

# Review Paper: Imitation Skill in Children With Autism Spectrum Disorder and Its Influence on Their Language Acquisition and Communication Skills



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## ABSTRACT

**Introduction:** Autism spectrum is a lifelong neural growth disorder, manifested as problems in social interaction, communication, and imagination along with limited and repetitive behaviors and interests. Furthermore, autistic children show clear defects in imitation skill. Acquiring imitation skill plays a vital role in the growth of social communication such as language, common attention, and play. Given the increasing prevalence of autism in advanced societies and lack of speech therapies for language enhancement and the role of imitation in the development of language, the purpose of this study is to evaluate recent studies in the field of mimicking effects on the different aspects of language in autistic children and determining the most effective and appropriate way of teaching imitation to improve the language and communication skills in these children.

**Materials and Methods:** This research is a review study aimed at collecting the relevant data from 2000 to 2017 in the field of imitation and its impact on language and communication in children with autism by searching the Google Scholar, Science Direct, Scopus, PubMed, SID, and IranMedex databases.

**Results:** In this article, 13 related studies were found from 2000 to 2017. Out of these studies, two studies were carried out in Iran, and 11 other studies in other countries. Two research studies compared imitation ability of autistic children with other disorders, and other studies examined the effect of imitation on different aspects of language acquisition.

**Conclusion:** All studies have shown that imitation influences on different aspects of language acquisition and enhances pre-lingual communication, such as the infant's gaze at mother's eyes, development of perception and expression language, improvement of understanding language application skills and syntax, including the number of verbs and the increase of the verbal production of vocabulary and the phrase.

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## 1. Introduction

The autism spectrum is a lifelong neural growth disorder, manifested as problems in social interaction, communication, and imagination along with limited and repetitive behaviors and interests [1, 2]. These disorders are increasingly recognized as the most important causes of communication disabilities [3, 4]. Autistic children show obvious defects in imitation skills [5-8]. These defects are recognized in a variety of assignments, including object [9, 10], gesture [9-11], and words [12]. For example, autistic children have a lower frequency of imitation skills than those children with normal growth or with other growth disorders [7, 8, 13, 14]. An interactive imitation is a primary tool for communication between the baby and the parents [15-17].

The first imitation function involves the movement of the body, whispering, and expressions of the face that provides a sense of communication or opposition with parents [6, 18-20]. Acquisition of imitation skills during the early stages of growth is necessary for speech and communication [17-21]. Imitation may be an essential cognitive process for the development of cognitive social skills [22-24]. Since imitation skills can predict language acquisition in autistic children [8, 25, 26], it is argued that acquiring imitation skill plays a vital role in the development of social communication such as language, common interests, and play [5, 8, 27].

In 2000, Carpenter, Pennington, and Rogers in a study on autistic children found a link between the imitation of arbitrary acts and referral language skills [28]. In 2005, in a study on young children with autism, Stone and Yoder found that imitation skills combined with speech therapy were the best predictor of language skills in the next two years in a sample of autistic children [29].

In 2006, Toth, Munson, Meltzoff, and Dawson reported that immediate imitation skills were related to language skills in preschool children with autism and delayed imitation was related with language achievements of over two years old children [26]. In 2001, Williams and his colleagues conducted an overview study on imitation and mirror neurons in autism. They focused on imitation problems in two types of imitation of action and avoidance of echolalia and concluded that the nerve base might be a problem in imitating the frontal cortex neurons, which are called mirror neurons. Early growth failure of the mirror neuron system is probably the result of a series of growth damages characterized by clinical symptoms of autism [4].

Because of the increasing prevalence of autism in advanced countries and lack of appropriate speech therapies for their linguistic improvement, the aim of this study was to study recent works in the field of imitation effects on different aspects of language in autistic children and to find the most appropriate method of teaching imitation for maximum improvement in the language and communication of these children. In this regard, the specialists in this area can use the most effective treatments to improve the language skills of these children.

## 2. Materials and Methods

This research was a review article aimed at collecting the studies from 2000 to 2017 in the field of imitation and its impact on language and communication in children with autism. First, we used keywords of "autism", "imitation", and "language" in databases such as Google Scholar, Science Direct, Scopus, and PubMed, and then we collected data from internal resources like IranMedex and SID databases.

## 3. Results

Table 1 summarizes the articles found in relation to our research.

## 4. Discussion

This study aimed to review recent studies in the field of imitation and its impact on language and communication in children with autism disorder. In this study, according to the research done at the aforementioned resources and applying inclusion and exclusion criteria, 13 studies were chosen from 2000 to 2017. These studies were arranged from the newest to the oldest. Of these studies, only 2 studies have been carried out in Iran, and 11 others in other countries. In most of the studies, video recording was used as the measurement tool, and most studies were of a cross-sectional design. The studies conducted prior to 2000 generally sought to investigate whether the ability to imitate in autistic children had been damaged and if so, tried to investigate the causes of the damage to the mirror cells as the main etiology of this problem.

From 2000 onwards, the studies examined the effect of imitation on the language of children with autism. Of 13 studies found, two studies compared the ability of imitation in autistic children with other disorders, including delayed growth, Down syndrome, and SLI. And eleven other studies evaluated imitation impact on different aspects of language and communication, including the effect of imitation on the development

Table 1. List of studies done on imitation skills in autistic children

Research Study	Study Objective	Sample	Variables	Measurement Tool	Study Design	Results
Hooshang Dadgar et al. [30]	Investigating the relationship between motor skills and the ability to mimic primary social communication skills in children with an Autism Spectrum Disorder	Twenty children with autism aged between 3 and 5 years	Dependent variable: Primary social communication skills, independent variable: Imitation ability and motor skills	The motor Imitation Scale (MIS; Stone, Ousley), Test of Gross Motor Development (TGMD, Ulrich), The Early Social Communication Scales (ESCS; Mundy, Delgado)	Cross-sectional, comparative	A significant and strong correlation was found between the total score of TGMD and the total score of imitation, which shows that imitation skills and motor function are related to each other and with the initial social communication skills. There is also a significant correlation between MIS and TGMD scores with common attention and response to common attention (P<0.025) as ESCS subscale. However, overall MIS and TGMD scores were not correlated with social interaction and response to the subscale of behavioral requests.
Ishizuka I et al. [31]	Find the difference between randomized imitation and random response over a short period of time in a test setting	Six male Japanese children with autism in the age range of 33-63 months	Independent variable: contingent imitation and contingency response, dependent variable: verbal interaction	Video recording	Within-subject multi-element design in a particular rapidly changing reversal design	All children showed a high incidence of verbal imitation during randomized imitation conditions compared with random response conditions and control conditions. In all children, the average frequency of verbal imitation showed a marked increase in contingent imitation compared with a contingent response.
Heimann et al. 2016 [31]	Comparison of delayed imitation and immediate extraction by operation with objects and gesture as imitation assignments in 3 study groups	Immediate, delayed, and extracted imitation	Nineteen children with autism and 20 children with Down syndrome and 23 children with normal growth according to mental and lingual age	Video recording with 2 cameras	Cross-sectional, comparative	Extracted Imitation showed significantly lower scores for the Autism Spectrum Disorder (ASD) group compared to the other two groups and a low level of gesture imitation among ASD children was observed. No difference was observed among groups for immediate Imitation, and the ASD and DS children showed lower delayed Imitations.
Yarmand et al. [32]	Comparison of the effect of stimulating the mirror neurons through the induction of music and imitation of the intended motions on the increase in the average number of verbs in the sentences in the free speech	Six autistic monolingual Persian speaking girls between 5-8 years old who divided into two groups: the first group with targeted gesture training without music play and the second group with music play	Independent variable: Stimulating the mirror neuron system through the training of imitation and intentional moves and music dependent variable: The average number of verbs in a sentence	Video recording	Experimental, applied and non-invasive	The average number of verbs in the sentence increased significantly in both groups and the average number of verbs in the sentence was significantly different from that of the first group. Stimulating the system of mirror neurons by including music and targeted imitation has a positive effect on the increase in the average number of verbs in sentences in autistic children.

Research Study	Study Objective	Sample	Variables	Measurement Tool	Study Design	Results
Souza et al. [33]	Comparison of successive and overall gesture imitation skills in family life among ASD and Specific Language Impairment (SLI) children and investigating the relation between imitation and verbal production in children with autism	Thirty-six children have participated, 24 ASD children and 12 SLI children	Independent variable: Imitation, dependent variable: verbal production		Case-control study	SLI individuals showed better performance in both sequential and general imitations, and a direct relationship was found between gesture imitation and verbal production of vocabulary and sentence production.
Miniscalco et al. [2]	Answering the question of whether the main language skills, such as grammar and vocabulary are measured or the prescriptive communication skills, including gesture and the ability to imitate stimulate lingual pragmatics development of autistic children.	Thirty-four children with autism, including 29 boys and 5 girls with an average age of 41 months	Independent variable: Imitation, dependent variable: development of pragmatics	Parent's Questionnaire MCDI (MacArthur Communicative Developmental Inventory) in two types: word and gesture for children aged 8 to 16 months and word and sentences for children aged 16 to 28 months	Cross-sectional, comparative	The results showed that basically all pre-language, linguistic, and pragmatics skills were simultaneously related. The results showed that imitation may play an essential role in the development of conversational pragmatics functionalities in autistic children.
Turan et al. [34]	Comparison of imitation skills in children with Autism Spectrum Disorders and normal children as well as children with delayed growth and assessment of the relationship between imitative skills and the developmental language of perception and expression in children with an Autism Spectrum Disorder.	Eighteen children with autism and 15 children with delayed growth and 16 normally developed children	Independent variable: Imitation skills, Dependent variable: Language development	Motor Imitation Scale (MIS) and Imitation Battery (IB) Turkish Communicative Development Inventory (TCDI) Ankara Developmental Screening Inventory (ADSI) assess children aged 0-6 years	Cross-sectional, comparative	Autistic children had significantly lower scores in imitation compared to children with delayed growth and normal children and there was no significant difference in the score of imitation between normal children and children with delayed growth. There was also a significant relationship between the score of imitation and the development of expressive language in autistic children. The findings show that the lack of imitation skill is a distinctive feature of children with autism, which plays a vital role in the development of child language.
Sanefuji et al. [35]	Investigating the effect of imitative behaviors on communication gaze in children with autism	Seventy mothers and children, 6 children were excluded. 30 boys and 2 girls in the group of autism and 30 boys and 2 girls in the normal group	Independent variable: Imitation behaviors Dependent variable: communication gaze	Video recording	Cross-sectional, Comparative	Autistic children look at longer in imitation behaviors than random behaviors, while normal children with normal growth (TD) gaze at their mothers regardless of the type of intervention.

Research Study	Study Objective	Sample	Variables	Measurement Tool	Study Design	Results
Ingersoll et al. [36]	Evaluation of the RTT effect for gesture and object imitation on the linguistic behavior of 4 autistic children	Four children with autism with the age range of 35-35 months and a cognitive age of 22-30 months and lingual age of 18-21 months, with 3 white-skinned children and one Spanish child	Independent variable: Gesture and object imitation, Dependent variable: Language	Preschool Language Scales, 4 <sup>th</sup> Edition Motor Imitation Scale (MIS; Stone et al.,1997) Unstructured Imitation Assessment (UIA) MacArthur-Bates Communicative Development Inventory (MCDI) (Fenson et al.,1993)	Modified multiple-baseline	Three out of four children showed a wider recovery in the use of proper language after the onset of gesture training, and children were more likely to use verbal emulation during gesture training than to object imitating training. The findings showed that adding gesture imitating training to object imitating training can lead to a wider increase in the use of language than to impose the object alone.
Ingersoll et al. [27]	Evaluating the benefits of natural behavioral techniques for object imitation training	Five children with autism at the age of 45-29 and a mental age of 29 to 15 years, less than 8 months to 25 months, and mild to severe autism	Independent variable: Mutual imitation skills, Dependent variable: language, symbolic game, and common attention	The Motor Imitation Scale, Structured Laboratory Observation (SLO), Pivotal Response Training (PRT)	A single-subject, multiple-baseline design	Participants increased their imitation skills, extended their skills to the new environment, and showed an increase in social communication behaviors that included language, play, and common interest. These findings support the effectiveness of natural behavioral interventions for imitation training.
Tardif et al. 2007 [37]	Investigating the effects of slowing down the presentation of facial expressions and corresponding voice sounds on the recognition of facial expressions and voice imaging or facial expression in autistic children	Twenty autistic children and 24 normal children for the control group	Independent variable: decrease the speed of presentation of facial expressions and corresponding sound Dependent variable: Recognition of facial expressions and audio/facial imitation	Video recording	Cross-sectional, Comparative	Autistic children showed a lower performance in recognizing facial expressions and more stimulation in facial-vocal imitation than in the control group. In the autism group, facial expressions recognition and induced facial-vocal imitation increased in slower conditions.
Karen Toth et al. 2006 [26]	Study of the effect of joint attention, imitation and toy play on linguistic abilities and the growth of communication skills in autistic children	Sixty preschool autistic children	Independent variable: joint attention, imitation and toy play, Dependent variable: linguistic abilities and the growth of communication skills	The Early Social Communication Scales (ESCS), Mullen Scales of Early Learning	Cross-sectional	The joint attention and immediate imitation skills were strongly related to language ability at the age of 3 to 4, while toy play and deferred imitation were the best predictors of communication growth from age 4 to 6.5 years.
Ross et al. [38]	Evaluating the effects of providing a fast general imitation sequence before the opportunity of imitation, on vocal speech in children with nonverbal autism	Five primary children diagnosed with DSM-IV autism.	Independent variable: rapid motor imitation sequence, Dependent variable: verbal behavior of Whispering	Preschool Inventory of Repertoires for Kindergarten (PIRK), the Mullen Scales of Early Learning	Two different multiple baselines across subjects	All participants began whispering, and they were preserved with the sequencing of generalized imitation in the follow-up phase of 3 months.

of the language of comprehension and expression, on the pragmatics of language, on the prognostic growth, such as gazing at mother, on syntax, such as increasing the number of verbs and on increase of voicing, and some studies examined the different approaches and methods of training imitation in terms of effectiveness and impact on language.

The results showed obvious deficiencies in the imitation ability of autistic children in comparison with normal children or children with other disorders such as SLI and Down syndrome [31, 33]. The problem in mirror cells is considered as one of the causes of the impairment of imitation performance in these children [4]. All studies have shown that imitation influences on different aspects of language and enhances pre-lingual communication, such as the infant's gaze at mother's eyes, development of perception and expression language, improvement of understanding language application skills, improvement of the syntax, including the number of verbs and the increase of the verbal production of vocabulary and the phrase.

A number of studies have examined the differences between various types of imitation training methods and their impact on language acquisition. Their results showed that the use of randomized imitation method has a more effective role on the language than the random response method [8] and natural behavioral intervention techniques can increase imitation ability and impact on the game, and common attention, and language acquisition [27].

The results of other studies showed that the joint attention and immediate imitation skills were strongly related to language ability at the age of 3 to 4 years, while toy play and deferred imitation were the best predictors of communication growth from age 4 to 6.5 years [26]. The findings also showed that the procedure and imitation training affect its effectiveness, and in the autism group, recognition of facial expressions and audio facial imitation increases with the reduction in the speed of presentation of facial expressions and audio imitation [36].

## Ethical Considerations

### Compliance with ethical guidelines

There was no ethical considerations to be considered in this research.

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## Authors' contributions

Conceptualization: Samane Mazaheri, Zahra Soleymani; Writing-original draft: Samane Mazaheri; Writing-review & editing: Zahra Soleymani; and Supervision: Zahra Soleymani.

## Conflict of interest

The authors declared no conflict of interest.

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