



# Effectiveness of Mind Simulation on Psychological Symptoms and Mental Capabilities in Adults who Stutter

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**Abstract**

**Background and Objective:** Since cognitive factors are very important in stuttering, this study aimed to examine the effectiveness of mind simulation on psychological symptoms and mental capabilities in adults who stutter.

**Materials and Methods:** This quasi-experimental study was conducted on two groups of experimental and control based on a pre- and post-test design. The study population was all females (n=33) suffering from a stuttering disorder who were the clients of speech-therapy centers. Eventually, 30 individuals were selected using a simple random sampling method from Aftab Institute and Empowerment Mind Center in Tehran, Iran, during 2019. They were subsequently divided into two control and experimental groups each containing 15 people according to the Cochran formula. Package of stuttering by Taghizadeh and Bigdeli Shamlou (2016), Cattell's anxiety questionnaire, Coopersmith's self-esteem measurement, Rogers's self-concept measurement, and Monjemizadeh's Social Communication measurement were used to collect data in this study. The data were then analyzed in SPSS software (version 18) through multivariate covariance analysis.

**Results:** In general, the findings indicated a significant difference between the pre- and post-test mean scores of the two groups regarding self-concept, self-esteem, social interactions, and anxiety involved in the mind simulation process (P=0.001).

**Conclusion:** The current mind simulation methods have a considerable impact on psychological symptoms and mental capabilities of adults suffering from stuttering, which can be used as an effective way to improve stuttering.

**Keywords:** Mental capabilities, Mind simulation method, Psychological symptoms, Stuttering adults

## Background

Stuttering often begins between the first two and three years in one's life. This is when rapid growth is viewed in long and complicated speech structures [1]. Orton [2] posed that developmental stuttering was accompanied by aberrant functional lateralization of cortical networks and psychological symptoms. These cortical disruptions result in inefficient activation of some regions involved in motor control, which produce repetitions, and are responsible for blocking speech [3]. Disfluency can be tuned out; however, it is anxiety that can never be tuned out. The negative reaction of the listener to the speaker shows the level of the speaker's discomfort. The reason is that we often notice disfluency because it is accompanied by a sense of anxiety or prohibitive behavior. It is, in fact, not so much about stuttering; however, the speaker's reaction to it [4]. Stuttering is found in all parts of the world. That is, all cultures experience this special physical situation and witness stutters

regardless of their occupation, income rate, and individual intelligence [5]. Stuttering, on the other hand, prevents the person from behaving in the social environment as he or she wishes to [6, 7]; therefore, over time, in addition to reducing social communication, this condition reduces self-confidence, self-concept, and increased anxiety [8, 9]. However, its cause is still unknown to scientists, and there have been many clues that help partially discover the reason [10]. First, it is strongly believed that stuttering is genetically inheritable. Moreover, it often begins between ages 2 and 5 years. Stuttering may disappear within a couple of months or it can be gradually worse and turn to be chronic [11].

Despite the recent progress in understanding the basic mechanism, it is not yet possible to introduce an all-inclusive mechanism for stuttering treatment [12]. Many techniques have been used to treat, modify, or rehabilitate the stuttering people so far.

To name a few, one can mention phonation interval modification [13,14], psychological counseling [15], hypnosis [16], and webcam preschool plan [17]. In the present study, mental simulation is selected as a treatment, which has been worked on before by other researchers [18] from the aspects different from ours.

The utilization of the virtual world offers exciting new lines of dealing with communication disorders and supporting clients [19]. In this rapidly-growing space of technological advances, some virtual systems could be used for speech pathologists to complement current methods and therapies [20]. Brundage and Hancock [21] found a significantly positive relationship between virtual and real-life conditions in terms of stuttering frequencies. Therefore, these virtual worlds can provide supervised and controlled space to assess and find a treatment for stuttering. In another study conducted by Arnold [22], it was suggested that stuttering did not result from relying too much on sensory feedback in order to move speech forward. Rather, it can only result from subtle anomalies in psychological symptoms and mental capabilities. Jones et al. [23] revealed this result that stuttering children had lower executive functioning. They proved that stuttering had a great impact on performance, behaviors, and characteristics all of which were related to psychological symptoms (i.e., social communication and anxiety), as well as mental capabilities (i.e., self-confidence and self-concept).

In general, people with stuttering tend to have low social interactions due to their negative self-esteem in social situations. They always blame themselves, which leads to lower self-confidence and self-concept. These people are susceptible to many other mental disorders, and mental simulation therapies help people visualize real situations. In addition, more practices on these techniques seem to help these people. In the present study, the mental simulation was selected as a treatment, which has been worked on before by other researchers from different aspects.

### Objectives

The present study aimed to investigate this hypothesis whether mind simulation has a significant impact on psychological symptoms and mental capabilities in adults suffering from stuttering. To this end, the following question has been raised: Does mind simulation has effects on psychological symptoms and mental capabilities of stuttering adults?

### Materials and Methods

This quasi-experimental study was conducted on

two groups of experimental and control based on a pre-and post-test design. The study population was all females (n=33) suffering from a stuttering disorder who were not treated in the past and were the clients of speech-therapy centers. Eventually, 30 females were selected using simple random sampling from the clients who referred to Aftab Institute and Empowerment Mind Center in Tehran, Iran, during 2019. Subsequently, they were divided into control and experimental groups each containing 15 people according to the Cochran formula (using 5% error and 95% confidence).

### Inclusion criteria

The inclusion criteria were: 1) Individuals suffering from a stuttering disorder, 2) female gender, 3) age range of 20-30 years, 4) lack of receiving any other treatments in the past, 5) lack of receiving any other treatments at the same time, 6) presence of recently diagnosed disease, 7) maximum of 1 month past from the diagnosis of the stuttering disorder, 8) single and non-married status, 9) lack of consuming psychotropic drugs, 10) willingness to participate in the study, 11) lack of existence of another concurrent disease, which affects the collaboration process by the diagnosis of a physician, 12) lack of a significant psychological problem by the diagnosis of Psychiatric Association according to the psychiatry records and based on DSM5 criteria. It is worth mentioning that the medium severity of the stuttering disorder was matched by the test of Stuttering Severity Instrument Fourth Edition.

### Exclusion criteria

On the other hand, the participants who were absent from the trial and intervention for more than two sessions, unwillingness to continue the trial and intervention, and used severe psychiatric disorder requiring urgent medication along with those who consumed psychotropic drugs or substances were excluded from the study.

Regarding the ethical considerations, before the initiation of the study, the participants got familiar with the layout specifications; moreover, the attitudes and beliefs of the individuals were respected in this study. Moreover, the cases were allowed to leave the research procedure at any stage. In addition, the group members were free to repeat the treatment sessions of the intervention group if they were interested in entering the intervention group only at the end of the treatment. It should be noted that the control group received treatment after the training sessions. All documents, questionnaires, and

confidential records were only available to the administrators. Written informed consent was obtained from the parents or legal guardians of all the candidates. According to the ethical principles regarding human experimentation stipulated in the Helsinki Declaration, the participants were allowed to quit participation in case of experiencing any discomfort or pain increase.

**Psychological symptoms included:** Social communication and anxiety.

**Mental capabilities included:** Confidence and self-concept.

Social communication, anxiety, self-confidence, and self-concept were the dependent variables, whereas stuttering status was regarded as the independent variable. In this regard, several measurements, including Monjemizadeh's Social Communication, Kettle's anxiety questionnaire, Coopersmith's self-esteem inventory, and Rogers' self-concept were used in this study.

### Research Procedure

Initially, the required permission was obtained from the director of Aftab Institute and Empowerment Mind Center in Tehran, Iran. Before the initiation of the study, the research procedures and objectives were explained to the participants. Moreover, they were informed of the confidentiality of the data. It should be noted that informed consent was obtained from the individuals, and questionnaires were received from the two groups at pre-test. The experimental group participated in 15 intervention sessions each lasted 60-minute, held two sessions per week, started in May, and finished in July 2019. It is worth mentioning that package of Taghizadeh and Bigdeli Shamloo [18] were used in the intervention sessions, and participants in both groups were asked to have a post-test after the intervention. On the other hand, the control group received no interventions. The obtained data were analyzed in SPSS software (version 18) through multivariate covariance analysis.

### Social Communication

The 19-item social communication questionnaire developed by Monjemizadeh was used to measure this variable [24]. This questionnaire is scored based on a 5-point Likert scale from strongly disagree to strongly agree within the score range of 19 to 95. The developers confirmed the construct and concurrent validity of this questionnaire, and the reliability was obtained at 0.73 by Cronbach's alpha. It should be mentioned that the reliability of this questionnaire was estimated at 0.82 using Cronbach's alpha in this study.

### Anxiety

This 40-item questionnaire was developed by Kettle in 1962 [25], and the scores of 0, 1, and 2 were used for incorrect, middle, and correct items, respectively. The overall scores were within the range from 0 to 80. The developers estimated the construct and concurrent validity and reliability at 0.84 using Cronbach's alpha. In Iran, the content and construct validity of this questionnaire was confirmed by Alirezaei Motlagh [26], and its reliability was obtained at 0.81 by Cronbach's alpha. It is worth mentioning that its reliability was determined at 0.79 using Cronbach's alpha in the present study.

### Self-esteem

This 58-item questionnaire was developed by Coopersmith in 1967 with [27]. The items are scored within the range from 0 (incorrect) to 1 (correct), and the overall score is from 0 to 50. It should be mentioned that eight questions are lie detectors on this scale. The developer estimated the construct and concurrent validity and reliability of this tool using Cronbach's alpha at 0.87. In Iran, content and construct validity of this scale were confirmed by Sabzevari et al. [28], and its reliability was determined at 0.82 using Cronbach's alpha. The reliability of this tool was estimated at 0.80 using Cronbach's alpha in the present study.

### Self-Concept

Self-concept was designed by Carl Rogers (1951) with 25 questions [29] within the range from 1 to 7. Moreover, the overall score is from 25 to 175. The construct and concurrent validity were confirmed by the developer, and the reliability was obtained at 0.82 using Cronbach's alpha. In Iran, content and construct validity of this scale was confirmed by Bijari et al. [30], and its reliability was obtained at 0.80 by Cronbach's alpha. In addition, the reliability was obtained at 0.78 by Cronbach's alpha in the present study.

### Stuttering Severity Instrument Fourth Edition

This 13-item scale was designed by Riley in 2009 to check the severity of stuttering [31] and scored based on a 9-point Likert-scale within the ranges from 1 to 9. This instrument is a reliable and valid norm-referenced stuttering assessment tool that can be used for both clinical and search purposes. It can also be used for adults with an overall score. The construct and concurrent validity of this tool were confirmed by the developer, and its reliability was obtained at 0.89 using Cronbach's alpha. In Iran, the content and construct validity of this scale was confirmed by Tahmasebi Garbatani et al. [32], and its reliability was determined at 0.86

**Table 1.** Mental Simulation Intervention Process

Session	Target	Session contents
1	Introduction and evaluation	Getting to know each other and expressing the goals of the sessions
2	Coding	Encoding important words in expression
3	Mental imagination	Imagination on the correct expression of important words
4	Speech linearity	Focusing on the words that are spoken correctly
5	Half-opened speech-mental technique	Repetition and mental training in problematic letters
6	Discussion on excitement control	Controlling negative emotions using relaxation technique and focusing on proper performance
7	Stress management	Managing stress by training for the best way to properly evaluate situations
8	Facial tics	Preventing facial tick formation using relaxation and mental visualization
9	Speech/mental obsession	Cognitive training and neglecting negative thoughts to prevent the obsessive-compulsive expression of words and letters
10	Self-confidence enhancement	Improving the spirit of individual empowerment to increase self-esteem
11	Mind cleansing	Teaching the cognitive technique and disregarding negative environmental factors
12	Power emphasis technique	Enhancing one's ability to empower
13	Cooperation between body and mind	Interaction between mental and behavioral states and supervising the training to both
14	Removing physical pressures when talking	Training by disregarding environmental factors that cause stress
15	Unity in the speech and summary of sessions	Unity in the speech and summary of sessions

using Cronbach's alpha. It should be mentioned that the reliability of this questionnaire was estimated at 0.82 using Cronbach's alpha in the present study.

**Results**

Initially, the data normalization presumption was confirmed by the Shapiro-Wilks test, and then the presumptions of multivariate covariance analysis including homogeneity of Box and Levine were confirmed in this study. Meanwhile, concerning complying with other assumptions (slope homogeneity and linear assumptions), a covariance analysis test was utilized to analyze the data.

As shown in Table 2, the descriptive findings are divided by measurement steps in pre- and post-test in two control and experimental groups in this

section. The experimental group obtained a considerable increase in the mean scores. Moreover, multivariate covariance was analyzed to test the research hypothesis.

As indicated in Table 3, the values of F are significant in all four tests. Therefore, the independent variable has effects on the dependent variables. The obtained values of F in the above table are the F values in covariance analysis. In fact, the F value in covariance analysis is equal to the variance one obtained after manipulating the independent variable in terms of variance error.

As shown in Table 4, the mind simulation has a significant effect on self-concept, self-esteem, social communication, anxiety, and stuttering severity, which is at a significance level of 0.01 and 99% certainty.

**Table 2.** Mean±SD of the variable scores obtained in pre- and post-test

Variable	Step	Groups			
		Control		Experimental	
		Mean	SD	Mean	SD
Self-concept	Pre-test	79.26	6.2	87.2	7
	Post-test	80.62	7.14	101.2	5.04
Self-esteem	Pre-test	23.46	3.15	23.86	4.5
	Post-test	23.13	3.05	33.06	3.05
Social communication	Pre-test	41.86	5.23	44.2	6
	Post-test	42.21	5.5	54.93	6.9
Anxiety	Pre-test	41.13	4.67	40.44	3.6
	Post-test	40.86	4.31	32.80	3.27
Stuttering Severity	Pre-test	72.49	9.28	72.62	8.12
	Post-test	71.94	8.04	46.17	10.98

**Table 3.** Results of multivariate analysis of covariance

Tests	Value	F	Hypothesis df	Error df	Sig.	Partial Eta squared
Hotteling's trace	3.58	5.86	9	15	0.001	.857
Wilks' Lambda	.364		9	15	0.001	
Pillai's trace	.874		9	15	0.001	
Roy's largest root	3.24		9	15	0.001	



**Table 4.** Variable analysis in the context of multivariate covariance analysis

Variable	Sum of squares	Df	Mean of squares	F	Sig.	Effect size
Self-concept	1009.2	1	1009.2	23.36	0.01	0.485
Self-esteem	182.53	1	182.53	14.3	0.01	0.413
Social communication	770.13	1	770.13	19.6	0.01	0.412
Anxiety	480	1	480	36.6	0.01	0.567
Stuttering Severity	182.36	1	182.36	24.87	0.01	0.863

## Discussion

This study aimed to investigate the effectiveness of mind simulation on psychological symptoms and mental capabilities in adults who suffers from stuttering. The findings revealed that mind simulation had effects on the treatment of stuttering. These results are consistent with the findings of the studies conducted by Taghizadeh, Yarollahi, and Bahrami [33] who showed that mind simulation model affected the stress reduction and cognitive flexibility increase in adults with the stuttering disorder. Brundage and Hancock [21] showed that mind stimulation increased psychological symptoms and mental capabilities. In another study performed by Arnold [22], mind stimulation can decrease the anomalies in psychological symptoms and mental capabilities. Jones et al. [23] showed that stuttering had a great impact on performance, behaviors, and characteristics all of which were related to psychological symptoms and mental capabilities. Different methods were used in the treatment procedure, including mind cleansing, coding, and self-talking [34]. In mind stimulation, self-talking is a means with interpretative and educational values, which increased social communication, self-confidence, and self-concept [32]. Self-talk or talk to an imaginary friend is not always psychotic [35]. Hardy et al. [36] in mind stimulation defined self-talking as a conversation individuals make with themselves in which they interpret their understandings, might change their evaluations and beliefs, propose themselves to other instructions, or even reinforce the existing structures.

Bloodstein [37] in mind stimulation admitted that stuttering people feel more comfortable when they self-talk. That is, they speak fluently when talking to themselves. According to the studies conducted over the years, stuttering is regarded as the least understood area, which language pathologists come across, and they often feel less comfortable in the treatment of such fluency disorder, compared to any other speech-related disorders [38]. Based on this insight, mind simulation will be practical by considering concurrent educational demands in emotional and behavioral fields, as well as other complex cognitive tasks [18]. Mind simulation methods in stochastic situations have approximate responses. Moreover, this condition is referred to as

cognitive development and a basic self-regulating process, which leads to cohesion and focus on actions [33]. It is becoming possible to train and treat people with stuttering using mind simulation and mind programming language by designing and performing medical and educational programs through simulating and reconstructing the natural process of forming skills [34].

The limitations of the study included an emphasis on female individuals who were suffering from stuttering disorder referred to speech-therapy centers, including Aftab Institute and Empowerment Mind Center in Tehran, Iran, during 2019, as well as the utilization of a self-report questionnaire.

## Conclusions

In conclusion, the effectiveness of mind simulation on increasing social communication, self-confidence, self-concept, and reducing anxiety in stuttering individuals was confirmed in this study. However, it can be concluded that these plans provide a reliable solution to overcome stuttering-derived anxiety, as well as increase social communication, self-confidence, self-concept, and capacity strengthening. The current mind simulation methods have also considerable effects on psychological symptoms and mental capabilities of adults suffering from stuttering that can be used as an effective way to improve stuttering.

## Compliance with ethical guidelines

All ethical principles were considered in this study. The participants were informed about the research objectives and procedures; moreover, informed consent was obtained from the parents or guardians of the participants. They were also assured about the confidentiality of their information. Moreover, they were allowed to leave the study whenever they wish, and if desired, the results of the research would be available to them.

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thesis by Negin Peivandinejad in Psychology.

### Conflicts of Interest

There are no conflicts of interest regarding the publication of the study.

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