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Effectiveness of Operant Conditioning on the Development of Language Skills in Persian-Speaking Children with Autism

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Abstract

In this study, we have examined the effectiveness of operant conditioning on the development of linguistic skills in Persian children with autism. It was a quasi-experimental study, and done by using pre- and post-tests. We randomly selected 40 children (6 girls and 34 boys, 5-10 years old) and divided them into experimental and control groups comprising of 20 children each. We used the Autism Spectrum Screening Questionnaire (ASSQ) to screen subjects and the Test of Language Development (TOLD-P:3) to measure their language skills. Both groups received grammatical comprehension and grammatical completion subtests. Using the Applied Behavior Analysis (ABA) method, the experimental group was then subjected to 48 one-hour intervention sessions ran for 24 weeks. After the intervention, we ran a post-test in both experimental and control groups. The data were analyzed using SPSS software. In the experimental group, the mean score in the grammatical completion subtest had increased by 4.2, and in the grammatical comprehension subset, the mean score had increased by 3.6. In contrast, in the control group, the mean score of the grammatical completion and comprehension subtests had increased by 0.25 and 0.3, respectively. The findings suggested that operant conditioning had direct effects on the improvement of the 5-10 years old Persian-speaking children with autism.

Keywords: Autism; Operant Conditioning; Practical Behavior Analysis; Grammatical Comprehension; Grammatical Completion.

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Introduction

Given the growing trend of autism spectrum disorder (ASD), the importance of studying linguistic characteristics in children with autism, to help them expressing their needs and being more autonomous, also increases. To express their daily needs, these children occasionally use single language or single words. This sometimes leads to a misunderstanding of their needs.

Autism is a disorder that affects the development of social and communication skills. Since the disorder has different symptoms in different people, the term "autism spectrum disorders" (ASD) is used (Samadi, 2017). Disturbance in the social relationships of children with autism is essentially significant and lasting and affects their verbal and non-verbal skills.

Based on the new classification of the American Psychiatric Association (DSM), poor performance in expressive communications is no longer a criterion for recognizing autism, but given the importance of language comprehension in the process of development and academic skills, knowing the nature and source of perceptual problems of the children is important (Kover and et al, 2014). Studies show that verbal and non-verbal communication impairments are the most prominent feature of ASD (Dimavi & Agbayewa, 2011). Children with autism encounter difficulties not only in spoken language but in the understanding of gestures, facial expressions, and other kinds of body language. Compared to others, children with autism have more challenges in making connections between words they hear and objects or acts that are related to them.

Autism is a neurological disorder caused by abnormal brain conditions. Research shows that parts of the brain processing emotions do not naturally develop in people with autism (Samadi, 2016: 25). Imitative repetition of words and phrases is quite common in autistic children's speech. They don't use immediate or delayed repetition of others' speech for communication purposes (Rezai, 2015). Echolalia, pronoun reversals, literal understanding and expression, neologism, repetitive questioning, over-repetition of a topic, self-talking, and problems in speech intonation control are among the most dominant abnormal language characteristics in people with ASD (Farhang Doost, 2015). Some researchers believe that echolalia may be one of the reasons for the attention deficit in autistic children (Prizant, Duchan, 1981). Echolalia and stereotypic vocalizations are the communication disorders which can be appeared as a persistent repetition of overheard words or whispering which are physically harmful and also disruptive for social and adaptive skills (Lanovaz and Sladecek, 2012).

People with autism may exhibit many different symptoms, but, in a comprehensive classification, all of these symptoms are classified into three domains, which provide a general framework for this type of disorders. These three domains are:

- Social development
- Language and communication
- Thinking and imagination

It should be mentioned that all three domains overlap one another, and those with ASD exhibit a wide range of impairments which none of them are outside of these three domains. Differences within people with autism are often due to impairment with different degree of intensity in one of these three domains.

An autistic person shows an intense and significant delay in social development, especially the development of interpersonal communications. People with autism have particular and noticeable difficulties in establishing social relationships and usual interactions, and typical procedures, like making friends, are difficult and sometimes impossible for them (Samadi, 2014). Bartolucci et al. (1980) found that the elimination of certain morphemes, especially the articles and auxiliary verbs, the past tense, and the 3rd person singular of the simple and continuous present tense, in people with autism is higher than normal. The results of linguistic studies indicate that incorrect use of tense, misapplication of prepositions, difficulty in producing plural nouns, and preventing the use of compound sentences are other factors which characterize children with autism.

What is most often affected is language comprehension and vocabulary. Word categorization and the relation between different domains of language are challenging for children with autism.

There are three levels of autism, which vary in their severity (Rafei, 2013: 30).
Level 1: Those at level 1 require support;
Level 2: Those at level 2 require substantial support;
Level 3: Those at level 3 require very substantial support.

In this study, we focused on children with autism at level one.

In autism research, linguistic features, especially grammatical ones, have not been studied accurately, while recognizing these features and impairments may play a significant role in treating these children. Given the fact that the grammatical features have significant effects on the process of constructing sentences, in this study, we tried to examine the effects of the operant conditioning on the language skills in children with autism. The results may help in enhancing the language performance of children with autism.

Theoretical Framework

Behaviorists consider learning as a change in the amount and frequency of the behavior, or the formation of behavior or response which is shaped by environmental factors. It may be possible to describe the conditioning as a factor which has a positive effect on the frequency of the behavior, and through which conditioned responses are learned. The behaviorists divide the conditioning into two types of classical or respondent conditioning and the operant or instrumental conditioning. In the classical conditioning, introduced by Pavlov, a subject learns to associate between a neutral stimulus and a reward/punishment. However, in the operant conditioning, a subject learns to associate between his behavior and a reward/punishment. To be more precise, in classical conditioning, a natural stimulus automatically calls for a response, while in operant conditioning, it is necessary to use reinforcements.

Of the other differences that can be mentioned, it is voluntariness. Classical conditioning operates with involuntary responses, while operant conditioning operates with voluntary behaviors. For those who support Skinner's view, reinforcement is an event (stimulus) which follows a response and increases the likelihood of its occurrence (Kadivar, 2017: 72). Reinforcement is used in circumstances in which one knows which behaviors should be performed, while the operant's behaviors are not always perfect and desirable, and in

these circumstances, the behavior must be formed before being reinforced.

In operant learning, complex behaviors are divided into smaller behaviors, and each of them is separately reinforced and altogether generates the ultimate behavior. In this research, we used the Applied Behavior Analysis method (ABA) to simplify behavior. By dividing the child's behavior into simple steps, the ABA method adapts them to the attention span of children with autism. In this method, the learning consists of simple steps; and by increasing the child's attention span, the steps become bigger and longer.

The ABA method uses reinforcements to raise the child's motivation for learning and entering into the next steps, and to acquire more complex behaviors. The ABA method teaches the autistic child which of the environmental stimuli is worth paying attention to. Through direct observation and accurate assessment and analysis of the child's behavior, in the ABA method, it has been tried to reveal the relationship between the environment and the child's behavior, and also to discover those features of the environment that can lead to new behaviors, the reinforcement or reduction of the child's behavior (Rafei, 2013: 120). Like Skinner's theory, in the ABA method, it has been referred to the concepts of positive and negative reinforcement and punishment. In this method, reinforcement increases or stabilizes a behavior, and punishment reduces it.ABA method has been used for the treatment of behaviors such as language issues, poor social behaviors, academic skills, living skills, and abnormalities such as aggression, self-harm, and coping and stereotypic behaviors.

In this study, we have used the Samadi's learning method (Samadi, 2014: 210) to teach grammar to students with autism. Samadi (2014: 210) suggested a pictorial grammar booklet for teaching grammar to children with autism. The booklet should be in pieces so that by putting them together, one can form a whole sentence. Using such a booklet allows the child to be familiar with different parts of speech, such as nouns, verbs, adjectives, and propositions, and their function in sentences, such as subjects and objects. The general form of the sentence is ordered by putting different parts next to each other (Samadi, 2014: 210). The separable feature of this method allows children to create new sentences. It also allows us to adjust the level of difficulty and complexity of sentences. By using the ABA method, we tried to teach the children word sequence and allow them to create new sentences. Saussure believed that linguistic elements are ordered on the speech sequence, and each element gains its value in contrast to its surrounding elements (Saussre, 2016).

Many studies have confirmed the effectiveness of the ABA method in improving linguistic issues in children with autism. Golabi et al. (2005) examined the effect of the ABA method on the treatment of children with autism. The findings, similar to those reported by Levas (1983), showed that the experimental group had been successful in reducing the severe autistic symptoms by 30 points and had significant improvement ($p<0,000$) in acquiring normal behaviors. Ahmadi et al. (2012) studied the effectiveness of the ABA method on autism symptoms. The study has been performed on 20 children with autism aged 3-7 years old in the center of autism in Isfahan for five years, and based on its findings, it can be concluded that the ABA intervention is effective in reducing

symptoms of autism and enhancing the skills. Mohseni Ejiyeh et al. (2015) was a meta-analysis on the effectiveness of the ABA method on the problems of children with ASD in Iran. The results, based on Cohen's effect size interpretation table, indicated that the effect of the ABA method on reducing the problems of children with ASD in Iran is very high. The results also suggested that if the method is implemented in the long run and more intensively, it will be more effective in reducing their problems. Therefore, the ABA method can be used as an effective treatment for children with autism. In a meta-analysis, Aghababaei et al. (2015) examined the effectiveness of the ABA on the language skills in children with autism. The mean effect of the ABA method on the improvement of expressive, perceptual, and compound language skills was, respectively, 1.79, 1.56, and 1.21, which, based on Cohen table, is considered to be high. The results of this meta-analysis confirmed the effect of the ABA method on improving language skills in children with autism.

Method

The statistical population of this study was children, aged 5 to 10 years old, which had been diagnosed with a high-functioning autism spectrum disorder. We randomly selected 40 children (6 girls and 34 boys), and after pairing, randomly divided them into two experimental and control groups, each containing 20 subjects. To pair the subjects, we used the Autism Spectrum Screening Questionnaire (ASSQ), and to assess their syntactic skills, we used two grammatical completion (GCR) and grammatical comprehension (GCL) subtests from the Test of Language Development (TOLD-P:3). We used the TOLD-P:3 and the ASSQ as assessment and pairing tools in our study.

TOLD-P:3 is one of the oldest, most valid, most common, and most comprehensive tests in the field of child language development. The test, which is used to measure the language development of 4 to 8 years old children, is based on a two-dimensional model, in which there are linguistic systems with listening, organizing, and speaking elements in one dimension, and linguistic characteristics or semantic, syntactic, and phonological features in the other dimension. The test consists of GCL and GCR subtests. The GCR subtest consists of 25 questions and measures the children's ability in understanding the meaning of sentences. Although the importance of semantics cannot be ignored in a sentence comprehension task, the subtest focuses on the syntactic aspects of the sentence. The GCL subtest is a syntactic subtest which consists of 28 questions and is used to measure the children's ability in recognizing, understanding, and applying the common morphological forms in the Persian language. In a GCL test, the examiner reads incomplete sentences aloud, and the child is required to provide the missing morphological forms.Although the subtest is characterized as a measure of speaking ability, it also measures the listening and organizing skills, as children's responsiveness depends largely on their ability to decode the sentences presented in the subtest.To answer the subtest, it requires knowledge of plural marks, pronouns, tense, comparative and superlative adjectives, and suchlike (Hasanzadeh, 2015).

The ASSQ is first designed by Ehlers, Wing, and Gilberg (1993) in Sweden based on long-term clinical studies on ASD populations and their various issues as a

high-functioning autism screening tool for Children aged 7-16 years old. It has 27 questions in different areas, including communication and social disorders, limited and stereotypic interests, clumsy movement, and vocal and motor tics. The questionnaire is filled in by parents and teachers, and approximately 10 minutes are required to complete it. There is no need for technical information to fill out the ASSQ, and it does not require any special training. Various studies have supported its validity and reliability. Each question is considered to have 0-2 points. Children who have a total score of 22 (if completed by teachers) and 19 (if completed by parents) are selected as high-functioning autism. It measures the problems of people with autism in three domains of social interaction, language delay, and behavioral problems and abnormality in symbolic plays.

In this study, first, we selected 40 children based on their score in the ASSQ, and after pairing them, based on their functioning, we divided them into two equal groups of 20 subjects. It is worth to mention that before the intervention, all parents completed a consent form for participating in the study. Both the experimental and control subcomponents then took GCR and GCL subtests. The experimental group was then subjected to 48 one-hour intervention sessions ran for 24 weeks. For children who were not able to read, we used visual cards, and for those with the ability to read, we used lexical cards. In the first step, we initiated the interventions with simple sentences (subject + verb) and then, we moved on to more complex structures (subject + object + ... + verb). In this method, one can change a sentence by replacing the cards. For example, in the sentence "علی سیب می‌خورد" [Ali eats the apple], one can replace the word "سیب" with the word "watermelon" or the word "علی" [Ali] with "مریم" [Mary], or by adding the word "مشق" [the homework] to the sentence "من می‌نویسم" [I am writing] one can change it to "من مشق می‌نویسم" [I am writing the homework]. This way, by using syntagmatic relations, we can change simple sentences to more complex ones, and by using paradigmatic relations, we can create new sentences. At the end of the intervention, both experimental and control groups took a post-test, and the data were analyzed by using SPSS software.

Findings

In this research, we studied 40 children (6 girls and 34 boys) aged 5 to 10 years old. The average age was 7:1. As mentioned earlier, both experimental and control groups took a pre-test and a post-test on GCL and GCR subtests, and the scores were recorded. Table 1 shows the means and standard deviations of the experimental group in both steps (pre- and post-test) of both subtests (GCR and GCL). As you can see, the average growth rate in GCL subtest was 4.2, and in the GCR subtest, it was 3.65.

Table 1. The Means and Standard Deviationsin the Experimental Group

N	Subtests	Steps	Means	SDs
20	GCL	Pre-test	8.15	2.852
20	GCL	Post-test	12.35	3.543
20	GCR	Pre-test	6.25	2.314
20	GCR	Post-test	9.90	3.007

The table shows that there have been significant differences in the means and standard deviations in both steps of both subtests. Figure 1 compares the means of pre-test and post-test in both groups. The means of both groups in GCL and GCR subtests indicate that in the experimental group, the intervention was successful.

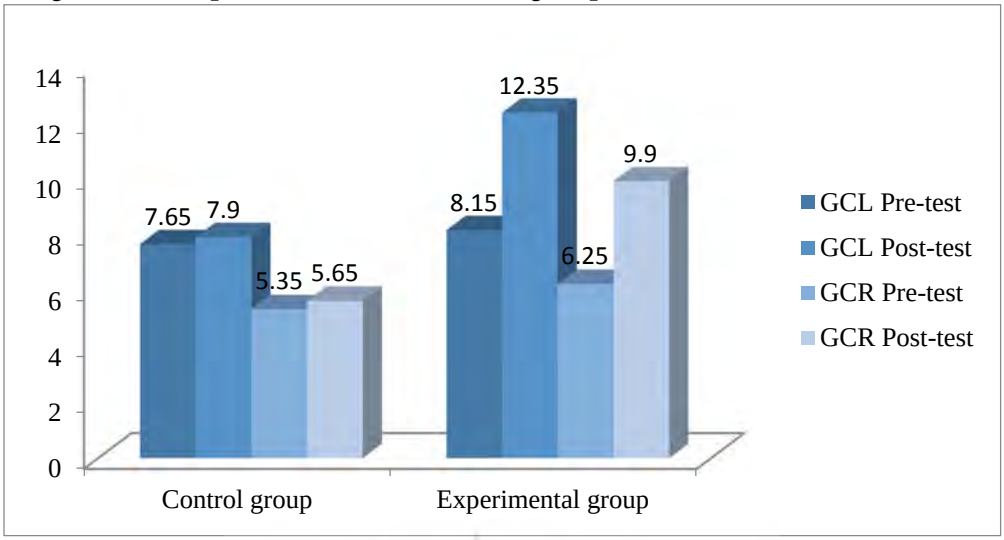

Fig 1. The Comparison between the Means of The Experimental and Control Groups

The table shows that there have been significant differences in the means and standard deviations in both steps of both subtests. Figure 1 compares the means of pre-test and post-test in both groups. The means of both groups in GCL and GCR subtests indicate that in the experimental group, the intervention was successful. Table 2 shows the means and standard deviations of the control group in both pre-test and post-test. In the control group, the mean score of the GCL and GCR post-tests have been increased, by 0.25 and 0.3, respectively. There is no significant difference between the means of two stages of the control group, which indicates the effectiveness of the intervention in the experimental group.

Table 2. The Means and Standard Deviations in the Control Group

N	Subtests	Steps	Means	SDs
20	GCL	Pre-test	7.65	2.519
20	GCL	Post-test	7.90	2.732
20	GCR	Pre-test	5.35	2.033
20	GCR	Post-test	5.65	2.300

Based on Cohen's theory, a correlation of 0-0.19 indicates the lack of correlation or insignificant correlation; a correlation of 0.20–0.39 is considered to be weak, 0.40–0.59 moderate, 0.60–0.79 strong, and >0.80 very strong (Cohen, 1988as cited in Hasanzadeh, 2015). Based on the correlation coefficients, illustrated in table 3, our results show strong correlations.

Table 3. The Correlation Coefficients

	GCL Pre-test	GCL Post-test	GCR Pre-test	GCR Post-test
GCL Pre-test	1	0.928**	0.940**	0.868**

GCL Post-test	0.928**	1	0.888**	0.815**
GCR Pre-test	0.940**	0.888**	1	0.939**
GCR Post-test	0.868**	0.815**	0.939**	1

** Significance levels were defined as $P < 0.01$.

Discussion and Conclusion

As noted, studies have shown that verbal and non-verbal communication impairments are the significant characteristics of ASD. Considering the importance of language as a medium of expressing feelings, thoughts, and needs, in this research, we studied 40 Persian-speaking children with autism. The findings suggest that operant conditioning has a significant effect on the production and comprehension of sentences in children with autism aged 5 to 10 years old. By using the ABA method, children learned the correct word orders, which helped them to produce grammatical sentences. While in the experimental group, the difference between the mean score of the GCL pretest and posttest was 4.2, and the difference between the mean score of the GCR pretest and posttest was 3.65; in the control group, the same differences were 0.25 and 0.3, respectively. In addition to confirming the effect of the intervention on the experimental group, the results revealed that the intervention was more effective on the GCL score than on the GCR score. Therefore, It can be concluded that the method was more effective in the production of children with autism compared with their perception.

Since ASD is more common among boys than girls, and due to a limited number of girls participating in our study, the effects of an intervention program on gender could not be precisely determined. The results were similar to those of other studies such as the effect of therapeutic intervention on children with autism by using ABA method (Golabi et al., 2005), and showed a significant difference between pretest and posttest scores in both GCR and GCL test. One of the limitations of the ABA method is being time-consuming. Considering the effectiveness of the intervention on the language of children with autism, increasing the intervention time may be more effective on the improvement of language.

Given the limitation of time and the population in our study, studies on the effects of the ABA method on gender are recommended. Since language has different aspects, including morphology, semantics, and pragmatics, we also suggest studies on the effectiveness of an intervention on other aspects of language. Finally, considering the effectiveness of the ABA method, we recommend the use of this method, as a complementary method, along with other therapeutic methods.

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