate future - other studies confirm that their manual, socio-relational, communicative and cognitive skills (Seal, Bonivillian, 1997) improve if they are prematurely immersed in amusing imitative situations (Koegel, 2000; Zappella, 1996) where partners act as indirect models (Ingersoll, Schreibaman, 2007; Schreibman, 2005): «around the child - in fact - adults may exchange something with each other; even if it may seem that the child with autism is not looking at them, in reality he is memorizing, and even after a while, he may be able to repeat something of what he observed few days before» [author translation] (Solari, 2009, p. 44).

Likewise, the peer group, within the educational context, may be imitated during spontaneous or structured play activities, even with adult guidance and with positive outcomes too (Ganz et al., 2008; Garfinkle & Schwartz, 2002; Carr, Darcy, 1990). Following this direction, other researches highlight the inclusive potential of AAC for pupils with disabilities and its effectiveness both to facilitate learning and to encourage and intensify interactions with peers during collaborative and playful activities (Light et al., 2019; Xaiz & Micheli, 2001). The use of low and/or high-tech systems (visual strips, daily diaries, communication tables, VOCAs) as the exchange of symbols, throughout everyday school life, may compensate communication and social interactions difficulties of pupils with Autism Spectrum Disorder (Ganz & Simpson, 2018; Ganz, 2015) who will become more and more competent by benefiting from the support of the other and observing his/her gestures and actions in the use of aids and tools.

In fact, the psychoeducational intervention of AAC within the school context will privilege strategies focused on the visualization of pictograms and on the shared use of assistive technologies (Costantino, 2011; Cafiero, 2009) that may support children with ASD to understand a sequence of instructions or activities, to manage the change by acting as visual anticipators (Hodgdon, 2004), to reduce maladaptive behaviors (Ianes, Cramerotti, 2002). Furthermore, they may also create opportunities for sharing and mutual acceptance by improving the climate of class (Mitchell, 2014; Keith, Keith, 2020). This may determine the conditions for a positive interdependence which «consists on establishing relationships among students so that no one may individually succeed if not with the success of the entire group; in fact, positive interdependence requires commitment and coordinated work» [author translation] (Johnson et al., 1996, pp. 87-88) thus becoming the fulcrum of cooperative learning in the school context.

4. PECS, *video modeling* and symbolic games to encourage imitation and gestures

As part of Augmentative Alternative Communication systems, based on the exchange of images and functional to the learning of communication skills and mutual interaction, the *Picture Exchange Communication System* (PECS) is the most widespread and used educational and rehabilitative interventions for children with Autism Spectrum Disorder and, subsequently, in the treatment of complex communication needs deriving from intellectual disabilities (Ganz, 2014; Bondy, 2012; Fontani, 2016). With a behavioral matrix, the PECS developed by Lori A. Frost and Andrew S. Bondy (Bondy, Frost, 2012; 1994) aims at evoking requests beginning with game situations and everyday life and structuring a protocol based on child's preferences, so as drawing up a real inventory (Visconti et al., 2007). The articulation in six phases (Table n.1) favors gradual *social openings* (Solari, 2009) and constitutes an opportunity to understand the nature of communication, its communicative function and the right way to relate to the other (Cottini, 2017).

Tab. 1 – *Picture Exchange Communication System phases*

Phase I: Assisted physical exchange
Phase II: Progressive increase in spontaneity in communication
Phase III: Symbols Discrimination
Phase IV: Construct sentences using symbols
Phase V: Learn to answer questions
Phase VI: Comment in response to questions

The initial phase of *physical exchange* aims at promoting a first action of the child with Autism Spectrum Disorder: the pictogram of the object, not necessarily the correct one, is released by the child in the hand of the communicative partner, who sit in front of him/her, with the purpose to receive what he/she desires; an action may also be supported by the adult (*physical prompt*) who is located behind him/her and may direct the movement avoiding accompanying bodily action with verbal solicitations (*verbal prompts*), that may act as reinforcements. If the first phase is assisted, controlled, characterized by the presence of clearly visible images and the help of partners, the second one aims at increasing the *spontaneity of communication*: child's goal is to recover the corresponding image even when the partner is out of sight or engaged in another activity, and whenever the pictogram is not available.

The third step of the intervention program focuses on child's ability to *discriminate stimuli* to make a choice between two symbols. Only one will represent the desired object: it is important that the child with Autism Spectrum Disorder understands, early on, the consequences of his/her actions and the communicative value of choice (Beukelman, Mirenda, 2014). In the next phase, the child should be able to *construct a minimal sentence* (eg. "I want the ball") on visual strips appropriately prepared by the partner, taking the symbol of the object he/she wants from the communication table. The goal of the fourth phase of the PECS program is that the child with Autism Spectrum Disorder is able to *answer typical questions* (eg. "What do you want?") by indicating the symbol and proceeding with the construction of the sentence and receiving the physical prompt only when its fine motor specificities do not allow autonomous grasping. Finally, the last level provides the possibility of extending communication to the desires, interests, emotions spheres and, above all, expanding the opportunities to *comment and tell experiences* (Fig. 2.); the methodological approach remains the same with the insertion of new symbols compared to the previous phases (eg. "I feel", "I see", "is/am").

Fig.2. Phase V: *complex string example*[4]

The PECS teaching program, in addition to the use of physical and verbal prompts, adopted as previously described, favors learning by imitation and enhances the observation of others' behavior. Actually, the child with autism has the opportunity to look at the partners engaged during a situation of communicative exchange even before actually participating in it. The adults, seated at the table, may simulate a typical situation of sharing objects and symbols, direct child's gaze towards simulation activities, emphasize the tone of voice and reduce the actions of "giving" and "receiving". The observation-imitation of other's action is pivotal because the child with Autism Spectrum Disorder may learn the value of exchange, imitation and forms of communication that enhance their own and others gestures thanks to this intervention (Dunst, et. Al, 2011; Thot, 2009).

Moreover, being able to use a visual-kinesthetic channel is coherent with the methodological structure of AAC which, by definition, is *augmentative* to the extent that it increases and enhances the natural communication skills of the person strictly connected to his/her corporeality, and it is an alternative in that supports communication, it facilitates social relationships with systems, aids, tools, techniques and strategies (ISAAC, 2017; Beukelman, Mirenda, 2014; Visconti et al., 2007). The *unaided* dimension of AAC and, specifically, the use of the gesture all through the different phases of the PECS may constitute one of the possible adaptive solutions that the child with ASD may spontaneously adopt - but also guided by an adult or a peer - to solve complex situations, even in the educational field. The physiologist of perception and action Alain Berthoz, within the framework of his *theory of simplicity*, provides an articulated reading of the gesture by distinguishing between *simple gestures*, which tend to be attributable to the movement of the body or part of it in the environment; *simplified coding*, socially shared and with a recognized communicative value; *simple*, to indicate the gesture «a sign of an emotion, an intention, a regret - or which may have - an abstract meaning» (Berthoz, 2011, p. 96). This last category refers to the spontaneity and spontaneity of the body that, with its gestures, posture and movements, constitutes itself a communicative bridge within an environmental dimension where the other attributes its meaning; similarly, simple movements such as those of the fingers of the hand, for example, allow the person to solve complex problems by configuring themselves both as forms of adaptation to the environment and as an expression of a *motor vicariance* (Berthoz, 2013). It may help, even the child with disabilities, to face the complexity of reality using different motor schemes and body segments. This theoretical framework outlined by the French scholar invites, albeit implicitly, to enhance the body-kinesthetic dimension during the educational intervention of AAC in the school context, recognizing the importance of gestures as an augmentative but also alternative channel to verbal language (Kendon, 1994; 1981) and as an expression of a communicative intentionality by recovering functions - such as indicating - that are typical of the child at an early age, and it is not excluded that they may be so even in the presence of an autism spectrum disorder (Colgan, 2006). Likewise, already in the 80s, the psychologist Bruner believed that differentiating gestures could be useful to analyze non-verbal communication for children and, in this regard, distinguishing *gestures of joint*

4 The pictograms used are property of Aragon Governement and have been created by Sergio Palao to ARASAAC (http://arasaac.org) which distributes them under creative commons license (by-nc-sa).

attention, used to shift attention to an object or situation; behavior *regulation gestures*, used to control behavior for a specific purpose (eg. delivering an object to a person in order to receive it); *social interaction gestures* used to interact with others, such as forms of greeting (Bruner, 1981).

These categories may still constitute an important point of reference in the CAA approach since joint attention, fundamental for the exchange of symbols in the PECS program and for the use of assistive technologies, seems to be subsequent to the regulation of the behavior and social interaction (Crais, Douglas & Campbell, 2004). For these reasons, it is important to plan routines and play activities that can improve *joint attention* thanks to the imitation of behaviors and actions (Colgan et al., 2006), but also exchanging objects. In this regard, through the CAA approach and the different levels of the PECS program, it is possible to plan a way that facilitates the gradual transition from concrete exchanges to symbolic and abstract communicative phases, ever closer to verbal language: objects, in fact, «they constitute "pieces" of the everyday life environment and can represent stable points of reference in the construction of progressively symbolic processes. By learning to ask for water, showing the photograph of the glass, the child uses "something" instead of "something else", that is, he gets used to symbolizing reality, as happens at a higher level with verbal language» [author translation] (Solari, 2009, p. 42).

Equally, the symbolic play activities may be simulated by the partners too, who, in addition to serving as a model, will help children with Autism Spectrum Disorder while manipulating the object/toy and replicating movements with the support of AAC symbols. In this case, according to *Ais Language Stimulation* (Gossens et al., 1992) the game actions may be come with the use of the voice and by the presence of the corresponding pictograms that visually reconstruct the motor sequence to be imitated (eg "take", "doll", "comb", "to comb"). Learning by imitation and the functional use of communication may be promoted by using additional visual strategies (Vivanti, Salomone, 2016): *video modeling,* for example, in the context of behavioral strategies, may facilitate the learning of personal and social autonomies (Costa, Fiorot, 2018) through the visualization of videos of children, adults or themselves (*self-modeling videos*) engaged in the reproduction of positive behaviors or sequences of correct actions such as tying shoes, pouring water, wash your hands (Cottini, Bonci, 2016). Several studies recognize the efficacy of video-mediated modeling in teaching a set of social skills and functional skills for carrying out actions in daily life (Cottini, Vivanti, 2013; Cottini, 2012) in children and adolescents with Autism Spectrum Disorder and wich, moreover, are long-lasting and may also be extended to other contexts (Delano, 2007; Bellini, Akullian, 2007). Furthermore, receiving visual instructions through videos the child with ASD is able to focus his/her attention on socially adequate behaviors and on the actions he/she has to perform, as well as to improve memorization thanks to the possibility of repetition at different times of the day, especially during those more motivating such as school recreation (Corbett, Abdullah, 2005). Hence, the imitation process may be supported by AAC tools such as visual strips or daily agendas that can be distributed in the home and school environment which, as concrete and permanent tools (Arduino, 2008), it may also reduce the disorientation experienced by the child with Autism Spectrum Disorder and improve their behavior and adaptation to the environment, also with the support of technologies (Light et al., 2019; Light and McNaughton, 2013).

5. Conclusions

On the basis of these suggestions and those summarized above in relation to the prerequisites of learning by observation, it is clear that teachers should identify the most appropriate educational-didactic strategies that allow students with Autism Spectrum Disorder to relate to the surrounding environment, to tune into others and learn. The inclusion of the child with ASD therefore represents a real educational challenge (Goussot, 2018) that may only be faced by knowing his/her individualities and his/her cognitive profile, but also the way he/she understands the world (Vivanti 2021). The recognition of his/her specific learning style and of peculiar perceptive processes do not exclude the fact that these may be mutually influenced

when interacting in a social and cultural (school and life) world (Cottini, 2017; Sibilio, 2020). Teaching and learning via imitation would be possible only if observation skills are facilitated in order to support the interpretation process (Rossi, 2011) and mental representations, by guiding pupils' action to achieve the goal that underlies the modeled action and rediscovering the value of didactic interaction (Sibilio, 2020). Since children with Autism Spectrum Disorder often perform well during emulation tasks (Byrne & Russon, 1999), but demonstrate great difficulty in imitating the emotional-affective quality of actions, rather than the sequences of actions themselves, the teacher should evaluate whether to use the Video-modeling strategy individually or by integrating it with other "child-centered" socio-constructivist evidence-based approaches. Among these the Group-based Early Start Denver Model, the Classroom Pivotal Response Teaching, the Jasper or other Naturalistic Behavioral Evolutionary Interventions (Vivanti et al., 2020; Odom et al., 2021) highlight the salience of socio-emotional interactions to enhance attention, social reciprocity, motivation and imitation (Rogers, Pennington, 1991; Rogers, 1999). Furthermore, taking into account the particular methods of processing the multisensory stimuli of pupils with ASD, the teacher may combine two or more didactics mediators with each other (symbolic/iconic; symbolic/active; symbolic/iconic/active) by associating the clarification and description of the behavior to be imitated through visual representations (with images or video), verbal and/or a kinesthetic ones. Demonstrations should be performed at a moderate speed to allow the student to maintain attention as, if the technique is shown too quickly, this could hinder selective attention processes and limit the ability to mentally process and correctly memorize the sequence of actions. The same can be said of an execution that is too slow, which may lead to a mismatch between the real image that is intended to be given and the perceived one. On the other hand, if it seems appropriate to associate the use of symbolic mediators, these should be clear, concise and highlight significative steps of the action the child has to learn through observation. For example, by changing the tone of the voice (if you use this type of verbal language), evaluating the number of necessary symbols and their dimensions in relation to the student's needs. By taking into consideration specific situations when the pupil with Autism Spectrum Disorder may manifest complex communication needs, may show verbal skills and have a visual learning style, the AAC intervention and PECS are very useful. In these cases, when the child needs more symbols and the space is limited, the teacher may choose to decrease the number of words and include the most significant ones for that context and for the child with ASD (Cafiero, 2009; Costantino, 2011).

In conclusion, the transformation of the learning environment according to the peculiar characteristics of the learner with autism is considered to be the most effective strategy for responding to special educational needs and allowing caregivers and peers to co-evolve and co-construct new meanings and experiences by virtue of a reciprocal relationship between the individual and the environment (Rossi, 2011; Sibilio, 2020).

References

Aiello, P., & Di Tore, S. (n.d.). Traiettorie non lineari della didattica speciale. Disponibile su: http://www.traiettorienonlineari.com/bologna/wp-content/uploads/2015/07/aiello.ditore.pdf

American Psychiatric Association (2013). Diagnostic and Statistical Manual of Mental Disorders (DSM–5). American Psychiatric Publishing: Washington, DC.

Arduino, G.M. (2008). Facilitare la comunicazione nell'autismo, dvd-rom. Trento: Erickson.

Armstrong, D.F., Stokoe, W.C., Wilcox, S.E. (1995). Gesture and the nature of language. USA: Cambridge University Press.

Aziz-Zadeh, L., Iacoboni, M., Zaidel, E., Wilson, S., & Mazziotta, J. (2004). Left hemisphere motor facilitation in response to manual action sounds. *European Journal of Neuroscience*, *19*(9), 2609-2612.

Bandura, A (1962). *Social learning through imitation*. ln M. R. Jones (Ed.). Nebraska Symposjum on Motivatyon, 1962, pp. 211-274, Univer. Nebraska Press.

Bandura, A. (1971). Analysis of modeling processes. In Bandura, A. (Ed.). Psychological modeling (pp. 1–62). Chicago, IL: Aldine-Atherton.
Bandura, A. (1977). Social learning theory. Oxford, England: Prentice-Hall.
Bandura, A. (1982). Self-efficacy mechanism in human agency. *American psychologist*, *37*(2), 122.
Beker, S., Foxe, J. J., & Molholm, S. (2018). Ripe for solution: Delayed development of multisensory processing in autism and its remediation. *Neuroscience & Biobehavioral Reviews*, *84*, 182-192.
Bellini, S., Akullian, J. (2007). A meta-analysis of video modeling and video self-modeling interventions for children and adolescents with autism spectrum disorders. Exceptional children, 73 (3), pp. 264-287. https://doi.org/10.1177/001440290707300301.
Berthoz, A. (2015). La vicarianza. Il nostro cervello creatore di mondi. Torino: Codice.
Berthoz, A., (2011). La semplessità. Torino: Codice Edizioni.
Beukelman, D.R., Mirenda, P. (2013). Augmentative and Alternative Communication. Supporting Children and Adults with Complex Communication Needs, Baltimore: Brookes.
Binkofski, F., & Buccino, G. (2006). The role of ventral premotor cortex in action execution and action understanding. *Journal of Physiology-Paris*, *99*(4-6), pp. 396-405.
Blackstone, S. W., Berg, H. M. (2003). Social networks: A communication inventory for individuals with complex communication needs and their communication partners. Monterey, CA: Augmentative Communication, Inc.
Bondy, A.S. (2012). The unusual suspects: myths and misconception associated with PECS. The Psychological Record, 62(4), pp. 789-816. DOI:10.1007/BF03395836.
Bondy, A.S., Frost, L.A. (1994). PECS: The Picture Exchange Communication System Training Manual. Cherry Hile: Pyramid Educational Consultants.
Borghi, A. M., & Scorolli, C. (2009). Language comprehension and dominant hand motion simulation. *Human Movement Science*, *28*(1), pp. 12-27.
Brewer, W. F. (1974). There is no convincing evidence for operant or classical conditioning in adult humans. In In W. B. Weimer & D. S. Palermo (Eds.), *Cognition and the symbolic processes*. Lawrence Erlbaum.
Bruner, J. (1981). The social context of language acquisition. Language and Communication, 1(2-3), pp. 155-178.
Bruner, J. S. (2009). La ricerca del significato: per una psicologia culturale. Torino: Bollati Boringhieri.
Buccino, G., Vogt, S., Ritzl, A., Fink, G. R., Zilles, K., Freund, H. J., & Rizzolatti, G. (2004). Neural circuits underlying imitation learning of hand actions: an event-related fMRI study. *Neuron*, *42*(2), pp. 323-334.
Cafiero, J. M. (2009). Comunicazione aumentativa e alternativa. Strumenti e strategie per l'autismo e i deficit di comunicazione. Trento: Erickson.
Carr, E. G., Darcy, M. (1990). Setting generality of peer modeling in children with autism. Journal of Autism and Developmental Disorders, 20(1), pp. 45-59.
Caruana, F., Borghi, A. (2016). Il cervello in azione. Introduzione alle nuove scienze della mente. Bologna: Il Mulino.
Cassani, C., Santelli, E., Alvarez, M.I., Giuberti, V. (2009). Le capacità di imitazione nei disturbi dello spettro autistico Autismo, 7(1), pp. 9-25.
Chetcuti, L., Hudry, K., Grant, M., & Vivanti, G. (2019). Object-directed imitation in autism spectrum disorder is differentially influenced by motoric task complexity, but not social contextual cues. *Autism*, *23*(1), pp. 199-211.
Cohen, J. D., Volkmar, F.R. (2004). Autismo e disturbi generalizzati dello sviluppo. Strategie di intervento*,* Vol. II. Brescia: Vannini.
Colgan, S. E., Lanter, E., McComish, C., Watson, L. R., Crais, E. R., Baranek, G. T. (2006). Analysis of social interaction gestures in infants with autism. Child Neuropsychology, 12(4-5), pp. 307-319.

Corbett, B.A., Abdullah, M. (2005). Video modeling: Why does it work for children with autism?. Journal of Early and Intensive Behavior, 2 (1), pp. 2-8. http://dx.doi.org/10.1037/h0100294.
Costa, A., Fiorot, E. (2018). Imparo con il videomodeling professional. Modelli comportamentali per l'apprendimento delle autonomie personali, domestiche e sociali. Trento: Erickson.
Costantino, M.A. (2011). Costruire libri e storie con la CAA. Gli IN-book per l'intervento precoce e l'inclusione. Trento: Erickson.
Costello, J.M. (2000). AAC Intervention in the Intensive care Unit: The Children's Hospital Boston Model, Augmentative and Alternative Communication, 16(3), pp. 137-153, DOI: 10.1080/07434610012331279004.
Cottini, L. (2012). Videomodeling e autismo: caratteristiche, efficacia, prospettive, American Journal on Intellectual and Developmental Disabilities, 10 (1), pp. 107-124.
Cottini, L. (2017). Didattica speciale ed inclusione scolastica. Roma: Carocci.
Cottini, L., Bonci, B. (2016). L'insegnamento di abilità di autonomia attraverso un programma di video modeling e di video self-modeling. Giornale italiano dei Disturbi del Neurosviluppo, 1 (2), pp. 83-95.
Cottini, L., Vivanti, G. (a cura di) (2013). Guide didattiche per l'autismo. Firenze: Giunti.
Crais, E., Douglas, D., Campbell, C. (2004). The intersection of the development of gestures and intentionality. Journal of Speech, Language, and Hearing Research, 47(3), pp. 678-694.
Dadgar, H., Rad, J. A., Soleymani, Z., Khorammi, A., McCleery, J., & Maroufizadeh, S. (2017). The relationship between motor, imitation, and early social communication skills in children with autism. *Iranian journal of psychiatry*, 12(4), 236.
Delano, ME (2007). Video modeling interventions for individuals with autism. Educazione correttiva e speciale, 28 (1), pp. 33-42. https://doi.org/10.1177/07419325070280010401.
Dumas, G., Nadel, J., Soussignan, R., Martinerie, J., & Garnero, L. (2010). Inter-brain synchronization during social interaction. *PloS one*, *5*(8), e12166.
Dumas, G., Soussignan, R., Hugueville, L., Martinerie, J., & Nadel, J. (2014). Revisiting mu suppression in autism spectrum disorder. *Brain research*, *1585*, pp. 108-119.
Dunst, C.J., Meter, D., Hamby, D.B. (2011). Influence of sign and oral language interventions on the speech and oral language production of young children with disabilities. Center for early literacy learning, (4) 4, pp. 1-20.
Dyrbjerg, P., Vedel, M. (2008). L'apprendimento visivo nell'autismo. Come utilizzare facilitazioni e aiuti tramite immagini. Trento: Erickson.
Fabbri-Destro, M., Gizzonio, V., & Avanzini, P. (2013). Autism, motor dysfunctions and mirror mechanism. *Clinical Neuropsychiatry*, *10*(5).
Fontani, S. (2016). Comunicazione aumentativa alternative e disabilità. Proposte differenziate per interventi educativi, scolastici e abilitativi inclusivi. Parma: Edizioni Junior.
Foti, F., Piras, F., Vicari, S., Mandolesi, L., Petrosini, L., & Menghini, D. (2019). Observational learning in low-functioning children with autism spectrum disorders: A behavioral and neuroimaging study. *Frontiers in psychology*, *9*, 2737.
Freeman, S., Dake, L. (2007). Il linguaggio verbale nell'autismo. Trento: Erickson.
Gallese, V. (2003). La molteplice natura delle relazioni interpersonali: la ricerca di un comune meccanismo neurofisiologico. *Networks*, 1(24-47).
Gallese, V. (2005). La consonanza intenzionale: meccanismi neurofisiologici dell'intersoggettività. *Sistemi intelligenti*, 17(3), pp. 353-382.
Gallese, V. (2006). La consonanza intenzionale: Una prospettiva neurofisiológica sull'intersoggettività e sulle sue alterazioni nell'autismo infantile. *Publicado en Corso di Stampa*.
Gallese, V. (2007). Dai neuroni specchio alla consonanza intenzionale: meccanismi neurofisiologici dell'intersoggettività. *Rivista di psicoanalisi*, 53(1), pp. 197-208.
Gallese, V., Ammaniti, M. (2014). La nascita dell'intersoggettività. Lo sviluppo del sé tra psicodinamica e neurobiologia. Milano: Cortina Raffaello.
Gallese, V., Rochat, M. J., Berchio, C. (2013). The mirror mechanism and its potential role in autism spectrum disorder. Developmental Medicine & Child Neurology, 55(1), pp. 15-22.

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, pp. 127-138.
Ganz, J. B., Bourgeois, B. C., Flores, M. M., Campos, B. A. (2008). Implementing visually cued imitation training with children with autism spectrum disorders and developmental delays. Journal of Positive Behavior Interventions, 10(1), pp. 56-66.
Ganz, J. B., Simpson, R. (2018). Interventions for Individuals with Autism Spectrum Disorder and Complex Communication Needs. Baltimore: Brookes.
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) pp. 203-214. doi: 10.3109/07434618.2015.1047532.
García-Pérez, R. M., Lee, A., & Hobson, R. P. (2007). On intersubjective engagement in autism: A controlled study of nonverbal aspects of conversation. *Journal of autism and developmental disorders*, *37*(7), pp. 1310-1322.
Garfinkle, A. N., Schwartz, I. S. (2002). Peer imitation: Increasing social interactions in children with autism and other developmental disabilities in inclusive preschool classrooms. Topics in Early Childhood Special Education, 22(1), pp. 26-38.
Gazzaniga, M. S. (1990). Stati della mente. Stati del cervello. Come l'interazione di mente e cervello crea la nostra vita cosciente. Firenze: Giunti.
Geraldine Dawson, Giacomo Vivanti, Sally J. Rogers, Ed Duncan (2019). *Implementazione dell'Early Start Denver Model in gruppo (G-ESDM) per bambini con autismo in età prescolare*. Roma: Giovanni Fioriti.
Goldaman, H. (2006). VCAA. Valutazione della comunicazione aumentativa e alternativa. Trento: Erickson.
Gomez Paloma, F., Damiani, P. (2021). L'Embodiment in Educazione: un collante scientifico tra complessità, semplessità e trasformatività. *Nuova Secondaria*, 10, giugno 2021, pp. 270-282. ISSN 1828-4582
Goossens, C., Crain, S., Elder, P. S. (1992). Engineering the Preschool Enviroment for Interactive Symbolic Communication. Birmingham: Southeast Augumentative Communication Conference Publications.
Gopnik, A., & Meltzoff, A. (1993). Imitation, cultural learning and the origins of "theory of mind". *Behavioral and Brain Sciences*, *16*(3), pp. 521-523.
Goussot, A. (2018). Autismo: una sfida per la pedagogia speciale: epistemologia, metodi e approcci educativi. Fano: Aras.
Guillaume, P. (1968). *L'imitation chez l'enfant*. Paris: Alcan. English translation: Imitation in children. 1971. Chicago: Chicago University Press
Guthrie, E. R. (1952). *The psychology of learning* (Rev. ed.). Harper.
Hamzei, F., Rijntjes, M., Dettmers, C., Glauche, V., Weiller, C., & Büchel, C. (2003). The human action recognition system and its relationship to Broca's area: an fMRI study. *Neuroimage*, *19*(3), pp. 637-644.
Hobson, R. P., & Lee, A. (1999). Imitation and identification in autism. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, *40*(4), pp. 649-659.
Hodgdon, L. A. (2004). Strategie visive per la comunicazione. Brescia: Vannini.
Hume, K., Steinbrenner, J. R., Odom, S. L., Morin, K. L., Nowell, S. W., Tomaszewski, B., & Savage, M. N. (2021). Evidence-based practices for children, youth, and young adults with autism: Third generation review. *Journal of Autism and Developmental Disorders*, pp. 1-20.
Hurley, S. L., Chater, N. (2005). Perspectives on imitation: From neuroscience to social science. Cambridge, MA: MIT Press.
Iacoboni, M., Koski, L. M., Brass, M., Bekkering, H., Woods, R. P., Dubeau, M. C., et al. (2001). Reafferent copies of imitated actions in the right superior temporal cortex. *Proc. Natl. Acad. Sci. U.S.A.* 98, 13995–13999. doi: 10.1073/pnas.241474598
Ianes, D., Cramerotti, S. (2002). Comportamenti problema e alleanze psicoeducative. Strategie di intervento per la disabilità mentale e l'autismo. Trento: Erickson.

Iavarone, M. L., Aiello, P., Militerni, R., Sibilio, M. (2017). I "sensi" dell'autismo. Verso un nuovo paradigma in didattica. Form@re, 17(2).
Ingersoll, B., Schreibman, L. (2007). Insegnare abilità di imitazione reciproca a bambini piccoli con autismo. Autismo e disturbi dello sviluppo, 5 (3), pp. 373-406.
ISAAC Italy (2017). Principi e pratiche in CAA. Roma: Associazione ISAAC Italy Onlus.
Johnson, D.W., Johnson, R.T., Holubec, E.J. (1996). L'apprendimento cooperativo in classe. Migliorare il clima emotivo e il rendimento. Trento: Erickson.
Keith, K., Keith, H. (2020). Lives and Legacies of People with Intellectual Disability. Washington: AAIDD.
Keller, R., Bugiani, S., Fantin, P., & Pirfo, E. (2011). Mirror neurons and autism. *Journal of Psychopathology*, *17*, pp. 404-412.
Kendon, A. (1981). Nonverbal Communication. Interaction and Gesture. Mouton: The Hague.
Kendon, A. (1994). Gesture and Understanding in Social Interaction. A Special Issue of Research on Language and Social Interaction. New Jersey: Lawrence Erlbaum Associates.
Koegel, K. L. (2000). Interventions to facilitate communication in Autism. Journal of Autism and developmental Disorders, 30 (5), pp. 383-391. doi: 10.1023/a:1005539220932.
Kohler, E., Keysers, C., Umilta, M. A., Fogassi, L., Gallese, V., Rizzolatti, G., (2002). Hearing sounds, understanding actions: action representation in mirror neurons. *Science*, 297(5582), pp. 846-848.
Kugiumutzakis, G. (2017). Intersubjective vocal imitation in early mother-infant interaction. In *New perspectives in early communicative development* (pp. 23-47). United Kingdom: Routledge.
Lidstone, D. E., & Mostofsky, S. H. (2021). Moving Toward Understanding Autism: Visual-Motor Integration, Imitation, and Social Skill Development. *Pediatric Neurology*.
Light, J. (1997). Communication is the essence of human life. Augumentative Alternative Communication, 13(2), pp. 61-70.
Light, J., McNaughton, D. (2013). Putting people first: Re-thinking the role of technology in augmentative and alternative communication intervention. Augmentative and Alternative Communication, 29(4), pp. 299-309. doi: 10.3109/07434618.2013.848935.
Light, J., Wilkinson, K., Thiessen, A., Beukelman, D., Koch-Fager, S. (2019). Designing effective AAC displays for individuals with developmental or acquired disabilities: State of the science and future research directions. Augmentative and Alternative Communication, 35(1), pp. 42-55.
Marco, E. J., Hinkley, L. B., Hill, S. S., & Nagarajan, S. S. (2011). Sensory processing in autism: a review of neurophysiologic findings. *Pediatric research*, *69*(8), 48-54.
Meltzoff, A. N. (2007). The 'like me'framework for recognizing and becoming an intentional agent. *Acta psychologica*, *124*(1), pp. 26-43.
Meltzoff, A. N., Prinz, W. (2002). The imitative mind: Development, evolution, and brain bases. Cambridge: Cambridge University Press.
Miller, N. E., & Dollard, J. (1941). *Social learning and imitation*. Yale University Press.
Mirenda, P., Iacono, T. (2009). Autism Spectrum Disorders and AAC. Baltimore: Bookes.
Mitchell, D. (2014). What really Works in Special and Inclusive Education: Using Evidence-Based Teaching Strategies. New York: Routledge.
Nadel, J. (2014). *How imitation boosts development: In infancy and autism spectrum disorder*. Oxford: OUP.
Nadel, J., & Butterworth, G. (Eds.). (1999). *Imitation in infancy* (Vol. 16). Cambridge: Cambridge University Press.
Nadel, J., & Pezé, A. (2017). What makes immediate imitation communicative in toddlers and autistic children?. In *New perspectives in early communicative development* (pp. 139-156). United Kingdom: Routledge.
Nadel, J., & Potier, C. (2002). Imitez, imitez, il en restera toujours quelque chose: le statut développemental de l'imitation dans le cas d'autisme. *Enfance*, *54*(1), pp. 76-85.

Nadel, J., Aouka, N., Coulon, N., Gras-Vincendon, A., Canet, P., Fagard, J., & Bursztejn, C. (2011). Yes they can! An approach to observational learning in low-functioning children with autism. *Autism*, *15*(4), pp. 421-435.

Nadel, J., Guérini, C., Pezé, A., & Rivet, C. (1999). The evolving nature of imitation as a format for communication. In J. Nadel & G. Butterworth (Eds.), *Imitation in infancy* (pp. 209–234). Cambridge: Cambridge University Press.

Nadel-Brulfert, J., & Baudonnière, P. M. (1982). The social function of reciprocal imitation in 2-year-old peers. *International Journal of Behavioral Development*, *5*(1), 95-109.

Papousek, M., Papousek, H., & Harris, B. J. (1987). The emergence of play in parent-infant interactions. *Curiosity, imagination, and play: On the development of spontaneous cognitive and motivational processes*, pp. 214-246.

Papousek, P., & Haekel, M. (1987). Didactic adjustments in maternal and paternal speech to three-month-old infants. *Journal of Psycholinguistic Research*, *16*, 491-516.

Pawlby, S. (1977). Interactive imitation. *Studies in Mother-Infant Interaction. New York*.

Peeters, T., De Clercq, H. (2012). Autismo. Dalla comprensione alla pratica educative. Piacenza: Uovonero.

Piaget, J. (1972). The role of imitation in the development of representational thought. *International Journal of Mental Health*, *1*(4), pp. 67-74.

Posar, A., & Visconti, P. (2018). Sensory abnormalities in children with autism spectrum disorder. *Jornal de pediatria*, *94*, pp. 342-350.

Quill, K.A. (a cura di) (2007). Comunicazione e reciprocità sociale nell'Autismo. Strategie educative per insegnanti e genitori. Erickson: Trento.

Rivoltella, P. C. (2014). *La previsione. Neuroscienze, apprendimento, didattica. Brescia: La Scuola*.

Rizzolatti, G., Sinigallia (2006). So quello che fai. Il cervello che agisce e i neuroni specchio. Milano: Cortina Editore.

Rogers, S. J. (1999). An examination of the imitation deficit in autism. In J. Nadel & G. Butterworth (Eds.), *Imitation in infancy* (pp. 254–283). Cambridge: Cambridge University Press

Rogers, S. J., & Dawson, G. (2020). *Early Start Denver Model for young children with autism: Promoting language, learning, and engagement*. New York: Guilford Publications.

Rogers, S. J., & Pennington, B. F. (1991). A theoretical approach to the deficits in infantile autism. *Development and psychopathology*, *3*(2), pp. 137-162.

Rossi, P. G. (2011). *Didattica enattiva. Complessità, teorie dell'azione, professionalità docente: Complessità, teorie dell'azione, professionalità docente*. Milano: FrancoAngeli.

Schreibman, L. (2005). The science and fiction of Autism. Cambridge: Harvard University Press.

Seal, B.C, Bonivillian, J.D (1997). Sign language and motor functioning in students with autistic disorder. Journal of Autism and Developmental Disorders, 27 (4), pp. 437-466. doi: 10.1023/a:1025809506097.

Sibilio, M. (2020). *L'interazione didattica*. Brescia: Scholé.

Skipper, J. I., Van Wassenhove, V., Nusbaum, H. C., & Small, S. L. (2007). Hearing lips and seeing voices: how cortical areas supporting speech production mediate audiovisual speech perception. *Cerebral Cortex*, *17*(10), pp. 2387-2399.

Smith, I. M., & Bryson, S. E. (1994). Imitation and action in autism: a critical review. *Psychological bulletin*, *116*(2), 259.

Solari, S. (2009). Comunicazione aumentativa e apprendimento della lecto-scrittura. Percorsi operativi per bambini con disturbo dello spettro autistico. Trento: Erickson.

Stern, D. (1977), The First Relationship. Cambridge, MA: Harvard University Press.

Stevens JA, Fonlupt P, Shiffrar M, Decety J. New aspects of motion perception: Selective neural encoding of apparent human movements. *Neuroreport.* 2000;11(1), pp. 109–115.

Stevenson, R. A., Segers, M., Ferber, S., Barense, M. D., & Wallace, M. T. (2014). The impact of multisensory integration deficits on speech perception in children with autism spectrum

disorders. *Frontiers in psychology*, *5*, 379.
Taylor, B. A., & DeQuinzio, J. A. (2012). Observational learning and children with autism. *Behavior Modification*, *36*(3), pp. 341-360.
Thot, A. (2009). Bridge of signs: can sign language empower non-deaf children to triumph over their communication disabilities? American annals of the Deaf, 154(2), pp. 85-95.
Tognoli, E., Lagarde, J., DeGuzman, G. C., & Kelso, J. A. S. (2007). The phi complex as a neuromarker of human social coordination. Proceedings of the National Academy of Science, USA, 104, pp. 8190-8195.
Tomasello, M. (2003). Constructing a Language: A Usage-Based Theory of Language Acquisition. Cambridge: Harvard University Press.
Tomasello, M. (2004). Learning through others. *Daedalus*, *133*(1), pp. 51-58.
Trevarthen, C., "Communication and cooperation in early infancy: A description of primary intersubjectivity. Before speech: The beginning of interpersonal communication", 1, 530-571, 1979.
Uzgiris, I. C. (1981). Two functions of imitation during infancy. *International Journal of Behavioral Development*, *4*(1), pp. 1-12.
Visconti, P., Peroni, M., Ciceri, F. (2007). Immagini per parlare. Percorsi di comunicazione aumentativa alternativa per persone con disturbi autistici. Brescia: Vannini.
Vivanti, G. (2021). La mente autistica: le risposte della ricerca scientifica al mistero dell'autismo. Firenze: Hogrefe.
Vivanti, G., & Zhong, H. N. (2020). Naturalistic developmental behavioral interventions for children with autism. In *Clinical guide to early interventions for children with autism* (pp. 93-130). Springer, Cham.
Vivanti, G., Hamilton, A. (2014). Imitation in Autism Spectrum Disorders. In Handbook of autism and pervasive developmental disorders, 4th edn (eds F.R. Volkmar, R. Paul, S.J. Rogers, K Pelphrey), pp. 278-301. Hoboken, NJ: Wiley.
Vivanti, G., Hocking, D. R., Fanning, P., & Dissanayake, C. (2017). The social nature of overimitation: Insights from Autism and Williams syndrome. *Cognition*, *161*, pp. 10-18.
Vivanti, G., Salomone, E. (2016). L'apprendimento nell'autismo: Dalle nuove conoscenze scientifiche alle strategie di intervento. Edizioni Centro Studi Erickson: Trento.
Vygotskij, L.S. (2013). Storia dello sviluppo delle funzioni psichiche superiori. Roma: Giunti.
Vygotskij, L.S., Lurija, A.R. & Leontjiev, A.N. (1970). Psicologia e pedagogia. Roma: Editori Riuniti.
Wallon, H. (1936). Les origines du caractère chez l'enfant. *The Journal of Nervous and Mental Disease*, *84*(3), 353.
Wallon, H. (1967). Sviluppo della coscienza e formazione del carattere (trad. dal francese), Firenza: La Nuova Italia.
Wing, L., Gould, J. (1979). Severe impairments of social interaction and associated abnormalities in children: Epidemiology and classification. Journal of autism and developmental disorders, 9 (1), pp.11-30.
Winnykamen, F. (1990). *Apprendre en imitant*. Treviso: FeniXX.
World Health Organization (WHO) (2001). International Classification of Functioning, Disability and Health. Geneva, Switzerland: WHO.
World Health Organization (WHO) (2007). International Classification of Functioning, Disability and Health – Children & Youth Version. Geneva, Switzerland: WHO.
Xaiz, C., Micheli, E. (2001). *Gioco e interazioni sociali nell'autismo: cento idee per favorire lo sviluppo dell'intersoggettività*. Edizioni. Trento: Erickson.
Xavier, J., Gauthier, S., Cohen, D., Zahoui, M., Chetouani, M., Villa, F., & Anzalone, S. (2018). Interpersonal synchronization, motor coordination, and control are impaired during a dynamic imitation task in children with autism spectrum disorder. *Frontiers in psychology*, *9*, 1467.
Zappella, M. (1996). Autismo infantile. Roma: NIS.