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# Enhancing Daily Living Skills in Children with Autism Spectrum Disorder Using Video Modeling: a Case Report

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# Abstract

Autism Spectrum Disorder (ASD) is a lifelong neurodevelopmental disease mainly characterized by socio-communicative problems and narrow and stereotyped interests. It is often accompanied by different levels of mental retardation and by a wide range of other developmental disorders. Children with ASD frequently show difficulties in developing independence, thus autonomy in daily living skills. Video modeling and its variations, such as the video self modeling, are successful strategies for improving various skills in ASD. These strategies involve the presentation of video clips that illustrate the correct execution of a desired behavior by a model (video modeling) or by the subject itself (video self modeling). The present study first aims to develop the daily living skill “hand washing” in a child with ASD and moderate mental retardation using a video modeling intervention. Secondly, it aims to investigate the efficacy of a classic video modeling training and an experimental video self modeling training in the target skill. The broader goal of the study is to contribute in providing a reliable tool for overcoming daily living difficulties in individuals with ASD. To this end we created two types of videos on hand washing skill: a classic video modeling clip, in which the model was a peer who had well acquired the target skill, and an experimental video self modeling clip, which was the same as in the video modeling condition, but with the difference that on the face of the model a picture of the participant’s face was pasted. The child enrolled in the research received a classic video modeling intervention and an experimental video self modeling intervention. A follow-up phase occurred five months after the study ended. Results revealed that video modeling lead to a rapid acquisition in the target skill, but it did not stabilized during the study. Results with video self modeling were less effective, but follow-up phase revealed some acquisitions. Video modeling

early capitalized child's cognitive resources. Because of his low cognitive level the child processed with difficulty the information provided by the videos. However, the child showed some improvements in the skill trained, therefore video modeling could be effective in teaching skills to children with ASD. Video modeling and its variations should be tailor made on the cognitive profile of the individuals and on other specific features related to ASD. Research on video modeling interventions may contribute to provide a reliable tool for the development of daily living skills in individuals with ASD.

*To my family*

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# 1

# Autism Spectrum Disorder

## 1.1 Autism Spectrum Disorder

### 1.1.1 History

The term “autism” comes from the Greek word "autos" meaning "self". It describes a condition in which a person removes himself or herself from social interaction, therefore an isolated self. The first psychiatrist who used the term “autism” was Eugen Bleuler in 1911 in the attempt of describing a pool of symptoms of schizophrenia. Leo Kanner (1943), a psychiatrist at Johns Hopkins University, described autism in a small group of children who showed extreme indifference to other people. In 1944, the Austrian pediatrician Hans Asperger described children who demonstrated symptoms similar to those of Kanner’s patients, with the exception that verbal and cognitive skills were better developed. Autism was considered connected with schizophrenia until the 1960s. In the 1970s was popular the Refrigerator mother theory [Bettelheim, 1967] which argued that autism was caused by a lack of maternal warmth. In those years, the treatments for autism focused on medications such as LSD, electric shock, and behavioral change techniques. Throughout the 1980s and 1990s behavioral therapy and controlled learning environments became the main treatments for autism.

### 1.1.2 From Autism Disorder to Autism Spectrum Disorder: symptoms and diagnosis

Autism is a condition including difficulties in social and communication skills, narrow interests and stereotyped behavior. Diagnostic criteria for autism first appeared [Johnson & Myers, 2007] in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM IV) [American Psychiatric Association, 2000].

Over the past decades, researchers have attempted to categorize the heterogeneous features of autism. The DSM IV was based on a multi-categorical system diagnoses of pervasive developmental disorders (PDDs) included autistic disorder, Asperger's disorder, pervasive developmental disorder not otherwise specified, childhood disintegrative disorder, and Rett's disorder [Grzadzinski, Huerta, & Lord, 2013]. The fifth edition of the DSM (DSM 5) [American Psychiatric Association, 2013], released on May 18th, 2013, eliminated the previously separate subcategories on the autism spectrum, including Asperger syndrome, PDD-NOS, childhood disintegrative disorder and autistic disorder. These subcategories are folded into the umbrella term of Autism Spectrum Disorder (ASD) [Grzadzinski et al., 2013; Matson, Hattier, & Williams, 2012].

DSM IV had three domains of autistic symptoms (verbal and nonverbal communication deficits, restricted interests, and repetitive behaviors, instead in DSM 5 two categories are used: social communication impairment and restricted interests/repetitive behaviors. It is because deficits in communication are intimately related to social deficits and both are "manifestations" of a single set of symptoms that are often present in different contexts. Under the DSM 5, the diagnosis requires the person to exhibit three deficits in social communication and at least two symptoms in the category of restricted range of activities/repetitive behaviors. With regards to the second category, a new symptom is included: hyper or hypo-reactivity to sensory input or unusual interests in sensory aspects of the environment [Grzadzinski et al., 2013; Huerta, Bishop, Duncan, Hus, & Lord, 2012; Mason, Ganz, Parker, Burke, & Camargo, 2012; Matson et al., 2012]. In addition, although the criteria for DSM IV Autistic Disorder required a delay in or complete lack of development in expressive language, this requirement has been eliminated in DSM 5. Under the DSM 5, clinicians should also rate the severity of

the deficits, based on the level of support the individuals require. The DSM 5 (pages 53-55) describes the diagnostic features of Autism Spectrum Disorders:

> "The essential features of autism spectrum disorder are persistent impairment in reciprocal social communication and social interaction (Criterion A), and restricted, repetitive patterns of behaviors, interests, or activities (Criterion B). these symptoms are present from early childhood and limit or impair everyday functioning (Criteria C and D). The stage at which functional impairment becomes obvious will vary according to characteristics of the individual and his or her environment. Core diagnostic features are evident in the developmental period, but intervention, compensation, and current supports may mask difficulties in at least some contexts. Manifestations of the disorder also vary greatly depending on the severity of the autistic condition, developmental level, and chronological age; hence, the term spectrum. Autism spectrum disorder encompasses disorders previously referred to as early infantile autism, childhood autism, Kanner's autism, high-functioning autism, atypical autism, pervasive developmental disorder not otherwise specified, childhood disintegrative disorder, and Asperger's disorder.
>
> The impairments in communication and social interaction specified in Criterion A are pervasive and sustained. Diagnoses are most valid and reliable when based on multiple sources of information, including clinician's observations, caregiver history, and, when possible, self-report. Verbal and nonverbal deficits in social communication have varying manifestations, depending on individual's age, intellectual level, and language ability, as well as other factors such as treatment history and current support. Many individuals have language deficits, ranging from complete lack of speech through language delays, poor comprehension speech, echoed speech, or stilted and overly literal language. Even when formal language skills (e.g., vocabulary, grammar) are intact, the use of language for reciprocal social communication is impaired in autism spectrum disorder.
>
> Deficits in social-emotional reciprocity (i.e., the ability to engage with others and share thoughts and feelings) are clearly evident in young children with the disorder, who may show little or no initiation of social interaction and no sharing of emotions, along with reduced or absent imitation of others 'behavior. What language exists is often one-sided, lacking in social reciprocity, and used to request or label rather than to comment, share feeling, or converse. In adults without intellectual disabilities or language delays, deficits in social-emotional reciprocity may be most apparent in difficulties processing and responding to complex social cues (e.g., when and how to join a conversation, what not to say). Adults who have developed compensation strategies for some social challenges still

struggle in novel or unsupported situations and suffer from the effort an anxiety of consciously calculating what is socially intuitive for most individuals.

Deficits in nonverbal communicative behaviors used for social interaction are manifested by absent, reduced, or atypical use of eye contact (relative cultural norms), gestures, facial expressions, body orientation, or speech intonation. An early feature of autism spectrum disorder is impaired join attention as manifested by a lack of pointing, showing, or bringing objects to share interest with others, or failure to follow someone's pointing or eye gaze. Individuals may learn a few functional gestures, but their repertoire is smaller than that of others, and they often fail to use expressive gestures spontaneously in communication. Among adults with fluent language, the difficulty in coordinating nonverbal communication with speech may give the impression of odd, wooden, or exaggerated "body language" during interactions. Impairment may be relatively subtle within individual modes (e.g., someone may have relatively good eye contact when speaking) but noticeable in poor integration of eye contact, gesture, body posture, prosody, and facial expression for social communication.

Deficits in developing, maintaining, and understanding relationships should be judged against norms for age, gender, and culture. There may be absent, reduced, or atypical social interest, manifested by rejection of others, passivity, or inappropriate approaches that seem aggressive or disruptive. These difficulties are particularly evident in young children, in whom there is often a lack of shared social play and imagination (e.g., age-appropriate flexible pretend play), and, later, insistence on playing by very fixed rules. Older individuals may struggle to understand what behavior is considered appropriate in one situation but not another (e.g., casual behavior during a job interview), or the different ways that language may be use to communicate (e.g., irony, white lies). There may be an apparent preference for solitary activities or for interacting with much younger or older people. Frequently, there is a desire to establish friendships without a complete or realistic idea of what friendship entails (e.g., one-sided friendships or friendships based solely on shared special interests). Relationships with siblings, co-workers, and caregivers are also important to consider (in terms of reciprocity).

Autism spectrum disorder is also defined by restricted, repetitive patterns of behavior, interests, or activities (as specified in Criterion B), which show a range of manifestations according to age and ability, intervention, and current supports. Stereotyped behaviors include simple motor stereotypies (e.g., hand flapping, finger flicking), repetitive use of objects (e.g., spinning coins, lining up toys), and repetitive speech (e.g., echolalia, the

delayed or immediate parroting of heard words; use of “you” when referring to self; stereotyped use of words, phrases, or prosodic patterns). Excessive adherence to routines and restricted patterns of behavior may be manifest in resistance to change (e.g., distress at apparently small changes, such as in packaging of a favorite food; insistence on adherence to rules; rigidity of thinking) or ritualized patterns of verbal or nonverbal behavior (e.g., repetitive questioning, pacing a perimeter). Highly restricted, fixated interests in autism spectrum disorder tend to be abnormal in intensity or focus (e.g., a toddler strongly attached to a pan; a child preoccupied with vacuum cleaners; an adults spending hours writing out timetables). Some fascinations and routines may relate to apparent hyper- or hyporeactivity to sensory input, manifested through extreme responses to specific sounds or textures, excessive smelling or touching of objects, fascination with lights or spinning objects, and sometimes apparent indifference to pain, heat, or cold. Extreme reactions are common and may be a presenting feature of autism spectrum disorder.

Many adults with autism spectrum disorder without intellectual or language disabilities learn to suppress repetitive behavior in public. Special interests may be a source of pleasure and motivation and provide avenues for education and employment later in life.

Diagnostic criteria may be met when restricted, repetitive patterns of behaviors, interests, or activities were clearly present during childhood or at some time in the past, even if symptoms are no longer present.

Criterion D requires that the features must cause clinically significant impairment in social, occupational, or other important areas of current functioning. Criterion E specifies that the social communication deficits, although sometimes accompanied by individual’s developmental level; impairments exceed difficulties expected on the basis of developmental level” [American Psychiatric Association, 2013].

Table 1 shows the diagnostic criteria of the DSM 5 for ASD. Table 2 shows the severity levels of the DSM 5 for ASD.

| DSM 5 Criteria for Autism Spectrum Disorder |
| --- |
| Currently, or by history, must meet criteria A, B, C, and D<br>**A.** Persistent deficits in social communication and social interaction across contexts, not accounted for by general developmental delays, and manifest by all 3 of the following:<br>1. Deficits in social-emotional reciprocity<br>2. Deficits in nonverbal communicative behaviors used for social interaction<br>3. Deficits in developing and maintaining relationships<br>**B.** Restricted, repetitive patterns of behavior, interests, or activities as manifested by at least two of the following:<br>1. Stereotyped or repetitive speech, motor movements, or use of objects<br>2. Excessive adherence to routines, ritualized patterns of verbal or nonverbal behavior, or excessive resistance to change<br>3. Highly restricted, fixated interests that are abnormal in intensity or focus<br>4. Hyper-or hypo-reactivity to sensory input or unusual interest in sensory aspects of environment;<br>*Specify* current severity (see Table 2).<br>**C.** Symptoms must be present in early childhood (but may not become fully manifest until social demands exceed limited capacities<br>**D.** Symptoms together limit and impair everyday functioning.<br>**E.** The disturbances are not better explained by intellectual disability or global developmental delay.<br>*Specify* if:<br>With or without accompanying intellectual impairment<br>With or without accompanying language impairment<br>Associated with a known medical or genetic condition or environmental factor<br>Associated with another neurodevelopmental, mental, or behavioral disorder |

Table 1. Diagnostic criteria for Autism Spectrum Disorder. Based on: DSM 5 [American Psychiatric Association, 2013].

| Severity level | Social communication | Restricted, repetitive behaviors |
|---|---|---|
| Level 3 "Requiring very substantial support" | Severe deficits in verbal and nonverbal social communication skills cause severe impairments in functioning, very limited initiation of social interactions, and minimal response to social overtures from others. For example, a person with few words of intelligible speech who rarely initiates interaction and, when he or she does, makes unusual approaches to meet needs only and responds to only very direct social approaches | Inflexibility of behavior, extreme difficulty coping with change, or other restricted/repetitive behaviors markedly interfere with functioning in all spheres. Great distress/difficulty changing focus or action. |
| Level 2 "Requiring substantial support" | Marked deficits in verbal and nonverbal social communication skills; social impairments apparent even with supports in place; limited initiation of social interactions; and reduced or abnormal responses to social overtures from others. For example, a person who speaks simple sentences, whose interaction is limited to narrow special interests, and how has markedly odd nonverbal communication. | Inflexibility of behavior, difficulty coping with change, or other restricted/repetitive behaviors appear frequently enough to be obvious to the casual observer and interfere with functioning in a variety of contexts. Distress and/or difficulty changing focus or action. |
| Level 1 "Requiring support" | Without supports in place, deficits in social communication cause noticeable impairments. Difficulty initiating social interactions, and clear examples of atypical or unsuccessful response to social overtures of others. May appear to have decreased interest in social interactions. For example, a person who is able to speak in full sentences and engages in communication but whose to- and-fro conversation with others fails, and whose attempts to make friends are odd and typically unsuccessful. | Inflexibility of behavior causes significant interference with functioning in one or more contexts. Difficulty switching between activities. Problems of organization and planning hamper independence. |

Table 2. Severity levels for Autism Spectrum Disorder. Based on: DSM 5 [American Psychiatric Association, 2013].

The symptoms are typically recognized during the second year of life, but they may be seen earlier than the first year of life if developmental delays are severe, or noted later than the second year of life if symptoms are more subtle. First symptoms of ASD include delayed language development which often occur with lack of social interest or unusual social interaction (e.g., pulling individuals by the hand without any attempt to play with them) and unusual communication patterns (e.g., knowing the alphabet but not responding to own name). ASD is not a degenerative disorder, and allows skills compensation throughout life. Nowadays ASD is one of the most studied conditions in the field of mental health [Matson & Kozlowski, 2011].

### 1.1.3 Epidemiology

Epidemiological data from the scientific literature estimate a prevalence of autism around 20/10,000 [Fombonne, 2009]. Pervasive Developmental Disorders-NOS's prevalence has been estimated at 3.7 per 1,000, Asperger syndrome at 0.6 per 1,000, and Childhood Disintegrative Disorder at 0.02 per 1,000 (Fombonne, 2009). Autism is more common among boys than girls (4:1) [Fombonne, 2005]. There is a significant increase of ASD diagnosis over the past decades, with an incidence estimated around 6 per 1000 children [Faras, Al Ateeqi, & Tidmarsh, 2010].

There are no differences in the prevalence by geographic region, ethnicity and socioeconomic factors [Elsabbagh et al., 2012].

The recent increase of autism spectrum disorder diagnosis is imputable to changes in diagnostic practices, availability of services, age at diagnosis and public awareness [Fombonne, 2009; Wing & Potter, 2002].

### 1.1.4 Comorbidities

ASD can occur with any other developmental, psychiatric or psychological condition. Mental retardation is frequent because of the intellectual level is extremely variable in individual with ASD, ranging from profound impairment to superior non-verbal cognitive skills. Around 50% of people with ASD also suffer from an intellectual disability [World Health Organization, 2013]. High rates of emotional disorders such as anxiety and depression co-occur with ASD as well as

attention-deficit/hyperactivity disorder, oppositional defiant disorder [Pandolfi, Magyar, & Dill, 2012; Simonoff et al., 2008] and obsessive-compulsive disorder [Russell et al., 2013]. Motor deficits are often present, including odd gait, clumsiness and other abnormal motor signs such as walking on tiptoes. Individuals with ASD may have catatonic episodes with mutism, grimacing and waxy flexibility. ASD is also associated with epilepsy, gastrointestinal symptoms, sleep problems, feeding problems and toileting problems [Mannion & Leader, 2013]. Neurogenetic syndromes such as Fragile X syndrome and Tourette syndrome can be present in ASD. Behavioral symptoms associated with ASD may include aggressive behaviors, self-injuries (e.g., head banging, biting the wrist), short attentional span, abnormal responses to sensory stimuli, abnormal eating or sleeping habits, playing in unusual ways, having inappropriate attachment to objects, having no apparent fear of dangerous situations.

### 1.1.5 Prognosis

The prognosis for children with ASD is governed by the impact of the degree of expression of ASD symptoms, the degree of mental retardation and language impairment and other comorbidities [Coplan, 2000]. Language level by age 5 years is a good prognostic sign, while epilepsy as a comorbid diagnosis is associated with greater intellectual disability and verbal difficulties [American Psychiatric Association, 2013]. Poorer outcomes are associated with severe symptoms, profound mental retardation, comorbidities, etc. Children with less severe symptoms can become functional adults.

To date, psychopharmacological treatments for individuals with ASD are not available. The early identification of the disease ensures that intervention can start as quickly as possible. Recently, an early onset of regulatory problems such as sleeping, crying and feeding has been observed in children with ASD [Fernell, Eriksson, & Gillberg, 2013]. The early identification of the disorder is associated with better outcomes. It allows to enroll the child in appropriate intervention programs and to include the child in regular community settings with peers and a successful inclusion in regular educational and community settings with typically developing peers [Johnson & Myers, 2007]. However, persons with ASD retain the disorder all their lives, therefore autism is considered a lifelong condition.

## 1.2 Etiology

The causes of ASD are still unknown, but it has been suggested that the etiology is multifactorial with genetic and environmental factors influencing early brain development. Various theoretical approaches have been addressing hypotheses for the explanation of the disorder.

### 1.2.1 Theories of Autism Spectrum Disorder

Three theories dominate the psychological research in autism:

**Theory Of Mind (TOM)**. The theory of mind, or metalizing, refers to the ability to identify, to attribute and to manipulate mental states such as beliefs and desires in order to explain and predict the behavior of others. This ability involves the lack to represent thoughts, leading to problems in understanding mental states and in using such knowledge in everyday life, thus showing problems in social interaction [Baron-Cohen, Lombardo, Tager-Flusberg, & Cohen, 2000]. Although the limit of this model is that individuals with high-functioning autism who have good language skills are able to successfully complete usual theory of mind tasks, the essential clinical feature that individuals with autism have difficulties in understanding both their own and others' mind seems unquestionable [Rajendran & Mitchell, 2007].

**Weak Central Coherence Theory**. The essence of the theory is that individuals with autism have difficulties in processing information by extracting the overall meaning of things. In other words, individuals with autism focus their attention on details or constituent parts rather than on the global picture [Frith & Happè, 1994]. This model refers to an information processing style, rather than a deficit [Hill, 2004; Rajendran & Mitchell, 2007]. This theory needs to be supported by empirical data.

**Deficit in Executive Functions**. In this model executive impairment underlies many of the social and non-mental disorders of the autism. "Executive functions" is an umbrella term referring to a range of skills such as planning, flexibility inhibition and shifting, initiation and monitoring for the control of action. Executive impairments presumed to reflect abnormalities in the frontal system. However, these neuropsychological deficits are not specific to autism and the

possible causal relationship between such impairments and social deficit in autism is not clear [Happè, 1999].

Furthermore there are peculiar characteristics in the cognition in this population. Concerning memory functions, visual memory has been found to be strengthen in ASD. Children with ASD encode better visuospatial information than auditory information [Bertone, Mottron, Jelenic, & Faubert, 2005; Marco, Hinkley, Hill, & Nagarajan, 2011]. Studies have showed that people with ASD do not use semantic or syntactic organization strategies in memory processes and they do not spontaneously use cues to facilitate the retrieval of the information [Williams, Goldstein, & Minshew, 2006]. Moreover, individuals with ASD frequently have difficulty with joint attention and have problems with disengaging attention from a central stimulus in an attention competition test [Gliga, Jones, Bedford, Charman, & Johnson, 2014; Kawakubo et al., 2007; Landry & Bryson, 2004]. Individuals with ASD often show over-selective attention, defined as an attentional deficit that involves the failure to utilize all of the important cues in an educational setting [Corbett & Abdullah, 2005; Lovaas, 1979]. This attentional abnormality is prevalent in autism spectrum disorder and has serious implications for the development of social and cognitive skills [Ploog, 2010].

### 1.2.2 Neurobiology

Many studies have been conducted in order to explore the neurobiology of the ASD. To date there is evidence of brain alterations including altered brain growth and size, white matter integrity and connectivity, and gray matter volumes [Minshew & Williams, 2007]. Recent investigations that analyzed the brain alterations of the white matter in individuals with ASD throughout the different stages of life, showed that brain volume is normal or slightly smaller at birth and it is bigger during 2 or 3 years of life. In the childhood alterations of white matter volumes and diffusivity parameters involve the frontal, temporal and parietal lobes. At the end of the brain maturation process, reduced white matter volumes and alterations in the diffusivity are still present, particularly in the fronto-temporal lobes and in the corpus callosum [Mengotti & Brambilla, 2014].

Structural magnetic resonance imaging (MRI) investigations in patients with autism found an increased total brain, parieto-temporal lobe, and cerebellar

hemisphere volumes [Brambilla et al., 2003]. Functional MRI (fMRI) investigations reported in the literature suggest an involvement of abnormal functional mechanisms in face recognition, mentalizing and executive functions in adults with high functioning autism or Asperger's syndrome, possibly due to brain maturation abnormalities, and resulting in dysfunctional reciprocal cortico-subcortical connections [Brambilla et al., 2004]. These data on brain alteration in ASD need to be clarified to explain the neurobiology of ASD.

### 1.2.3 Genetic Factors

Several scientific studies reported the strong role of genetics in the etiology of ASD. Studies on twins reported 70-90% concordance for autism in monozygotic twins versus 10% in dizygotic twins [Schaefer, Mendelsohn, & Professional Practice and Guidelines Committee, 2013]. The higher monozygotic concordance suggests that genetic inheritance is an important causative agent. The evaluation of an autistic phenotype including communication and social disorders enhanced the concordance from 60% to 92% in monozygotic twins and from 0% to 10% in dizygotic twins. It suggests that environmental factors are involved in autistic like traits [Muhle, Trentacoste, & Rapin, 2004]. ASD may reflect the interaction of multiple genes. Anyway there is no genetic test to detect ASD.

### 1.2.4 Environmental Factors

Environmental nonspecific risk factors may contribute to the risk of developing ASD or ASD-like traits. Prenatal environmental factors include in utero exposure to virus infection such as the rubella virus, valproate, drug and alcohol use during pregnancy, advanced age in either parent. During post-natal period, low birth weight and encephalitis may contribute in developing ASD. Possible environmental agents also include food, tobacco smoke, and most herbicides [Roullet, Lai, & Foster, 2013].

## 1.3 Intervention Programs

Actually, psychopharmacological interventions are not available for individuals with ASD. There are intervention programs which aim to habilitate potential functions specifically focused on individuals with ASD. The most widespread

programs are the Applied Behavioral Analysis (ABA) and the Treatment and Education of Autistic and related Communication handicapped CHildren (TEACCH). Both programs are effective in the treatment of people with ASD [Probst, Jung, Micheel, & Glen, 2010; Warren et al., 2011].

### 1.3.1 ABA

Applied Behavioral Analysis (ABA) aims to reinforce new useful and adaptive behaviors and reduce maladaptive ones. This intervention focuses on verbal behavior guiding children using techniques such as errorless teaching and prompting and on Pivotal Response Training that aim to identify skills such as initiation and self-management. The treatment may involve parents and caregivers.

### 1.3.2 TEACCH

TEACCH (Treatment and Education of Autistic and Communication Handicap Children normal development) is a psychoeducational treatment developed in the 60s by Eric Schopler [Cox & Schopler, 1993]. It is based on the neuropsychological features of people with ASD [Orellana, Martìnez-Sanchis, & Silvestre, 2014] and aims to organize the environment to meet the needs of people with ASD through the organization of time and space with visual support. TEACCH is a global approach to autism that involves parents and caregivers as co-therapists [Fornasari et al., 2012].

## 1.4 Tools for Diagnosis

The diagnosis of Autism Spectrum Disorder is a process that carefully assesses behavioral parameters. Having a diagnosis allows to access to support and services. Therefore is important to use standardized clinical tests. The clinical tests most commonly used for the diagnosis of ASD are listed below.

### 1.4.1 Autism Diagnostic Observation Schedule (ADOS)

The ADOS [Lord et al., 2000] is a semi-structured tool which allows to accurately assess and to diagnose ASD across ages (from toddlers to adults), developmental levels, and language skills. It assesses five main domains: language and communication, social interaction, play, stereotyped behaviors, restricted

interests and other abnormal behaviors. Test scores range from 0 (not abnormal behavior) to 2 or 3 (abnormal behavior). ADOS contains four modules each requiring about 40 minutes to administer. The module to be used is chosen based on chronological age and verbal skills of each individual. Module 1 is addressed for children who do not consistently use phrase speech. Module 2 is addressed whom are able to use phrase speech but are not verbally fluent. Module 3 is addressed to fluent children and Module 4 to fluent adults. ADOS diagnosis is based on diagnostic criteria of DSM-IV and ICD-10.

### 1.4.2 Autism Diagnostic Interview-Revised (ADI-R)

The ADI-R [Lord, Rutter, & Le Couteur, 1994] is an interview done to the caregiver for assessing ASD in children and adults with a mental age above 2 years. It has to be used in combination with the Autism Diagnostic Observation Schedule (ADOS). ADI-R investigates three domains: language and communication, reciprocal social interactions and restricted, repetitive and stereotyped behaviors and interests. It explores the skills acquisitions and losses in the three domains. It also explores subject's medical, educational and family background and clinical relevant features such as aggression or self injury. For this reason ADI-R is useful for planning interventions.

### 1.4.3 Achenbach's Child Behavior Checklist (CBCL)

The Child Behavior Checklist (CBCL) [Achenbach & Rescorla, 2001] is a standardized questionnaire on behavioral and emotional problems resumed within eight scales with T-scores (M= 50, SD= 10). It is completed by parents. It assesses internalizing problems (i.e. anxiety, depression, and overcontrol) and externalizing problems (aggressivity, hyperactivity, noncompliance, and undercontrol). The other subscales include social withdrawal, somatic complaints, anxiety and depression, destructive behavior, social problems, thought problems, attention problems, aggressive behavior, and rule-breaking behavior. CBCL also provide an Autism Spectrum Disorder profile (CBCL-ASD profile) [Biederman et al., 2010]. It results by the sum of the CBCL Withdrawn, Social and Thought Problems scales.

### 1.4.4 Adaptive measure: Vineland Adaptive Behavior Scale (VABS)

The Vineland Adaptive Behavior Scales (VABS) [Sparrow, Balla, & Cicchetti, 1984] is a semi-structured interview useful in assessing the daily functioning in individuals from birth to adulthood. It measures adaptive behavior in four domains and sub-domains: Communication (receptive, expressive, written); Daily living skills (personal, domestic, community); Socialization (interpersonal relationships, play and leisure time, coping skills); Motor skills (fine and gross). These activities are compared to those of people who are the same age to determine which areas are within average, above average, or in need of special help. The VABS provides a final composite score that refers to the performance across all four domains. The interview can be administered to parents or teachers. Adaptive behavior information from VABS can be combined with other subject's information such as intelligence level or school difficulties in order to develop educational treatments. The more recent version of the VABS is the Vineland II. It provides the Maladaptive Behavior Index and it has an age range from birth to 90 years old. It is an expansion from the VABS that has a age range from birth to 18 years old.

## 1.5 Functional living Skills in Autism Spectrum Disorder

Many children with autism spectrum disorder show deficit in functional behaviors. Functional behaviors are daily living skills, which include dressing, toileting, grooming, preparing simple meals. Children with ASD need extensive instructions to carry out daily living skills [Carothers & Taylor, 2004]. The core feature of the disease such as communication deficits and executive function deficits contribute to the difficulty with independent behavior [Hume, Loftin, & Lantz, 2009]. The achievement of these skills can decrease parent's and caregiver's burden and make individuals with ASD more integrated into society.

# 2

# Video Modeling

## 2.1 Visual Learning in Autism and Visual Supports

Several studies show that individuals with ASD learn best through visual means [Ganz, Earles-Vollrath, & Cook, 2011; Quill, 1997]. People with ASD show an unusual cognitive style based on the cognitive characteristics of the disorder (see above), for example they tend to focus more on small details within a scene and are less able to integrate information in a relevant context [Griffiths & Milne, 2007]. Indeed they better encode visual information; adults with ASD stated their propensity to process visually based information. For example, Temple Grandin in her book “I think in picture” [Grandin, 2009] well explains that “words are like a second language to me: I translate both spoken and written words into movies complete with sound, which run like a movie in my head. When somebody speaks to me, his words are instantly translated into pictures”. There is support in literature in favor of using visually based strategies with children with ASD [Rayner, Denholm, & Sigafoos, 2009]. Visual strategies mainly involve visually based schedules which include pictures photographs or selected schemes and visually based scripts which include key words for participating in social interactions and well-defined situations [Ganz et al., 2011]. Other forms of visual supports involve video technology.

## 2.2 Autism and Video Technology

Social and anecdotal data suggest a preference for visual media such as television, computer, and video games in individuals with ASD. Shane and Albert investigated in a survey the time children with ASD spent with media. Children spent more time with electronic screen media than other leisure activity and showed a prevalence of verbal and physical imitation during and following exposure to the visual media [Shane & Albert, 2008]. Young individuals with ASD spent most of their time using media, but not using social media (email or chat) compared with peers [Mazurek, Shattuck, Wagner, & Cooper, 2012]. Given the visual learning style of individuals with ASD and the attraction they feel for visual media, a growing number of researches have been developed to reduce deficit in this population using video technology. Video-based intervention (VBI) refers to a pool of techniques that involve presenting videos as the independent variable of the intervention. It includes video modeling, video self modeling and computer-based video instruction (CBVI) [Mechling, Pridgen, & Cronin, 2005].

## 2.3 Video Modeling and Video Self Modeling

Video modeling is a procedure in which a person is asked to watch a video of a model performing a target behavior or a desired task followed by the opportunity for the person to perform the skills displayed in the video [Bellini & Akullian, 2007; Sigafoos, O'Reilly, & De La Cruz, 2007]. The model in the video can be an adult or a peer. They can be familiar to the participant but also they can be unknown. Adult models may include teachers or parents. Peer models may include individuals with the same age and gender of the participant, such as classmates or siblings [McCoy & Hermansen, 2007]. When the model in the video is the participant himself/herself it is a video self modeling. Thus, video self modeling is a specific variation of video modeling that allows the participant to observe himself or herself successfully performing a targeted behavior following with the opportunity to imitate it [Dowrick, 1999]. To ensure that the learner attends the entire video, video modeling procedures may include reinforcement such as praise statements (e.g. “Good”) or access to a preferred toy. The learner may need to receive several sessions over a period up to 10 days before learning the desired

behavior [Sigafoos et al., 2007]. Video self modeling is more difficult to create rather than video modeling because it is necessary to record the child performing the targeted behavior for many times and then edit footages in a clip [Buggey, 2009].

The use of video modeling interventions in individuals with ASD is supported by specific factors. These interventions involve visual information processing and are implemented using media which attract and hold attention in individuals with ASD. The video can be seen anytime by the learner. Video modeling procedure allows to cut out visual and auditory stimuli. These factors help the individual to focus on the information showed on the video [Corbett & Abdullah, 2005]. Furthermore video does not involve face to face interaction that may stress learner with ASD.

### 2.3.1 Theoretical Roots

Video modeling is rooted in the social learning theory. Social learning theory, introduced by Albert Bandura [Bandura, 1977], states that children not only learn through personal experience but also they can learn by observing other people performing a behavior. Individuals that are observed are called models. Children mostly attend and imitate a model that they perceive as competent. They also tend to attend and imitate models who are similar to themselves in features such as age, sex, ethnicity etc. Another important point of the Bandura's theory is the self-efficacy, thus the confidence children feel regarding their ability to successfully perform a task. The self-efficacy feeling of a person is often directly related to his/her success when trying to learn a new skill or improve upon an existing one. Self-efficacy can be acquired by observation of his/her own success [Bandura, 1997].

Over the years, thanks to technological development, the strategies of modeling have been widely explored using video technology.

### 2.3.2 Variations of Video Modeling

**Video prompting.** While in video modeling the entire videotape is shown to the learner, in video prompting the videotape is showed segment by segment one at time. In video prompting the learner is shown with a series of video clips in

sequence. It begins by showing the learner a video clip depicting only the first step of the targeted behavior followed with the opportunity to perform that behavior. After that the learner is shown with the next video clip in the sequence and so on until all of the desired behaviors have been shown. During initial session the instructor may help the child to correctly complete the step so that the next clip of the sequence can be shown [Sigafoos et al., 2007].

**Video modeling point of view.** In video modeling point of view, the video maker records the targeted behavior performed from the point of view of the model, at the eye-level of the child. Recording often occurs behind shoulders. When the learners see the video they see exactly what they have to do from the beginning until the end of the task [Shukla-Mehta, Miller, & Callahan, 2010].

**Mixed models.** Approaches and model types described above can be combined each other. For example, a video modeling with an adult as model can be associated with a video self modeling to improve the child imitation of a targeted skill [McCoy & Hermansen, 2007].

### 2.3.3 Video Modeling Creation

Sigafoos and colleagues [Sigafoos et al., 2007] indicated the procedure for creating a video modeling for individuals with autism spectrum disorder. The process is similar for each type of video modeling technique and involves some steps which are briefly reported below.

*Identify the target behavior.* The instructor or teacher has to identify a behavior to improve. It may include a wide range of skills, from social and communicative skills (interaction with peers, greetings, sharing toys), to self-help skills (grooming or dressing) and many other desired behaviors.

*Having the Correct Equipment.* To create the video the instructor can use video recording device such as a traditional video camera, a hand-held or micro video camera, or digital camera. To show videos to the participant a television with a video cassette player (VCP) or Digital Video Disk (DVD) or a computer with a video player (e.g., Real Player, Apple Quick Time Player, Windows Media Player) can be used.

*Task analysis*. The instructor should write a task analysis including a list of all of the steps needed to complete the target behavior. It is helpful for the taping process and for analyzing the child's achievements during the intervention.

*Baseline Data.* Before starting with the intervention is important to verify if the learner is already able to complete some steps of the target skill. These baseline data provide a stable starting point to evaluate improvement during the training.

*Video Making*. In this phase the instructor decides which model to include and the point of view of the video. After recording the video may has to be modified to remove environmental cues. Voice-overs might narrate the steps.

*Setting and material.* The training should be conducted in a natural setting. During the training it is important to use the same materials that are used in the clip.

*Showing the Video.* The video is shown to the learner. The instructor provides prompts to the learner to keep attention.

*Troubleshooting.* During intervention the instructor analyzes the progress of the child with the task analysis. Progress monitoring data allow to identify critical factors of the procedure and then to change them. Critical factors may include the child's ability in attending the video, imitating the target behavior and the need of reinforcement.

### 2.3.4 Instructional Procedures

Video modeling is also used in conjunction with instructional procedures. Duker and colleagues [Duker, Didden, & Sigafoos, 2004] described all the instructional procedures for training to learners with developmental disabilities. The main procedure are listed below.

*Most-to-least prompting or decreasing assistance*. The trainer use a hierarchy of prompts that are ordered from the most to the least intrusive. Initially the most intrusive prompt is presented simultaneously with the target stimulus and correct responses are reinforced. It continues until the child reaches a specified level of performance. When level is reached with the most intrusive prompt, the next less intrusive prompt is provided until performance meets criterion. This process continues until the child can respond alone to the stimulus.

*Least-to-most prompting or increasing assistance*. The trainer use a hierarchy of prompts ordered from the least to the most intrusive. On each trial, the trainer presents the target stimulus and provides an opportunity to respond. If the learner does not respond or makes an error, the least intrusive prompt is presented as is an opportunity to respond. Again, if no response is forthcoming or an error occurs, the next most intrusive prompt is presented with an opportunity to respond. This process continues until the child responds correctly. Reinforcement is provided and the trial is terminated when the child responds correctly to any level of the hierarchy.

*Combining most-to-least prompting and least-to-most prompting*. It is a combination of the both procedures and is mostly use for teaching communicative gestures.

*Backward chaining*. It involves to train first the last response of the behavior chain. The responses of the chain are added successively in the reverse sequence until the first response is trained.

*Forward chaining*. It involves to train the first element in the chain and progresses to the last element. Elements should not be taught in isolation but together, hence the term ‘chain’.

## 2.4 Video Modeling Interventions on Functional Living Skills: State of the Art

### 2.4.1 Overview of the Literature

In a meta-analysis of 23 single-subject designs Bellini and Akullian [Bellini & Akullian, 2007] evaluated the effectiveness of video modeling including video self modeling interventions for individuals with ASD aged from three to twenty years. Interventions were aimed at enhancing social, behavioral, communication, and daily life skills. Results show that video modeling and video self modeling are effective strategies in these areas. However, it is noteworthy that in most of the studies examined video modeling and video self modeling were used in

combination with prompts, reinforces or additional strategies such as social stories or computerized instruction [Shukla-Mehta et al., 2010].

Delano reviewed 19 empirical studies where video interventions were the primary independent variable for students with ASD. She found that these methods were effective in teaching students with ASD social-communication skills, functional living skills and in reducing problem behavior [Delano, 2007]. She compared, with the same criteria, studies that embedded instructional prompts and reinforces as integral part of the intervention with studies that used video interventions alone [Shukla-Mehta et al., 2010]. It could be a critical point of the review.

Hermansen and McCoy classified studies based on the type of the model (such as adult, peer, self, point-of-view, and mixed model) used in video modeling interventions on social, academic, and functional skills in students with ASD. The main finding of the review is that video modeling is an effective intervention for individuals with ASD. Authors also observed that video self modeling and peer video modeling have the most influence in participants with ASD [McCoy & Hermansen, 2007].

Shukla-Mehta and colleagues reviewed 26 studies of the literature with the aim of determining the effects of video instruction on the acquisition and generalization of social and communication abilities in individuals with ASD. Results of the review revealed that most of the studies used video modeling with additional components when video modeling alone did not improve the correct responses of the participants. These interventions included instructional prompts, verbal reinforces and other teacher-directed strategies. Few studies examined video modeling as the primary intervention without additional intervention components. However it is not specified if video modeling was more effective given that participants in the control group, who also received direct instruction, also showed improvement in target skills. Similar findings emerged with video self modeling but overall data suggest that there is limited evidence on the effectiveness of video self modeling for improving socio-communicative responses in students with ASD [Shukla-Mehta et al., 2010].

Mason and colleagues [Mason et al., 2012] conducted a meta-analysis of single case studies on moderating factors in video modeling studies with other as model.

The majority of studies explored functional daily living skills and socio-communicative skills. Most of the studies reviewed enrolled individuals with ASD (84%), other studies enrolled individuals with other developmental disabilities (43%). Results showed that video modeling is more effective for individuals with ASD and moderately effective for patients with other developmental pathologies. The highest effects of video modeling in participants with ASD were achieved when video modeling was used together with reinforcements. Statistically significant differences between video modeling with other as model delivered alone or as part of a package was not found. This data is inconsistent with the findings of Shukla-Mehta and colleagues that showed that the performance of subjects with ASD improved with video modeling plus other interventions such as prompts and error correction procedures.

Ayres and Langone demonstrated the benefits of video instruction in a review that included 14 studies where video modeling and video self modeling have been used. The focus of the review was video modeling interventions as part of an instructional package for people with ASD in the areas of social skills and functional skills [Ayres & Langone, 2005].

The review conducted by Mechling [Mechling, 2005] restricted the studies to those in which the videos used were personally created by the instructor, as opposed to commercial software or feature films to teaching people with disabilities including ASD. The research analyzed studies that utilized video modeling, video self modeling, subjective point of view, interactive video instruction, and computer-based video instruction. About 91% of the instructor-created video programs included in the review showed positive intervention effects. It is noteworthy that half of the participants in the reviewed studies were diagnosed with autism, even though the survey included different disabilities.

Rayner and colleagues examined five reviews [Ayres & Langone, 2005; Bellini & Akullian, 2007; Delano, 2007; McCoy & Hermansen, 2007; Mechling, 2005] to assess the efficacy of video-based intervention approach (VBI) for teaching individuals with ASD. Single-subject research designs were used in all the studies examined. The studies mainly aimed to enhance social and language skills and secondly functional skills. As the focus of the examined reviews differed, taken together these results demonstrate that a range of procedural variations in the use of

the video produced positive outcome and effects in maintenance and generalization in various target behaviors. The authors stated that important questions concerning the type of model and the perspective to use in the video, as well as the other procedures combined with the video, needed to be fully clarify [Rayner et al., 2009].

In sum, empirical data from the literature suggest that video modeling and video self modeling have demonstrated promising outcome. However most of the video modeling studies aimed to teach social-communicative skills while few studies aimed to teach functional living skills. In this field the most of the research studies used video modeling alone or in combination with other instructional strategies in order to enhance daily living skills in children with ASD. The majority of the studies investigated the use of other as model (peer or adult). To the best of our knowledge for enhancing daily living skills only one study adopted video self modeling, one study used video prompting and another one used video modeling point of view. The results obtained showed positive effect of the strategy used. However, there are frequently differences in the experimental procedure adopted. Some studies involve prompts or reinforcements during baseline or during training conditions, for example when the participant does not show progress in the performance or when he/she reaches a plateau. These prompts or reinforcements can be given also when it is needed to praise the participant's attention to the video or to the correct performance of the entire task or of some steps of it. There are also differences in the video tape creation that may involve verbal narration in the tape or similar indications, adjunct of verbal or visual information. In general, video modeling could be a promising technique, although some results are not significative. Overall, in video modeling studies there is a great variability in the performance between the participants.

The relevant studies of the scientific literature are briefly described in the following paragraph.

### 2.4.2 Studies Enhancing Daily living Skills in Children with Autism using Video Modeling

During the past 20 years research studies have used video modeling and its variations in order to enhance daily living skills in children with ASD. Further researchers examined other implementations of video modeling.

## Video Modeling

Two studies in the specific field of functional skills concerned purchasing skills. A research study conducted by Alcantara reported findings using a video that taught to three children with autism grocery purchasing skills in three settings. Participants viewed at school a narrated video of a model performing the correct task with a narration that included descriptions of the relevant stimuli. After viewing the videos students went to their grocery store to make a purchase. A 32 steps task analysis was conducted to determine which steps the participants would need to complete in order to perform the entire task. An instructor provided a verbal reminder, if needed, by asking the student what he or she needed to do next. Each step of the task analysis was scored as correct only when the participants correctly performed the step independently. Anyway reinforcement occurred in the form of verbal praise whenever a correct step was completed and students were able to keep items to the final purchasing stage. Participants began to acquire skills through video instruction alone, but 4 steps of the 32 steps in the task analysis needed in-vivo instruction. In this case, the researcher used a least-to-most prompting system. The change in level between baseline and video instruction condition in the three settings for all participants was from 4 up to 17 correct steps of the 32 task analysis steps. After video plus in vivo training condition, data stabilized from 25 up to 32 correct steps for all participants. Authors conducted a follow-up phase in which no prompts were issued and all participants showed maintainance. At the end of the study all students acquired and generalized the purchasing skills to new settings. A decrease in the total amount of time required for students to make a purchase is also reported. Overall, the study suggests the combination of video modeling, a prompting system and reinforcement were successful in teaching a functional skill to students with autism [Alcantara, 1994].

Haring and colleagues made a training in order to generalize purchasing skills in six children with ASD. The study involved three orders of treatments: in vivo

instruction followed by videotape training, videotape training followed by in vivo instruction and concurrent videotape and in vivo instruction. Generalized purchasing skills, measured by the percentage of the 12 steps task analysis correctly performed, were produced by the participants who received concurrent training and by the students who received sequential training, showing that video and in vivo training alone are not sufficient for the generalization of the trained skills [Haring, Breen, Weiner, Kennedy, & Bednersh, 1995].

Video modeling was used to improve unpacking bag and teeth brushing in a young boy with ASD [Rayner, 2010]. Videos featured the investigator, who was unfamiliar to the child, correctly performed the behaviors. Videos included an opening title, a closing screen with text and several visual symbols for the relevant actions. Symbols were embedded in the video in order to associate them with the video footage, therefore the symbols could be used as prompts after fading the video component of the intervention. The video was presented three or two times depending on the phase, followed by the opportunity to complete the target behavior. Verbal and signal prompts were provided if the participant did not initiate the step independently. Variations of video prompting procedure and live modeling were introduced only for teeth brushing in order to facilitate task acquisition. Based on a task analysis, the number of steps correctly performed were recordered. Results reported that video modeling intervention increased the ability in the unpacking bag (the participant correctly performed a mean of 8% of the steps during baseline and a mean of 92% during interventions) and these gains generalized to packing bag prior to departure from school. However, limited success was obtained in the use of the video modeling for teaching the participant to brush his teeth (he correctly performed a mean of 35% of the steps during baseline and a mean of 55% during interventions).

A research by Rosenberg and colleagues investigated the effects of using a commercially available video model and then a customized video modeling to teach three children with ASD to wash their hands. The commercial video was purchased from an Internet web site. The model of the video was a male child, who was shown walking into the school and washing his hands. No verbal narration of the steps was provided in the tape. The words “Wash” and “Dry” appeared in the tape when the model was performing these actions and were given indications,

such as “always remember to wash your hands when you’re done” and “and don’t forget, dry those hands.” Customized video included a familiar child as model. The tapes featured the model washing hands in the same bathroom used for the data collection in the study. The video embedded narration accompanying each target step (i.e. get soap, wet hands) and praise at the end of the hand washing sequence. After viewing the tape the researcher accompanied the child to the bathroom for washing hands, just like on the video. During training no prompts occurred. Thirty seconds were allowed for a step completion and proceed to the next one before the session was terminated. The performance was recorded in a 9 steps task analysis indicating whether each step was complete or not complete. One of the three participants learnt the majority of the steps from the commercial model. The average of the correct performed step during baseline was 1,5 the average of the correct performed step during commercial video modeling was 2; the other participants did not show evident improvements with commercial video modeling. All participants were subsequently exposed to a customized video modeling and showed some acquisition of the targeted skill (for two of the three participants the average of the correctly performed steps with customized video modeling was respectively 9 and 4; the third child did not showed evident improvements) [Rosenberg, Schwartz, & Davis, 2010].

A video modeling plus least-to-most prompting procedure (vocal, gesture and physical guidance) was compared to least-to-most prompting procedure alone to investigate if the use of a video model would increase the effects of least-to-most prompting alone in acquiring daily living skills [Murzynski & Bourret, 2007]. The target skills of the experiment included shirt folding, pants folding, sandwich making and juice making. Participants were two males aged eight and nine years old. The interventions were conducted at the participant’s home twice a week. During combined intervention the video was shown to the participants and prompted procedure followed whenever a step was conducted incorrectly. The same procedure was used for the condition with prompt system only. During both conditions praise and edibles where given as reinforcement after each trial regardless of the responses of the paticipants. During each trial the number of the steps independently performed or the prompt level required to a correct response was recorded in a task analysis data sheet. The criterion to consider a skill mastered

was the independently and accurately response on all steps in five consecutive trials. Outcomes reported that both children acquired skills trained via video modeling plus least-to-most prompting in fewer trials and with fewer prompts than skills trained with least-to-most prompting alone [Murzynski & Bourret, 2007]. Video modeling condition required fewer prompted steps for the children. However video modeling alone was not addressed in this study.

Charlop-Christy and colleagues [Charlop-Christy, Le, & Freeman, 2000] compared the effectiveness of video modeling with in vivo modeling for teaching a wide variety of developmental skills including self-help skills to children with ASD. They found that video modeling rather than in vivo modeling led to faster acquisition and generalization of target responses for four out of five children enrolled in the study. For self-help skills they compared brushing teeth through video modeling and washing face through in vivo modeling in a child. The model of the video was an adult who performed at a slow pace the target behavior and children were reminded to pay attention or to respond whenever necessary. During baseline prompts and reinforcement but no rewards were provided. During the modeling conditions, verbal prompts or praise were given for on-task behavior and for attending to the model or television screen. Scoring was done using a checklist where the rater marked each correct response of the targeted behavior. The criterion to consider a skill mastered was 100% correct performance for two consecutive sessions. The participant first acquired the skills trained through video modeling and generalized it. For brushing teeth, the average response accuracy was around 50% during baseline and when video modeling was introduced the performance met criterion after three presentations. For face washing, the average response accuracy was around 50% during baseline and when in vivo modeling was introduced the performance met criterion after seven presentations. Generalization was not demonstrated for in vivo modeling trained skill.

### Video Prompting

In the study conducted by Rayner [Rayner, 2011b] was evaluated the efficacy of a video prompting procedure to teach three boys with ASD to tie a shoelace knot in comparison with a backward chaining strategy. The participant would be seated and then presented with the mock shoe or real shoe on a desk. The author would then instruct the participant to tie the shoelace knot. The backward chaining was

introduced when participant reached a plateau or not progressed in their performance of the target behavior during the video prompting phases. During backward chaining sessions, the participant was provided with live modeling with verbal cues. Although video prompting increased the number of steps in the shoelace tying task completed by each of the participants, the backward chaining procedure was more effective, enabling one participant to reach mastery (within a 11 task analysis steps) and a second participant to approach mastery.

### Video Modeling Point of View

Shipley-Benamou and colleagues investigated if a video recorded from the participant's point of view, at the eye level of the child, as if the participant was performing the task, could produce skill acquisition in five years old children with ASD. The participants saw in the video the hands of a person performing a specific target skill among setting a table, mailing a letter, feeding a cat or making orange juice. The video included a step-by-step narration of the skill. Video began with five seconds of a cartoon to capture the children's attention and during the video; verbal praise were provided to the children for attending the video. After they viewed the video they had the opportunity to do what they saw. Researchers used a task analysis sheet recording wheather a step was completed or not completed. If the participant did not initiate the task within 60 seconds he/she received a prompt, then if he/she did not initiated within another 60 seconds the task was terminated and subsequent steps were scored as incomplete. The criterion for responding was two instances of 100% correct responding on a task. Two students received candy as reinforcement for successful task completion, defined as completing the task with 100% accuracy, while the third student received access to a preferred toy. All participants made large gains in independent performance of the target skills and maintenance data was reported one month after intervention ended [Shipley-Benamou, Lutzker, & Taubman, 2002]. Anyway one of the participant required additional prompting procedure in order to reach the criterion.

### Self as Model

To the best of our knowledge, only one study [Cihak & Schrader, 2008] focused on video self modeling in daily living skills in students with autism. The study compared the efficacy of learning vocational skills such as preparing family packs, preparing first aid kits, sending a fax, making copies, using video self modeling and

video adult modeling instruction. Four males with ASD, aged sixteen to twenty-one, watched a video of themselves or a video of an unfamiliar male adult model, depending on the condition, who performed independently the targeted skill. For each video, a male voice-over stated each step of the task analysis. Sound was added for each video using either the participant's voice or the voice of the unfamiliar male. Participants watched videos two times per day in the school setting, where they were required to perform the tasks. Immediately after video was ended, the students were asked to complete the task. Verbal praises were provided after completing the task-analyzed steps independently. If an incorrect step was performed the teacher played the segment of the video for a second time. A system of least-to-most prompt hierarchy involving verbal, gesture, gesture plus verbal explanation, modeling plus verbal explanation, physical assistance plus verbal explanation was used. The steps of each task were recorded in a task analysis data sheet as completed independently or incorrectly. The acquisition criterion was three consecutive data points with 100% independence. Results indicate that both self and adult model were effective in teaching and maintaining vocational skills. During baseline the participants were not able to do some of the targeted tasks. During video self modeling condition the mean percentage of steps independently completed was from 46% up to 81%; during video modeling with adult it was from 53% up to 70%. Follow up was conducted after students acquired the trained skills (three and six weeks after intervention) and maintainance was 100%.

## Other Implementations of Video Modeling

Some studies with video modeling include substantial variations in the classical procedure. Variations mainly include the protagonist of the video, that is not a person, and the transposition on the video format of other educational strategies. In a study [Hagiwara & Myles, 1999] designed for using self modeling, authors implemented multimedia social stories with video vignettes for student engaged in a hand washing task. Responses were recorded on a six steps task analysis. Criteria for scoring was: independent responses (without any cues or prompts), prompted responses (if the child did not complete the task within five seconds), physical assistance (provided if the child did not respond to prompt after five seconds). Results, in term of the percentage of step independently achieved, did not provide convincing evidence about the efficacy of treatment. An animated toilet training

video was used for teaching daytime urinary control to five boys ranging from four to six years of age with ASD across several settings [Keen, Brannigan, & Cuskelly, 2007]. In the research, children in the treatment condition received video modeling plus operant conditioning strategies, whereas children in the control condition received only operant conditioning strategies. Children were provided reinforcement for each step of the toileting process successfully performed. Children watched the video prior to each toileting session. The video in the treatment condition was full of colors and sounds. It displayed different models such as a green frog as well as both male and female humans. The presence of colors and sounds in the video could distract the participants from the target behavior. During the study the frequency of the participants of in-toilet urinations par day was recorded in a monitoring sheet. The type model used in the video was different from typical video modeling procedure that involved human models. Anyway, results indicated the children who received the animated video had from 4 up to 14 in-toilet urinations and some of them were unprompted. The participants in the control condition had a maximum of 2 in-toilet urinations. Gains were maintained for some participants at a six week follow-up as well as generalization to new settings.

Ayres and Langone evaluated the effectiveness of two types of video models, first-person versus third-person perspective, for teaching students with autism to put away groceries. All videos depicted an adult actress who performed the action. In the video modeling session instructions were provided on the computer. After that partitcipants were required to carry out the task of food storage at the computer. Pre and posttest they were asked to put away groceries in real life with real food. Results not clearly indicated the superiority of one perspective over the other. All participants learned the behavior on the computer and all generalized it to the natural environment [Ayres & Langone, 2007], but the classic video modeling procedure was not used.

The table below reports all studies using video modeling or its variations for the development of daily living skills in children and adolescent with ASD.

## 2.4 Video Modeling Interventions on Functional Living Skills: State of the Art

| Author(s) | Targeted skills<br><br>Participants | Intervention | Outcome | Type |
|---|---|---|---|---|
| Alcantara, 1994 | Grocery-purchasing skills in community settings<br><br>Participants: three children aged 8-9 | Evaluate the effects of a videotape instructional package on the acquisition and generalization of children's grocery-purchasing skills in community settings. | After training in two stores, all students increased their level of performance in the third store:<br>-generalized the skills across settings<br>-decreased total time required for making a purchase in the store. | VM |
| Haring et al., 1995 | Purchasing skills<br><br>Participants: six children aged 10-16, three with autism | Three treatments: (a) in vivo instruction followed by videotape training, (b) videotape training followed by in vivo instruction, (c) concurrent videotape and in vivo instruction. | Production of generalized purchasing skills by the students who received concurrent training and by the students who received sequential training. Videotape and in vivo training in isolation did not lead to generalize shopping skills. | VM |
| Charlop-Christy, Le & Freeman, 2000 | Brushing teeth (VM), washing face (in vivo modeling), among others social skills<br><br>Participants: Five children aged 7-11 | Compare VM and in-vivo modeling (same procedure) with prompts and reinforces for attending to the model. | VM led to faster acquisition and generalization of brushing teeth. | VM |

| | | | | |
|---|---|---|---|---|
| Rayner, 2010 | Unpacking bag, brushing teeth<br><br>Participant: a boy 12 years old | VM with verbal and signal prompt if the participant didn't initiate independently. Variation with prompting procedure and live modeling were introduced only for teeth brushing. | VM led to rapid increases in the percentage of steps performed in the unpacking bag sequence and these gains generalized to packing bag. Limited success with VM for brushing teeth. | VM |
| Rosenberg, Schwartz, & Davis, 2010 | Hand washing<br><br>Participants: three children aged 3-5 | Commercial VM and then customized VM were used. | One child learned 80% of the steps but two of the three children did not learn from the commercial model. All were subsequently exposed to a customized VM, which resulted in at least some acquisition of the skill for the two students who did not learn from the commercial model. | VM |
| Rayner, 2011 | Coin matching, circle time, preparing noodles<br><br>Participant: a boy 15 years old | VM with sibling as model compared to VM with adult as model in a child with difficulties in imitation. (Verbal prompt during baseline and withdrawal). | Coin matching: not improve. Circle time: possible improve but no clear, positive intervention effect. Preparing noodles: the participant completed more steps during adult-as-model condition. | VM |

| | | | | |
|---|---|---|---|---|
| Murzynski & Bourret, 2007 | Shirt folding, pant-folding, sandwich making, juice making<br><br>Participants: two children aged 8-9 | VM plus least to most prompting compared to least-to-most prompting (LTMP) alone. | The participants acquired skills taught with VM plus LTMP in fewer trials and with fewer prompts than skills taught with LTMP alone. | VM |
| Rayner, 2011 | Tie a shoelace knot<br><br>Participants: three children aged 9-10 | VP procedure compared to backward chaining procedure. | Although VP increased the number of steps in the shoelace tying task completed by each participant, the backward chaining procedure was more effective, enabling one participant to reach mastery and another participant to approach mastery. | VP |
| Cihak & Schrader, 2008 | Preparing family packs, preparing first aid kits, making copies, sending a fax.<br><br>Participants: four boys aged 16-21 | VSM compared to adult VM. (No additional prompts or feedback were provided; system of a least-to-most prompt hierarchy was used). | Both self or adult model were effective. | VSM |

## 2.4 Video Modeling Interventions on Functional Living Skills: State of the Art

| | | | | |
|---|---|---|---|---|
| Shipley-Benamou, Lutzker, & Taubman, 2002 | Preparing to mail a letter, mailing letter, taking care of pet, table setting.<br><br>Participants: three children aged 5 | VM from the first person perspective with a narrator who spoke on the tape to give instructions. | Large gains for all students in independent performance of the target skills. Maintenance data were reported one month after intervention. | VPOV |
| Ayres & Langone, 2007 | Putting away groceries<br><br>Participants: four children aged 6-8 | VM from the first person perspective compared to VM from third person perspective through computer. | Not clear indication of the superiority of one perspective of VM over the other. All students learned the behavior on the computer and all generalized the behavior to the natural environment. | O |
| Keen, Brannigan & Cuskelly, 2007 | Toilet use<br><br>Participants: five children aged 4-6 | VM plus operant conditioning strategies compared to operant conditioning strategies only.<br><br>The video was a cartoon | Gains for children who received VM. Gains were maintained for three participants at a six-week follow-up. Two participants showed generalization to a new setting. | O |
| Hagiwara and Miles, 1999 | Hand washing<br><br>Participants: three children aged 7-9 | Social Stories in a computer-based format | The intervention increased the skill level. | O |

| | | | | |
|---|---|---|---|---|
| Mechling, Pridgen, & Cronin, 2005 | Fast food restaurant purchasing skills<br><br>Participants: three adolescent aged 17, one with autism | Constant time delay (CTD) and Computer-based video program (CBVI) were used. On the computer there was no a model who completed the task. | Each student enhanced verbal and motor steps after CBVI. | O |

Abbreviations: VM: video modeling; VP: video prompting; VSM: video self modeling; VPOV: video modeling point of view; O: other implementations of video modeling.

Note: all participants had a mental age between two and seven years old.

# 3

# Single-Subject Research

## 3.1 Autism Spectrum Disorder and Research Implications

Autism Spectrum Disorder (ASD) refers to a condition that may highly differ from person to person. Different intelligence level can be associated with different levels of impairment in communication, in social skills, in motor skills and in autonomy skills. In addition, sensory impairments can affect learning in this population. Because of the high variability among subjects it is difficult to use the classical group methodology and to compare the group averages. Single-subject methodology focuses on group averages, but the behavior performed by the average of the group may not represent the single-subject performance. Instead the *single-subject method (N=1)* allows to investigate the behavior of individual participants.

The single-subject studies aim at documenting the effect of an intervention on a participant. The main features of this research are the focus on the single individual and use of the very same subject as him/her own control. Unlike classical experimental designs which involve the average effects of an intervention within or between groups of participants, in single-subjects designs comparisons are made between the behavior of one individual and that same individual at a different time-point. Single-subject research is experimental rather than correlational or

descriptive research, it aims to document the relationships between independent and dependent variables [Horner et al., 2005]. The single-subject methodology has shown to be effective in the study of the independent variables [Cottini, 2014]. In addition, this method allows to overcome problems that are usually connected with the classical group methodology [Callahan & Barisa, 2005; Ferron & Ware, 1994; Hersen & Barlow, 1976; Kazdin, 2001].

- *ethical problem*, associated with the lack of opportunity to administer to the control group an ineffective or less effective intervention;
- *practical difficulties*, as above mentioned, are related to the possibility of putting in the same group individuals that have a wide variety of difficulties.
- *statistical significance and clinical significance*, related to the previous point, means that in the research group statistical significance is obtained through a comparison of the differences in performance between the groups (under different conditions), related to the variability within groups. The large variability between subjects could hide the influence of others variables.

## 3.2 Phases and Methodological Requirements in Single-Subjects Research

Single-subject designs basically involve three phases. A baseline phase in which the investigator collects data on the dependent variable without any intervention; the intervention phase in which the investigator introduces an independent variable (the intervention) and collects data on the dependent variable; the reversal phase in which the investigator removes the independent variable and collects data on the dependent variable. Four methodological requirements are included in single-subject designs:

*Repeated measurement*. The same behavior (dependent variable) is measured over and over again. Measurements might include the frequency of the behavior, response latency, response duration, response intensity, response selection (among several alternatives). Repeated measurements in a single-subject allow to overcome the lack of a large number of subjects.

*Establishing a Baseline*. Repeated observations of the dependent variable provide a point from which the effects of the intervention can be judged, i.e. the baseline. It is important to establish a stable baseline to characterize a pattern but

there is not a number of observation that define the stability of a baseline. For this reason is important to obtain a constant level of data. The baseline usually should include at least three measurements. *Duration of the phases*. In each phase data should be stable. The results of the repeated measurements are placed in a chart (time series) which indicates the trend of the data. It allows to make operational decisions such as the introduction of another independent variable, the reversal of the treatment or the modification of the experimental design. Kratochwill and colleagues [Kratochwill et al., 2013], in their determination of the criteria for the single-subject research to validate evidence-based practice interventions assert at least three measurements, preferably to be extended to at least five measurements.

*Reversal phases*. The efficacy of the intervention is demonstrated when the target behavior improve only during the intervention, and it decreases when the intervention is removed. However, the improvement could be due to other variables that are not controlled for. The problem can be solved using a reversal phase which consists in the intervention interruption while data on the target behavior are collected. If the intervention led to a change in the behavior and the removal of the intervention led to data similar to the baseline, it is possible to conclude that it is due to the intervention per se. The impact of the intervention can persist after the intervention was stopped. This effect is known as *carry-over effect*. From the clinical point of view it is a benefit because the positive effects of the treatment over the time are prolonged, but from the methodological point of view it could limit the evidence concerning the effectiveness of the procedure used.

## 3.3 Single-Subject Designs

Single-subject research embraces various types of designs. In this methodology, the phase A refers to the baseline, phases B and C refer to the intervention and the BC to the combined intervention. Main designs are illustrated in the following paragraphs [Cottini, 2014].

**A-B-A design**. The simplest design is the A-B Design which allows to quickly assess the effects of an intervention. This design is not able to distinguish the experimental effect from possible concurrent confounding effects. A variation is the BA design, also called "interrupted time-series design", in which the intervention is withdrawn to determine its effectiveness. The A-B-A or reversal

design assess the effect of the independent variable by repeatedly introducing and withdrawing the independent variable. The repetition ensures that confounds are unlikely to occur repeatedly at the same times as the independent variable. It can be extended indefinitely. A variation is the BAB design. ABA design cannot be used whether the independent variable has irreversible effects or when return to baseline is undesirable.

**Interaction design.** The Interaction design combines testing the effect two independent variables (two interventions). An example is the A-B-A-B-BC-B-BC design. This design can be used if each independent variable does not cause a maximum increment in performance.

**Multiple baseline design**. In the multiple baseline design a series of A-B designs are used at the same time for at least three subjects, behaviors, or settings. This design allows to control for external confounds across the three cases and the baseline is staggered. The repeated changes in the dependent variable after each successive introduction of the independent variable ensure experimental control because is unlikely that the confound will occur with the introduction of the intervention. The multiple baseline design is widely used. Its disadvantage is that it requires some planning and effort to be successfully implemented.

**Changing criterion design**. The changing criterion design is useful when the target behavior due to the independent variable cannot be emitted initially. The baseline is followed by a treatment program associated with a change in criterion rate for the target response. Thus, by repeating the change in the response the experimental manipulation is implemented. These steps allow the subject to meet the criteria and must be wide enough to show the effect of the intervention.

## 3.4 Data Analysis

There are two main approaches to data analysis of single-subject designs: visual analyses and inferential statistical analyses. Visual inspection of the data graph is a procedure used to evaluate the significance of the data obtained. Three criteria are used:

- the main criteria is a comparison between baseline data points and intervention data points through average and median analysis. It provides a trend, thus the direction of the data point in the pattern for each phase.

- The latency with which the target behavior changes after the introduction of the independent variable. [Kratochwill et al., 2013].
- The data variability meaning how divergent the scores are within baseline and intervention phase. When scores greatly differ within a phase, the assessment is difficult because it is hard to determine whether the change in the dependent variable has been changed by the independent variable.

The application of statistical tests require a minimum number of measurements for each phase. For example C test is able to provide significant information with eight observations [Cottini, 2014].

## 3.5 Advantages and Disadvantages

The focus on the single-subject is particularly important in the field of rehabilitation because several programs involve intervention with single individual. Single-subject designs allow to take into count the characteristics of the participant such as age or diagnosis. For this reason these designs can provide evidence that reflects practical findings. The focus on the individual is an advantage and a weakness at the same time because of the generalization of the results to other subjects. The problem of generalization is an issue of external validity. Ideally we want to extend the findings of the research to different subjects, behaviors or settings, that respresents the extent to which the results with one or a few participants can be generalized to others. Results are hard to generalize to others and researchers cannot be certain that other subjects would behave like the participant in the same situation. When only a few participants are tested is hard to identify characteristics that may explain why some subjects responded better or worse than others. It is more relevant in the field of autism where there is a wide clinical heterogeneity in the core symptoms, intellectual level and comorbidities. Thus it is difficult to identify a large group of individuals who share similar characteristics and therefore to generalize results.

To demonstrate the external validity of single-subject design requires replication of both the research conditions and beyond the research conditions. Authors suggest that sequential replication strategies (direct replication, systematic replication, and clinical replication) should be used to enhance the external validity of single-subject design [Barlow & Hersen, 1984]. The small size of the sample

does not allow to conduct post-hoc analysis of characterisitcs that may affect the response to the intervention. Another limitation in these studies is related to the use of the visual inspection where data interpretation could be different between different judges.

Single-subject studies do not require control conditions or comparison groups, therefore they can be easily incorporated into routine clinical work without disrupting the natural pace of treatment. Indeed they are valuable to study atypical or rare behavior. In cases where impairments in functioning are severe and important but occur so infrequently as to preclude subject recruitment for large sample studies, case studies can provide critical information about the phenomena of interest. Similarly, the absence of methodological restrictions or structure imposed by the techniques used for measurement provides an opportunity to observe the behavior of interest as it naturally occurs, which may be useful for generating hypotheses that can subsequently be tested using empirical methods [Cottini, 2014].

## 3.6 Evidence-based Practice

In recent years, educational and rehabilitation intervention have been stressed by health organizations to provide evidence supporting or rejecting the effectiveness of specific interventions. This approach, named *Evidence-based practice* (EBP) first involved the medicine field and then it spread to education field [Hjørland, 2011]. Authoritative institutions such as the *What Works Clearinghouse* [WWC, 2013] and the *Council for Exceptional Children* [CEC, 2013] state that single case research is a rigorous methodology used to establish evidence based practice. Kratochwill and colleagues [Kratochwill et al., 2013] identified four criteria that single subjects research have to meet for EBP:

1. the independent variable, that is the intervention, must be systematically manipulated by the researcher;
2. the values of the dependent variable should be systematically measured over time (repeated measures) by more than one evaluator in an appropriate manner;

3. the study must include at least three attempts to demonstrate the effect of the intervention at different times, in order to control the effects of secondary variables (it requires the use of specific types of experimental design);
4. each phase must include a minimum of three or five measurements.

In the field of ASD a method that meets these criteria is video modeling. A recent meta-analysis [Mason et al., 2012] has found that video modeling is an effective intervention through different age-ranges for improving socio-communicative and functional skills in individuals with ASD.

# 4

# Research Design and Methodology

## 4.1 Purpose of the Study

Children with Autism Spectrum Disorder (ASD) may show difficulties in developing self-help skills and they need instructions to master those skills. Video modeling can be a strategy for improving daily living skills in children with ASD. Video modeling has been widely implemented with various skills and interventions. An U.S. web site, *lookatmenow.org*, provides customized video modeling materials focused on daily living skills. The customer can choose one of the available videos (e.g. brushing teeth, go to the dentist, go to the doctor, etc.), after sending a picture of the face of the child, the customer will receive a video in which that picture is pasted on the face of the model of the videos. This could improve the identification of the child and it could help the development of the skill illustrated in the video. This can be considered as a variation of a video self modeling. To the best of our knowledge in the literature this factor is not yet been explored.

## 4.2 Aims of the Study

The target skill we aimed to improve through video modeling was hand washing. Firstly, the study aims at investigating the efficacy of video modeling and

experimental video self modeling in this daily living skill. Secondly, the study aims at providing a reliable tool to improve and possibly to overcome daily living difficulties in children with ASD.

## 4.3 Participant

The participant was a 7 years-old boy diagnosed with ASD and moderate mental retardation. He was recruited at “La Nostra Famiglia” Scientific Institute IRCCS E. Medea” in Pasian di Prato (Udine, Italy) which is a health no-profit organization for children and adolescents with disabilities. It is the only Italian Scientific Institute recognized for research and rehabilitation for childhood and adolescence (see www.emedea.it). At the time of the study, the child attended the rehabilitation institute and lived with his family. The diagnosis of ASD was made according with the DSM-IV criteria and was confirmed by a consensus meeting that involved some child psychiatrics and a child psychologist. The diagnosis were assessed with ADOS (language and communication: 8, cut-off: 5; social interaction: 10, cut-off: 5; total:18, cut-off: 12) and with ADI-R (reciprocal social interactions: 23, cut-off: 10; language and communication: 18, cut-off: 8; repetitive and stereotyped behaviors and interests: 4, cut-off: 3; anomalies in the development before 36 months: 4, cut-off: 1). Intelligence quotient (IQ) was assessed through the WPPSY scale [Wechsler, 2003]: total IQ: 43, verbal IQ: 47, performance IQ: 49; the score was in the range of a moderate mental retardation. The Griffiths Scale [Griffiths, 1984] was also administered (developmental IQ: 33; mental age: 2 years and 27 months; Strong point: locomotor scale; weak point: language and thinking and problem solving). A note reported the child was not able to wash his hands.

Behavior profile of the participant was assessed with CBCL [Achenbach & Rescorla, 2001]. Child’s parent completed the questionnaire. The total score was in the clinical range (65 pT), as well as Internalizing Problems (65 pT); Externalizing Problems were in the subclinical range (62 pT). Clinical scores emerged in the social area (Activites: 24 pT, and Social: 25 pT). Behavioral scale in the subclinical range were Thought Problems (67 pT) and Attention Problems (69 pT), Withdrawn scale was in the clinical range (73 pT). The CBCL-ASD profile score [Biederman et al., 2010] was 196.

Adaptive behavior was assessed with the Vineland Adaptive Behavior Scale, VABS (communication age range: 1-11, daily living skills age range: 2-1, socialization age range: <1-6, motor skills age range: 3-1; composite score for equivalent age: 1-11). All scores were below average with respect to children of the same age. The adaptive behavior level for each scale compared to children with diagnosis was below average. The analysis of the subscales compared to children with diagnosis showed that in daily living skills scale the community area was the most impaired (raw score: 0). Personality area was within average (raw score: 69) but situated near the low part of the range for average functional level (64-92). Socialization skills were the most impaired, while motor skills were the most developed. However, composite score compared to children with diagnosis was below average.

In accordance with the diagnosis of moderate mental retardation the child showed a global adaptive behavior level below normal limit with respect to children with diagnosis. The table below contains in details scores and adaptive behavior level of the participant.

| VABS Scale | Raw score | Equivalent scores (compared with control group of same age) | IQ corrected scores (compared with diagnosis group) | Adaptive Behavior Level respect to subjects with diagnosis |
|---|---|---|---|---|
| Receptive | 20 | <1-6 | 81 | *Below average* |
| Expressive | 59 | 1-11 | 92 | *Average* |
| Written | 0 | <1-6 | 85 | *Below average* |
| **COMMUNICATION** | **79** | **1-11** | **87** | *Below average* |
| Personal | 69 | 1-10 | 92 | *Average* |
| Domestic | 3 | 3-1 | 90 | *Below average* |
| Community | 0 | <2-2 | 84 | *Below average* |
| **DAILY LIVING SKILLS** | **72** | **2-1** | **89** | *Below average* |

| | | | | |
|---|---|---|---|---|
| Interpersonal Relationships | 23 | <1-6 | 77 | *Below average* |
| Play and Leisure Time | 11 | <1-6 | 83 | *Below average* |
| Coping skills | 0 | <2-8 | 83 | *Below average* |
| **SOCIALIZATION** | **34** | **<1-6** | **80** | *Below average* |
| Gross | 71 | 3-6 | 109 | *Above average* |
| Fine | 39 | 2-9 | 100 | *Average* |
| **MOTOR SKILLS** | **110** | **3-1** | **105** | *Average* |
| IQ scores | | | 361 | |
| **COMPOSITE SCALE** 185 | | **1-11** | 90 | *Below average* |

VABS score of the participant.

The procedure of the research was clearly explained to the child's parents, who gave their consent. The privacy was preserved: videos and photos of the child were only used for research purposes within the institute and they were not distributed.

## 4.4 Materials and Settings

A video in two forms and a task analysis for checking the behavior during interventions were realized. The video maker was a director who was directly involved in the study and collaborated in writing the script and in the shooting of the videos.

### 4.4.1 Video Modeling Production

The model in the video was a male peer, unfamiliar to the participant, who had well acquired the selected skill (hand washing). The video depicted the model performing the target behavior, with simple actions, following the steps of the task analysis. The video opened with the title "hand washing", then it showed the model from the third-person perspective in front of the sink and it continued showing the model washing his hands. A voiceover said the title and named the procedure step-

by-step "*I open the water, I put some soap, I rub my hands with soap, I rinse my hands, I close the water, I dry my hands with the towel"*. The footage was made alongside the model while he was washing his hands. Several shots showed the steps in detail, in particular for the steps "put some soap" and "rub hands". The face of the model was visible except for the detail shots. Rubbing hands was also shot from the shoulder of the model. Then the model showed his hands in the close-up. The first shot and the last shot were a close-up. This part was of one minute in duration. The video continued with a summary of the hand washing sequence. The title "summary" appeared in the screen and the video continued showing the step-by-step sequence with the voiceover. Most of the shots were focused on details. The video ended with a close-up of the model who showed his hands. This part was of 20 seconds in duration. The entire video was of one minute and 20 seconds in duration. Visual and sound effects were not included. The voiceover in the clip was that of the director. Video was filmed using a Panasonic video-camera ag-ac 90, full hd (1920x1080) and edited using the software "final cut pro".

### 4.4.2 Experimental Video Self Modeling Production

The experimental video self modeling consisted in the classic version of the video modeling video-clip (described above) with a difference: a close-up photo of the face of the participant was pasted on the face of the model depicted in the video. No other substantial differences were added. The child's facial expression in the photo was kept neutral. This effect appeared in the first shot and in the last shot of the video, thus just before the model initiated the task and at the end of the task, when he showed his hands. During the hand washing sequence, with voiceover, the face of the model was not visible and most shots focused on details. As well as in the video modeling clip the title "summary" appeared followed with the step-by-step sequence and the voiceover. Some shots depicting the face of the model were eliminated in order to ensure a proper editing. For this reason the entire video was of one minute and three seconds in duration. The photo of the participant was embedded in the video using the software "Photoshop" and the editing was made using the software "final cut pro".

The videos depicted the model from the third-person perspective. In order to show the sequence of the steps most shots were focused on details. It also allowed

the viewer to focus attention on the steps of the task, rather than on other details, as it often occurs with autistic children. The video-clip was filmed in a bathroom of the institute that was well known by the participant. The materials used for the training video were soap and towel.

### 4.4.3 Settings

The training was conducted by the rehabilitation institute “La Nostra Famiglia” in the bathroom usually used by all children including the participant. The setting depicted in the video was another bathroom of the institute, similar to the bathroom where the training occurred. Differently from the video-clip, in this bathroom the towel was hung on the wall, among classmates’ towel. For the most of the time the child watched the video-clip in the library of the institute.

### 4.4.4 Task Analysis

The performance of the participant was measured over each phase of the study using a task analysis data sheet (see appendix 1). The task analysis contained the skill trained during the interventions segmented into a series of steps. It was completed by the investigator after each training session. The task analysis included the following eight steps:

1. Is he/she able to open the tap water in a right way?
2. Is he/she able to put in the correct way a bit 'of soap in the hands?
3. Does he/she rub his/her hands with soap every inch?
4. Does he/she rub his/her hands palm to palm weaving fingers?
5. Is he/she able to overlay the right palm to the back left entwining his/her fingers and vice versa?
6. Does he/she rinse his/her hands under the water?
7. Is he/she able to turn off the water?
8. Is he/she able to dry his/her hands with a towel?

The achievement in each step of the task analysis was scored within a range from 0 to 3 points based on the autonomy of the participant showed in each step. The criteria were the following:

0: not performed the step or did it after physical prompt

1: performed the step after verbal prompt or after point out

2: performed the step independently but not properly
3: correctly and independently performed the step without any verbal or physical prompt

The purpose was to evaluate the ability of the participant in performing the target skill in autonomy during the interventions with video modeling and video self modeling. Therefore, a step performed in a totally independent way was scored as 3 and a step performed by physical guidance was scored as 0. The maximum score was 24.

## 4.5 Design and Procedure

An experimental design with two independent variables was adopted. The independent variables were video modeling intervention and video self modeling intervention. The dependent variable was the number of steps of the task analysis ranged 0-24 correctly performed.

**Phase A: baseline**. It involved the observation of the daily normal behavior of the child in performing the skill. One observation per day for a week was obtained. During the fifth day two observations were obtained for a total of six observations. The child was invited to wash his hands in the bathroom. As usual a teacher helped him in the task. Observations were videotaped by the investigator and scored with the task analysis.

**Phase B: video modeling**. The participant received three video modeling sessions per day, each lasting about 30 minutes for a period of two weeks. Sessions were done between 9.00 a.m. and 1.30 p.m.

Every session involved the following procedure. The investigator escorted the child to the library to watch the video stating “let’s go to watch a video” and then he played it. The video was shown to the child from two up to six times, one after the other or as long as he was able to pay attention to it. The video was never shown for more than 15 minutes. The child was encouraged by verbal praise intermittently to sit to the table and to pay attention to the video. Then the child was engaged in classroom activities for about 15 minutes. After then he was invited to wash his hands by the investigator who stated “let's go wash our hands” and mimicked the action.

During the hand washing some cues were provided by the investigator in hierarchical order. First verbal prompts and then physical prompts were given. Verbal prompts included simple instruction such as “what have you to do now?, “take the soap”, “turn off the water”. They were provided when it was necessary to re-focus the participant’s attention on the task, or whenever the participant did not initiate a step, however at least after 10-15 seconds from the beginning of the task and at maximum after one minute. The experimenter interfered with the child’s actions less possible, by observing the behavior and by intervening only if strictly necessary. Sometimes verbal prompts were associated by pointing, for example the experimenter pointed out the soap if the child was spending more time than expected in the previous step. Verbal prompts were provided for a maximum of three times. If the previous prompts were ineffective, physical prompts were provided. Physical prompts consisted first in touches the arm of the participant, if it was ineffective physical guidance of the child’s arm or hand was given.

**Phase C: experimental video self modeling**. The participant received three video self modeling sessions per day, each lasting about 30 minutes for a period of two weeks. Sessions were done between 9.00 a.m. and 1.30 p.m. It involved the same procedure described in the phase B (video modeling intervention) with the exception that the video showed the participant. The video was the video B, where on the face of the model a photo of the face of the participant was pasted. Verbal praise and prompts were provided to the participant as in phase B.

During intervention phases the video-clip was showed via desktop computer Windows in the library of the institute. No other people were in the room. All observations were videotaped by the investigator and scored based on the task analysis.

***Scoring***. In order to score a point in a step of the task analysis, the completion of all previous steps was not required. For example, the participant could turn the water on and dry his hands and receive points for these items even if the previous steps were not performed. This is because the aim was to assess which steps were improved in autonomy. There was not a fixed time for the participant to complete a step and move to the next one of the sequence. Whenever necessary the investigator turned off the water.

**Withdrawal phase.** After video modeling intervention and video self modeling intervention a withdrawal phase occurred. Each withdrawal phase lasted a week. Two observations per day of the target behavior were collected. The procedure was the same adopted during interventions but no video was shown. Thus, the participant was invited to wash his hands by the investigator stating “let's go wash our hands” and mimicking the action and no video was shown during this phase. In the first withdrawal phase three observations occurred with the teacher. In the second withdrawal phase five observations occurred with the teacher because was impossible to change the educational activities of the participant. Teachers, who were familiarized with the procedure during the study, only did the hand washing while the investigator recorded. All the observations were videotaped by the investigator and scored with the task analysis.

**Maintenance**. For assessing maintenance of the results obtained with video interventions, a follow-up phase was conducted five months after the training ended. It occured in the same setting used during baseline and interventions training. It involved the same procedure of the withdrawal phase. The participant was invited to wash his hands by the investigator stating “let's go wash our hands” and mimicking the action. No video was shown. One observation per day for a week was performed. Observations were videotaped by the investigator and scored with the task analysis.

The entire study lasted seven weeks.

## 4.6 Data Analysis

First a visual analysis was conducted. Moreover, statistical analyses were done to assess the significance of the visual inspections. For the analysis the software Microsoft Excel (v. 2010) was used. In order to standardize the effects of time on the performance of the participant we decided to consider, for both visual and statistical analysis, the first observation of each day of the phases (baseline, interventions, withdrawals, follow-up). In all these observations the participant performed the task without the teacher, only one observation in the second withdrawal phase was conducted with the teacher. As the training was performed from Monday to Friday, intervetions phases had 10 data points each one, the baseline had 5 data points, withdrawals phases had 5 data points and 6 data points

each one, and the follow-up had 5 data points. In addition to these analyses an item analysis of the checklist was conducted. The item number five of the checklist was eliminated from the analysis because it always scored 0 points during the study.

# 5

# Results and Discussion

## 5.1 Visual Analysis Results

### 5.1.1 Task Analysis Data

The data sheets for the task analysis of each observation were scored following the procedure described above.

*Baseline (A)*. Average score of the checklist: 8.8; average item scored as three (mastered item): 2.2 (27.5%).

*Video modeling intervention (B)*. Average score of the checklist: 12.8; average item scored as three (mastered item): 2.2 (40%).

*Video self modeling intervention (C)*. Average score of the checklist: 10.8; average item scored as three (mastered item): 2.5 (31%).

*Withrdawal phase 1 (W1)*. Average score of the checklist: 12.0; average item scored as three (mastered item): 3.0 (37%).

*Withrdawal phase 2 (W2)*. Average score of the checklist: 8,5; average item scored as three (mastered item): 1.3 (16.7%).

*Follow-up (FU)*. Average score of the checklist: 13.0; average item scored as three (mastered item): 4.2 (52.5%). Data are reported in the table below.

| | A | B | W1 | C | W2 | FU |
|---|---|---|---|---|---|---|
| **Average_score** | 8,8 | 12,8 | 12,0 | 10,8 | 8,5 | 13,6 |
| **Average correct items (%)** | 2,2 (27,5%) | 3,2 (40%) | 3,0 (37,5%) | 2,5 (31,3%) | 1,3 (16,7%) | 4,2 (52,5%) |

### 5.1.2 Visual Inspection

Visual analysis showed an increase in the performance during the first days of the video modeling intervention. The trend decreased in video self modeling condition compared with video modeling condition. The follow-up phase revealed maintenance of some acquisitions. Data are resumed in the graphics below.

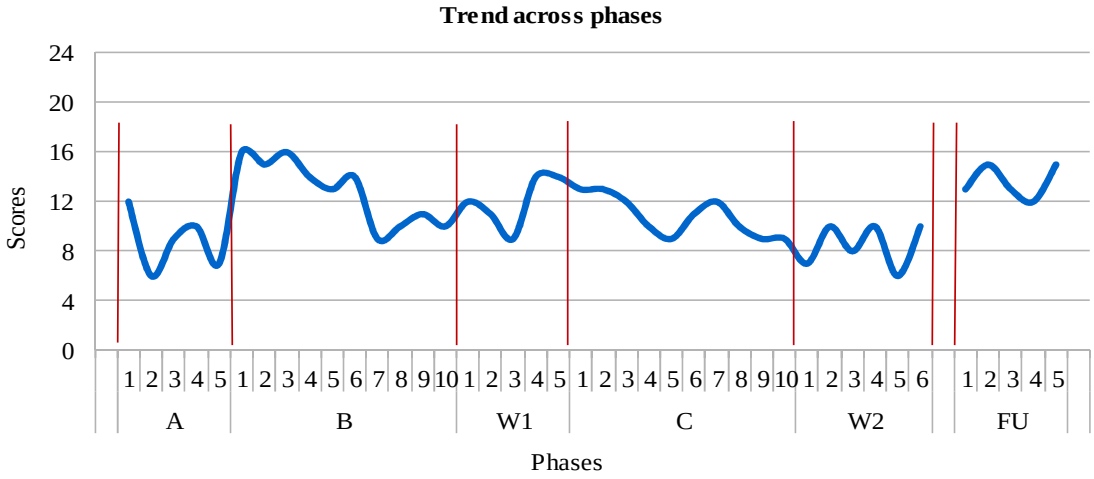


Figure 1: Trend of the entire training across phases for the target behavior.

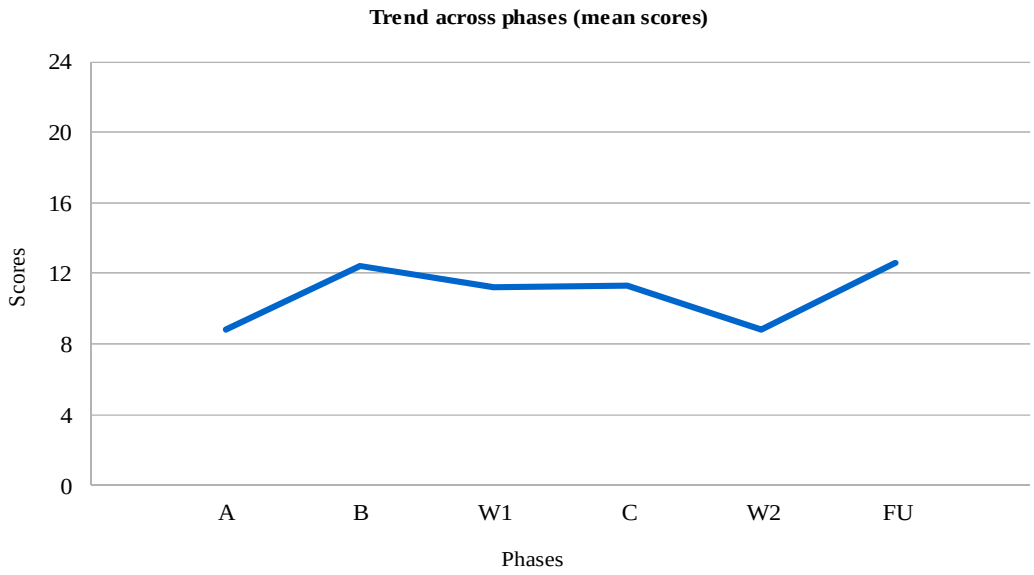


Figure 2: Average percentage of steps completed by the participant across phases for the target behavior.

## 5.2 Statistical Analysis

Statistical analysis were done using the *C Test*. Analysis were conducted using the last data from baseline (A) and the video modeling intervention (B) and video self modeling intervention (C) data. It allows to identify the development compared to the baseline. Results revealed that the effect of video modeling and of video self modeling interventions were not statistically significant. Results are showed in the graphs below.

Follow-up phase was not statistical significant compared with the baseline phase. Compared with the second withdrawal phase there was a trend towards significance with $p<0.05$.

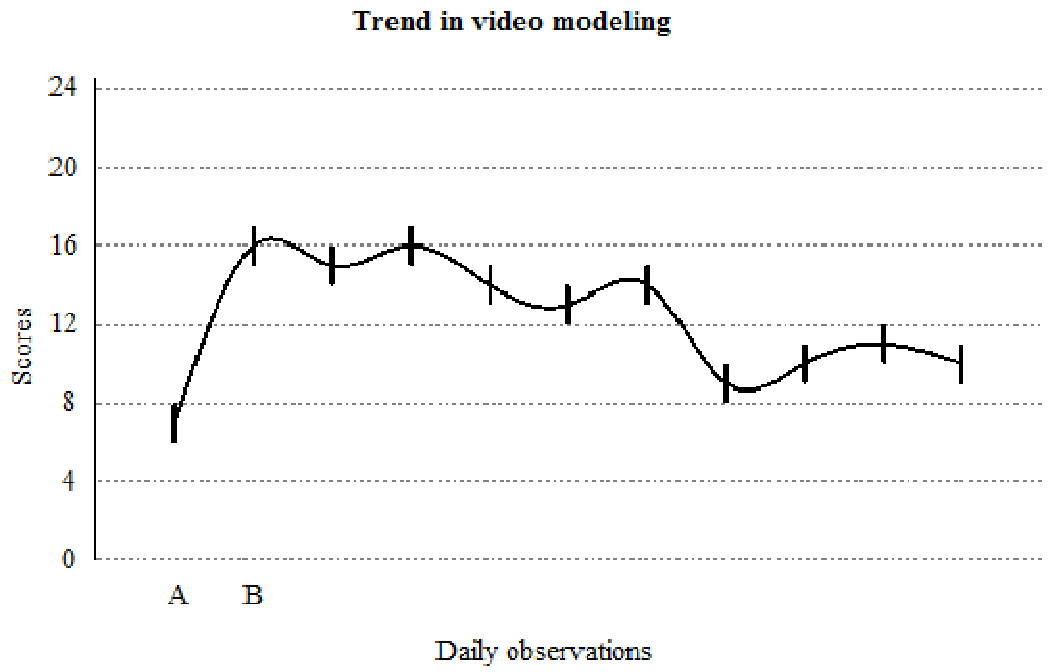


Figure 3: Data trend in video modeling intervention.

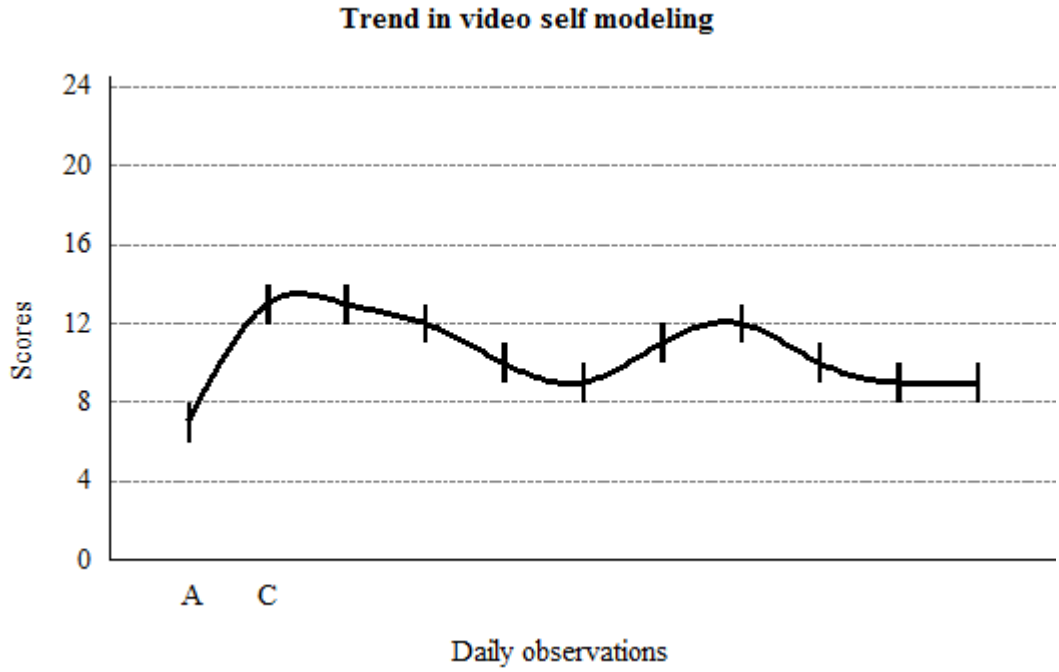


Figure 4: Data trend in video self modeling intervention.

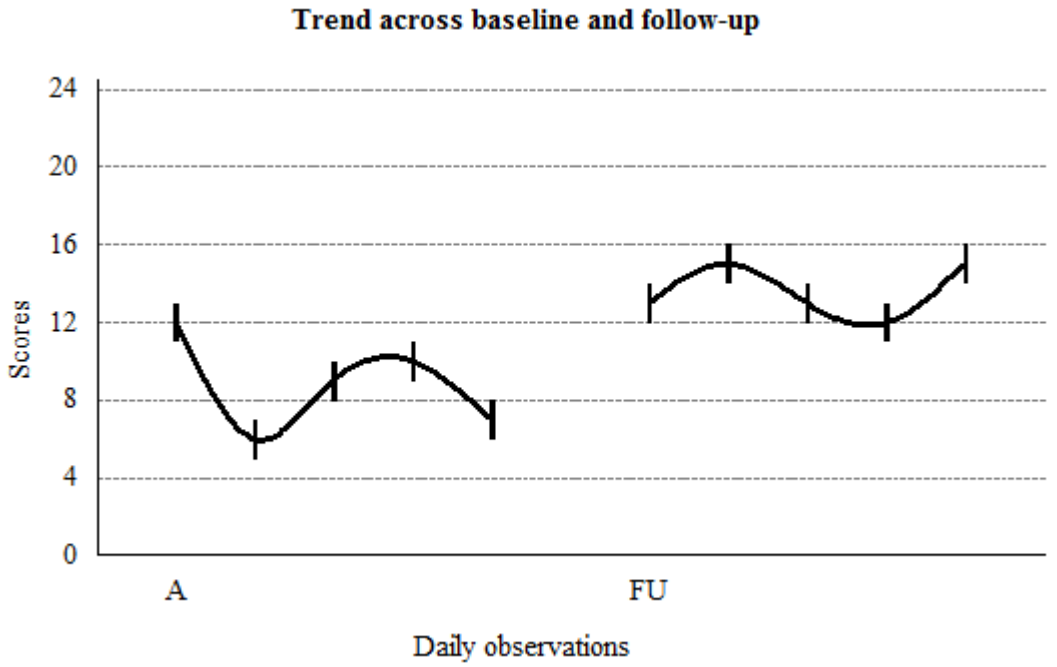


Figure 5: Data trend in baseline and follow-up.

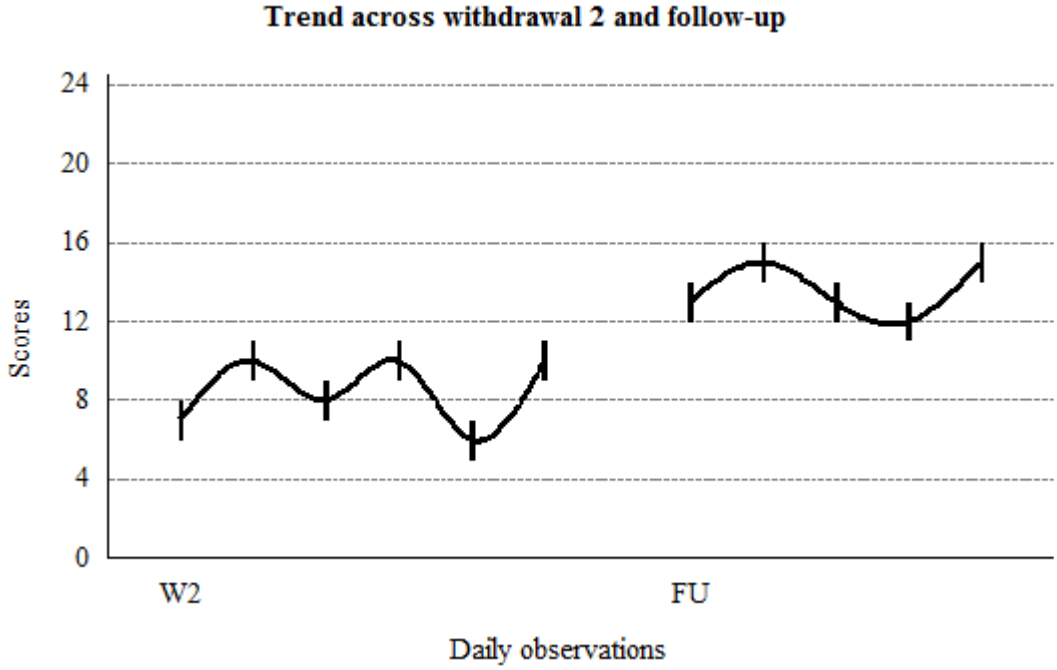


Figure 6: Data trend in withdrawal phase 2 and follow-up.

## 5.3 Item Analysis

A comparison analysis of items scored as three over the baseline, video modeling, video self modeling and follow-up phase was conducted. Item 2, item 3, item 6 and item 7 were statistically significant ($p<0.01$). Data are showed in the graphics below.

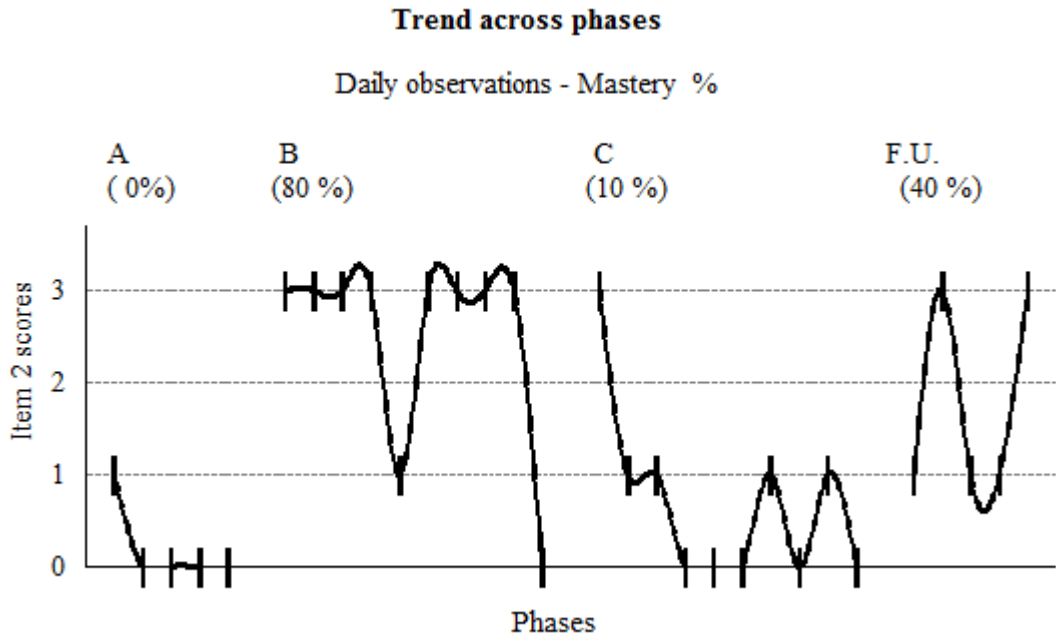


Figure 7: Item 2, statistically significant with $p < 0.01$.

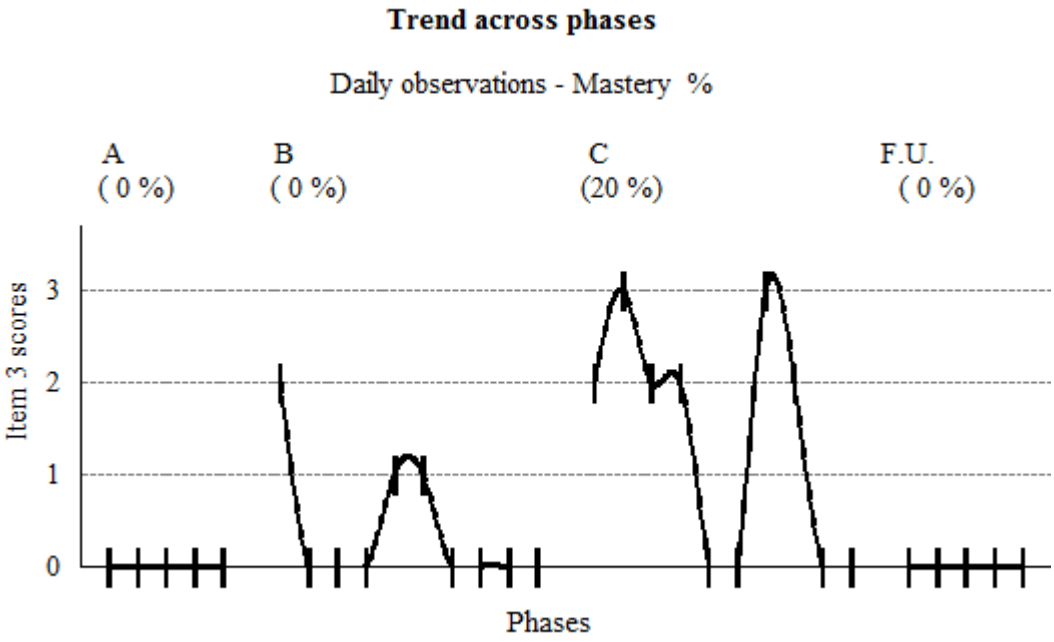


Figure 8: Item 3, statistically significant with $p < 0.01$.

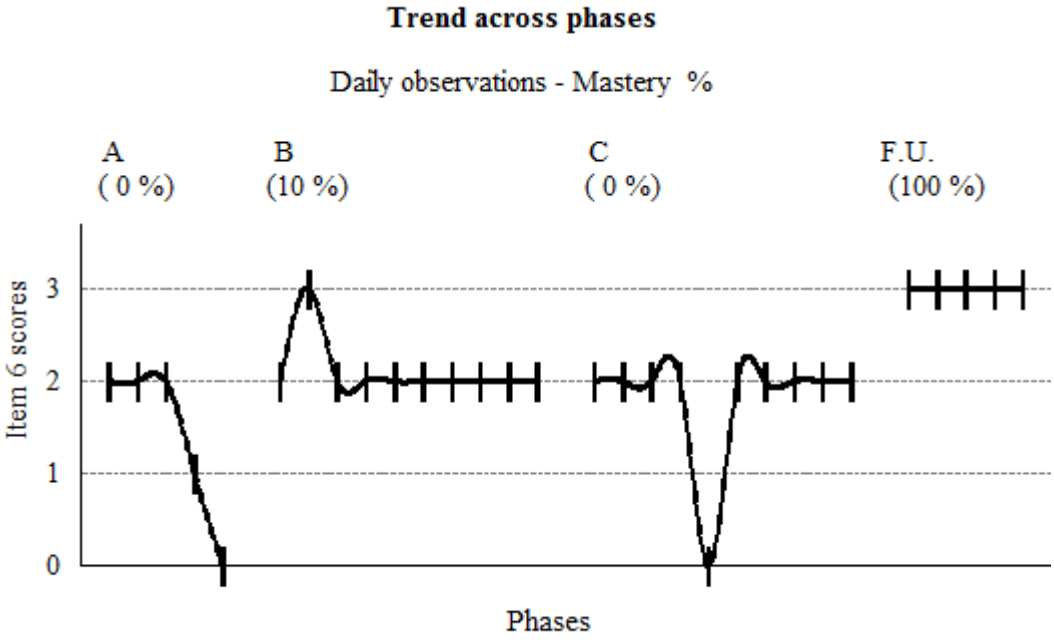


Figure 9: Item 6, statistically significant with $p < 0.01$.

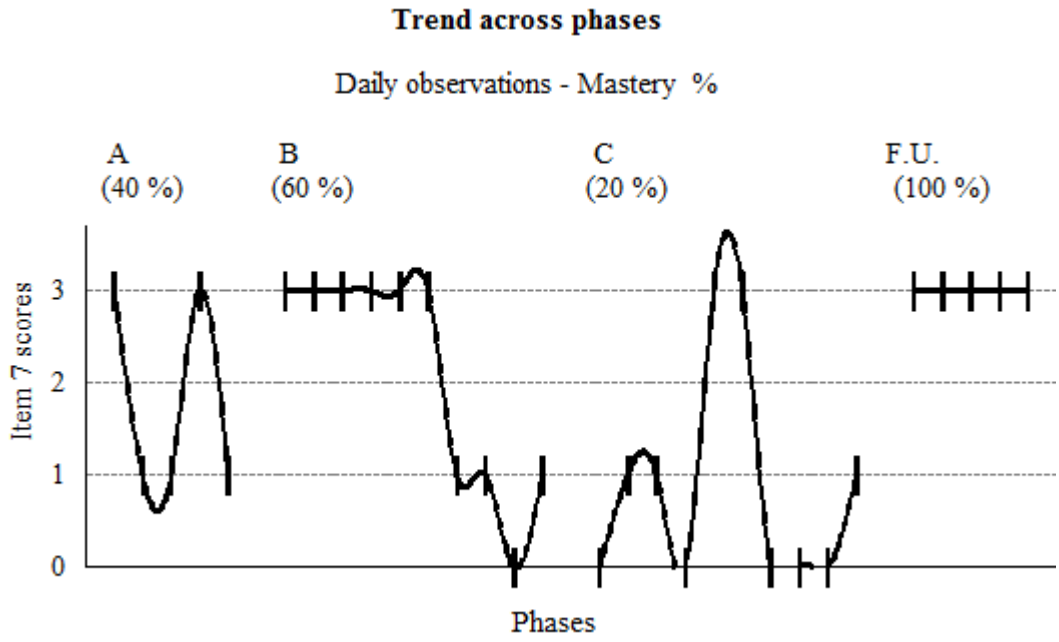


Figure 10: Item 7, statistically significant with $p < 0.01$.

## 5.4 Discussion

In the present study video modeling training led to a rapid initial acquisition of some of the steps of a daily living skill, i.e. hand washing, in a child with ASD and mental retardation. However, after the initial peak during the video modeling condition, the child's performance did not stabilize throughout the course of the study. Indeed during the first withdrawal phase, video self modeling condition and second withdrawal phase the performance decreased. Follow-up revealed maintenance of some acquisitions. Statistical analysis confirmed what suggested from first visual evaluation of the child's performance.

### 5.4.1 Effects Over the Time

At baseline the child needed the teacher's supervision in each step of the hand washing sequence. Without guidance he tended to play with water instead completing the task. Similarly he lacked autonomy and needed the caregiver's supervision for hand washing, as well as for other simple tasks, in his everyday life.

When video modeling was introduced the child immediately imitated the behavior of the model presented in the video, in the appropriate setting, accomplishing autonomously and correctly the 40% of task's analysis steps.

In the first withdrawal phase the participant showed a performance decrease, however he performed correctly and independently a higher percentage of steps (37,5%) than in the video self modeling phase (31,3%). Probably, a carry-over effect during the withdrawal phase had occurred, meaning that the acquisitions the participant gained during video modeling intervention had effects in the later phase.

During the video self modeling intervention the participant immediately gave positive signs (laugh, surprise) of recognizing himself in the video. Despite this positive signs he performed poorly (average correct independently performed step: 31,3%). It may be possible that this change in the video represented a too heavy load of visual information to be processed for a participant with such a low functioning profile.

The findings of the present study fit with those of the study conducted by Rosenberg and colleagues [Rosenberg et al., 2010] on hand washing. In that study the author found that one child only, out of a group of three, could acquire the skill from a commercial video modeling, while two did not learn. Subjects were then exposed to a customized video modeling (with a familiar child as model), which gave some skill acquisition for the two children who could not learn from the commercial model.

Results are consistent with those in the study of Rayner [Rayner, 2010] where one of the functional skills trained, teeth brushing, got limited success. This is in contrast with the previous finding from Charlop-Christy and colleagues [Charlop-Christy et al., 2000] in which the participant could acquired the target functional skill (i.e. teeth brushing). This suggests that developing daily living skills through video modeling in children with ASD can produce inconsistent results, maybe depending on the participants' characteristics and on the procedures adopted.

An explanation for the initial peak in performance is that video modeling immediately capitalized cognitive skills, visual attention and visual memory of the child. Nevertheless he was not able to retain this high cognitive level and the performance decreased over the time. Furthermore, video modeling may have improved the child motivation as it represented a novelty in the learning

environment. In fact the training took place as an extra educational activity out from his classroom. Additionally this novel activity was carried over using a computer, which is an attractive tool for children with ASD [Shane & Albert, 2008]. These elements may have increased attention with benefits in the acquisition of the target behavior. Bandura, a leader in the field of modeling interventions, argued that attention plays important role for observational learning [Bandura, 1969]. All these elements are mainly related to videomodeling intervention rather than video self modeling intervention as it was the first one provided to the participant. They were probably more salient in the first presentationand the effect might have decreased overtime. It may have contributed to increase the performance during video modeling intervention.

At the best of our knowledge, video self modeling intervention adopted in the present study has not been explored in the scientific literature yet. Although recent evidence showed that the use of static pictures combined with video modeling intervention lead to positive outcome in children with ASD [Cihak, 2011], the use of pictures in the video self modeling condition did not have a positive effect. A possible explanation for this result is that the child was required to manipulate too much different visual information for his (low) mental level. When he was exposed to the video he saw motion and action of the model performing the task and a static picture with his photo. Maybe he tried to process those two pieces of information separately. These difficulties may have not allowed the low functioning participant to manipulate the information consistently. Data suggest that this kind of video self modeling may interfere with the acquisition of the target behavior. These findings provide preliminary evidence that different elements of a video modeling clip may be critical for skill's learning. As the picture applied on the model's face in the video was the only manipulation made in that study, it may be possible that this component was difficult to process for the subject. Although he could recognize himself, this component could have appeared too different from real life to him. For future research the manipulation of components of the clip will be necessary to distinguish which are the critical components for skills acquisition and investigate which critical components differ from individual to individual.

The participant was unable to attend to the video each time it was required to him. In several observations, for the most of time, the child was engaged in water

play, hand flapping and hand flickering while looking himself in the mirror and laughing rather than completing the task. These stereotypes did not allow him to focus his attention on a step for time required. In some occasions an interval of about one minute was required before the child was able to focus again his attention and proceed with the task. As suggested by Rosenberg and colleagues an important question for further research is how long a video modeling intervention should last before providing prompts.

During the second withdrawal phase the participant dropped in performance below baseline level (average correct items in W2: 16,7%, average correct items in A: 27,5%). The drop during a withdrawal phase appears to be rare in literature on video modeling interventions in daily living skills in children and adolescent with ASD. This data is similar to those reported by Rayner [Rayner, 2011a]: he found differences in the averages between baseline (0,37), intervention (0,54) and withdrawal phase (0,34) in a task for enhancing circle time skill. The author argued there was not a functional relationship between the intervention and the target skill during the study. Differently from our study, in the study conducted by Rayner there was only one withdrawal phase and the participant was a 15 years-old boy. In our study, we can determine that video modeling and video self modeling interventions not clearly affect the performance of the participant in the target behavior.

Some researches in the field of video modeling involve participants who received a prior training in the target behavior [Alcantara, 1994] or involve procedural change in providing reinforces (such as candy or access to a favorite toy), verbal and physical prompt during baseline, withdrawal and interventions phases occurred [Cihak & Schrader, 2008; Murzynski & Bourret, 2007; Shipley-Benamou et al., 2002]. In the present study prompts and reinforces were provided only when it was necessary for the task completition because the aim was to analyze video modeling and video self modeling interventions alone and their effects on learning. In this study the child performance would probably have improved if more aid were provided. The participant could be cognitive stressed for the training and it could not allow him to perform at his maximum level over the study. The present study was a single-subject design where elements such as verbal praise could not always be standardized and time before prompting was vague

because the behavior of the child was variable considering his disorder and his cognitive aspects. This is the reason why there is a necessity of adaptability of this field of research.

About the point of viewing the video, the target behavior was presented from a third person perspective. Ayres and Langone [Ayres & Langone, 2007] suggest that first-person perspective may be more effective for teaching self-help skills because children see in the video what they would actually see when performing the behavior. Third-person perspective could be more effective for teaching social abilities because the children can see individuals as they would in real settings.

In interpreting our results it is important to make some considerations. As mentioned in chapter 1, better outcomes are associated with lower degree of mental retardation and symptoms severity. The participant was a child with ASD and a consistent gap between chronological age (7 years old) and mental age (2 years and 27 months). Typical behavioral features of the child related to ASD that we observed during the study were stereotypical behaviors such as hand flapping and hand flickering. He appeared to be strongly captivated by water, he played continuously with it and showed hand flapping and hand flickering instead completing steps in the hand washing sequence. It is possible that he could not inhibit his desire of playing with water to carry on the task. These factors could have interfered with visual learning during video viewing and with task acquisition during training sessions. For these reasons achievement comparable to typically children was not expected, although some acquisitions in the target skill is noteworthy. Also the coexistence of both verbal instructions and visual information may have confused him. Indeed, although verbal instructions should allow the individual to direct the attention to the model [Haring et al., 1995], this may be not true for children with difficulties as severe as the ones reported by our participant (see above for details). Future research should explore the impact of verbal instructions during video modeling training in low functioning children. Finally, our participant had poor imitation skills. Findings of this research are in line with the hypothesis that imitation abilities are important factors determining the degree of success of video modeling intervention on children with ASD [McCoy & Hermansen, 2007; Rayner, 2011a]. During video self modeling intervention the

participant took an intestinal flu. Illness in this period of the study is also a factor that may have influenced negatively the target skill acquisition.

Follow-up phase, carried out 5 months after the end of the study, showed that the participant maintained some steps of the trained skill. The gains showed in this phase cannot be exclusively attributed to the video modeling or video self modeling intervention. Hand washing is a daily activity that occurs at school and at home and this may have contributed to further practice the skill. Also, the child growth and maturation through the months may have contributed. The child's caregivers (teachers and parents) did not change his hand washing routine during the course of the study and after its end. It may be possible that video modeling interventions developed some behaviors that helped the child in consolidating the target skill in his everyday environment.

Taken together, data from this study suggest that video modeling interventions should be tailor-made on the cognitive profile of the individual, on his or her specific features related to ASD (e.g., stereotypes and captivation for some elements or objects) and other behavioral or neurological comorbidities.

### 5.4.2 Effects on the Autonomy in the Steps of the Target Behavior

The comparison between items scored as three over baseline, video modeling, video self modeling and follow-up indicated the level of independence achieved by the child at each phase. Item 2, item 3, item 6 and item 7 were significant ($p<0.01$).

Step 1 (turn on the water) and step 8 (dry hands) were performed autonomously from baseline and thorough the entire duration of the study. Video interventions may have even made more stable the skills involved in those two steps of the sequence. During baseline the participant never performed item 2 (put soap on hands) autonomously (0%) while he could master this skill during video modeling intervention (80%). This gain appeared to be lost in the following phases although it was present again in the follow-up (40%). Item 3 (rub hands with soap every inch) showed some gains during video self modeling interventions (20%), but it did not appear in follow-up (0%). Item 4 (rub hands palm to palm weaving fingers) was not learned during the training. Item 6 (rinse hands) most scored as two during the training conditions, but it was always scored as three in the follow-up phase, reaching a mastery of 100%. This was an emerging ability that was trained during

the interventions and was stabilized in the follow-up phase. Similarly item 7 (turn off the water) was emerging at baseline, improved greatly during video modeling, decreased in video self modeling phase and was finally mastered (100%) in the follow-up. The training helped the development of these steps and they seemed to become stable in the final follow-up.

According to anecdotal report from the parents the child changed something in the way he washed his hands at home. In particular he rubbed well his hands, overlaying the right palm to the back left, entwining his fingers and vice versa. With reference to the task used in the present study, rubbing hands corresponds to items 3 and 4 which were emerging during the training. Overlaying hands corresponds to item 5 of our task, which was never performed during the training. The specificity of the stimulus may have not allowed the child to focus on this complex action of the sequence when presented in the video. Nonetheless he could have visually memorized the action and eventually perform it. During the study the child spontaneously asked going to wash his hands at appropriate times, for instance after using tempera colors for painting. This indicates that he learned the meaning of the trained activity. Generally, the child demonstrated at least some acquisition of the washing hands skill. The teachers stated that the intervention was never problematic and they found it was worthwhile for the child.

# 6

# Conclusions

## 6.1 Autism Spectrum Disorder and Video Modeling

Students with Autism Spectrum Disorder (ASD) show a wide variety in characteristics, including normal to poor social and communication skills, moderate to severe intellectual difficulties and adequate to poor adaptive skills. However visual learning style of these population make video intervention a way to use for overcome difficulties in ASD. The progress in video technology may help in the implementation of visual strategy. Recent research develop video modeling intervention supported by iPod [Cihak, Fahrenkrog, Ayres, & Smith, 2009]. A review research [de Bruin, Deppeler, Moore, & Diamond, 2013] on the effectiveness of various video-based intervention, such as video modeling, showed that it met sufficient research base to be considered one of the Evidence Based Practices (EBPs). The research included public school settings and demonstrated the need of prerequisite skills for positive outcome. Video modeling can be considered an effective educational practice for children with ASD.

## 6.2 The current Study

In this study a classic video modeling intervention led to an initial rapid improvement in hand washing task acquisition steps for a child with ASD and

mental retardation. Although these gains did not persist over experimental video self modeling intervention, the child showed some acquisitions in washing his hands independently. The participant did not show a schema for washing his hands, he needed to be driven step by step by the caregiver to complete the sequence. The initial step (turn on the water) and the final step (dry hands) of the sequence appeared acquired at baseline, showing the participant was able to keep in mind a temporary macro sequence of the task. With the interventions he stabilized these steps. However he showed difficulties in properly performing the subsequent steps during the entire process. For example he often put soap on his hands but then tended to immediately put his hands under the water, so the soap was leaking and had to repeat the step.

Several times the child imitated the behavior of the model depicted in the video. It was mainly observed in the movement of rubbing hands and interlacing fingers which are basic steps of the activity. Although his poor imitation skills he acquired some behaviors which could favorite the task competition through video modeling.

Factors that made difficult the task for the participant have been clarified. Because of the low cognitive profile and poor attention skills he was not able to attend the video every time it was asked to him and he difficultly processed and integrated the information of the video. It resulted in an initial peak of the performance because of the high level of cognitive engagement but it was early saturated. Furthermore, he was easily distracted by water play, hand flapping and hand flickering during the task. In general the participant achieved some acquisitions in the hand washing skill. Follow-up phase showed the participant stabilized some behaviors of the hand washing sequence. It is possible that video modeling interventions enhanced some behavior that helped the participant in the target skill acquisition in everyday living environment. This point could be investigated replicating this study.

Results of this study concerning the video self modeling intervention should be considered preliminary. Future studies attempting to use this component to teach hand washing skill, as well as other daily living skills could be conducted.

The current study has some limitations. Inter-observer agreement and procedural reliability were not assessed. It might have contributed to these findings. In the present study no more than one evaluator assessed the dependent variable. Thus the

study does not meet one of the criteria identified by Kratochwill and colleagues [Kratochwill et al., 2013] for the evidence-based practice (see Section 3.6). Social validity was assessed by asking to the teachers and the parents whether the child showed improvement in hand washing or in other daily living skills. For future development of this research topic, a social validity questionnaire administration could give more information. The research enrolled a single subject. It is a limit for the generalization of the findings. Further research should replicate the procedure of the present study across larger numbers of children. Furthermore the procedure should be replicated in children with low cognitive profile as well as in children with high functioning profile.

The study supports the general finding that video modeling and its variations can be an effective strategy for improving functional living skills in children with ASD. However the training should be based on the cognitive feature of the child. Video modeling capitalized its effects when is tailor made on the child.

Although the outcomes of the present research are not wide extensively, the participant showed some improvement in the skill trained through video modeling, therefore video modeling has been an effective strategy.

## 6.3 Future Developments

Findings from the present study may raise some suggestions for possible future research. A video modeling study focusing in the step of the sequence in which the child poor performed should be interesting to realize. Moreover studies should aim to investigate the contribute of video modeling and video self modeling intervention separately. Further research should aim to address which are the key components in a video that improve skills acquisition. In addition is important to investigate whether and even how these components differ in skill acquisition from child to child across different cognitive profiles.

# A

## Task analysis data sheet
## “hand washing”

| | | | | |
|---|---|---|---|---|
| 1) Is he/she able to open the tap water in a right way? | 0 | 1 | 2 | 3 |
| 2) Is he/she able to put in the correct way a bit 'of soap in the hands? | 0 | 1 | 2 | 3 |
| 3) Does he/she rub his/her hands with soap every inch? | 0 | 1 | 2 | 3 |
| 4) Does he/she rub his/her hands palm to palm weaving fingers? | 0 | 1 | 2 | 3 |
| 5) Is he/she able to overlay the right palm to the back left entwining his/her fingers and vice versa? | 0 | 1 | 2 | 3 |
| 6) Does he/she rinse his/her hands under the water? | 0 | 1 | 2 | 3 |
| 7) Is he/she able to turn off the water? | 0 | 1 | 2 | 3 |
| 8) Is he/she able to dry his/her hands with a towel? | 0 | 1 | 2 | 3 |
| TOTAL | | | | |

Notes : _____

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