

Research Paper: Designing Family-Based Cognitive Rehabilitation and Evaluation of Its Effectiveness on Working Memory, Sustained Attention, Inhibition, and Social Skills of Children With Intellectual Disability



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Citation: Ghasemi S, Arjmandnia AA, Gholamali Lavasani M. Family-Based Cognitive Rehabilitation and Evaluation of Its Effectiveness on Working Memory, Sustained Attention, Inhibition, and Social Skills of Children With Intellectual Disability. Journal of Modern Rehabilitation. 2019; 13(2):87-96. <http://dx.doi.org/10.32598/JMR.13.2.87>

doi <http://dx.doi.org/10.32598/JMR.13.2.87>



Article info:

Received: 08 Dec 2018

Accepted: 27 Feb 2019

Available Online: 01 Apr 2019

Keywords:

Cognitive rehabilitation,
Working memory, Sustained
attention, Cognitive inhibition

ABSTRACT

Introduction: Educational performance and executive functions are two factors related to positive outcomes. Delay or the reduction of the development of executive functions in children with Intellectual Disabilities (ID) may result in negative outcomes in social skills and educational competence. The main important aspects of executive functions, including working memory, attention, and inhibition are considered the main predictors of learning social skills, as well as educational skills in life. The current study aimed at evaluating the effectiveness of family-based cognitive rehabilitation on working memory, sustained attention, inhibition, and social skills of children with ID.

Materials and Methods: The participants of the present study were a subgroup of 11-14-year-old children with ID, who were studying in the exceptional schools from 2017 to 2018 in Tehran, Iran. The samples were selected by clustering multi-stages method; 15 students were assigned to the experimental group and 15 students were assigned to the control group. Then, they were evaluated by the Boshra test for cognitive inhibition, working memory test for children, Integrated Visual and Auditory (IVA) test, Behavior Rating Inventory of Executive Function (BRIEF), and Vineland social skill scale before and after the cognitive family-based intervention. The experimental group received 12 sessions of intervention. The data were analyzed by SPSS V. 24.

Results: Family-based cognitive rehabilitation had significant effects on improving working memory, attention, and inhibition ($P < 0.001$) through addressing underlying executive functions, but had no significant effect on the social skills of children with ID.

Conclusion: As a new intervention, cognitive family-based rehabilitation may improve the executive functions of children with ID as supplementary intervention along with behavioral or other cognitive interventions to help children overcome some challenges under social situations.

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1. Introduction

Executive function is a term used by psychologists to describe many tasks, which our brain does to act, think, and solve problems. Executive functions help us learn new information, remember and retrieve information that we got in the past, and use this information for everyday problem-solving. Executive functions make it possible to live, work, and learn to get independence and competence in any age [1]. Executive functions include abilities, such as working memory, attention, cognitive flexibility, problem-solving, decision-making, and inhibition. People who suffer from poor executive functions do not perform these tasks intuitively. They may have difficulties with planning, organizing, and managing time and place. The weaknesses of the executive functions can be seen at any age, but become more obvious when children reach mid to upper elementary grades [2].

Intellectual Disability (ID) is a disability that occurs in the developmental period of life before 18 years old and is characterized by intelligence quotient below average. The main characteristics of this clinical population include intelligent quotient under 70, as well as deficits in at least 2 areas of adaptive behaviors such as communication, self-care, social skills, and learning (for example reading and writing). The ID is defined based on the amount of subjective severity and disability.

The Diagnostic and Statistical Manual of Mental Disorders, fifth edition describes intellectual functioning as abstract thinking, planning, ability to solve problems, and capacity for academic learning, which needs working memory, shifting attention, and inhibit irrelevant stimulus. An adaptive function includes social skills and the ability to work and communicate with others [3]. People with ID have limitations in intellectual functioning and adaptive behaviors, such as social and practical skills [3]. As a system for short-term maintenance and manipulating information, working memory is very weak in people with ID [4]. Given its important role in cognitions, improving working memory was an important issue in some studies [5-8].

Attention is one of the most important components of executive functions affecting education and learning. Attention is defined as a set of complex mental acts involving concentration on goal, keeping attention, and changing focus from one stimulus to another one [9]. Several studies on attention in this population evaluate the effectiveness of attention training and report positive results [10-13].

Children with ID have difficulty in controlling their impulses, organizing, prioritizing, and coordinating the information they receive because of weakness in underlying mechanisms [14]. Previous studies evaluated the effects of inhibition training in ID and reported that such intervention has significant effects [15-21].

Adaptive behavior is a behavior that the individual does to meet the social/cultural norms of independence and social responsibility. Social skills represent behaviors that predict some social outcomes. Not only poor social skills and peer interaction are problematic in this population but also they affect psychological and psychiatric problems [22]. Daily activities like sharing, turn-taking, extending social cues, and participating in class may create problems for children with poor executive functions. When children with poor executive functions experience problems in social interaction, they are separated from peers and may experience other difficulties in a particular situation [23]. Previous studies investigated the social skills training of this population and reported positive consequences [24-26]. So, there is a necessity to understand the best intervention to improve executive functions and the social skills of this population to improve their quality of life.

Various studies have been carried out on the effectiveness of the cognitive intervention on some components of executive functions [8, 27]; but, there is no study on the effectiveness of family-based intervention for improving executive functions and social skills of this population. Since executive functions and social skills are not perfect in this population, children with ID have no appropriate performance under the social situations, and because executive functions predict social skills, families of these children are worried about their social skills; so, they help to reduce their worries, educational delivery, treatment, and rehabilitation of new strategies and to improve their personal/social independence. Thus, the intervention based on family is important because children may generalize their improvement during the intervention to another setting with the support of parents; the reason is the fact that family, especially parents, can help their children since they spend more time than the other ones with their children and parents are aware of their children's needs and problems; therefore, the present study tried to fill the gap by designing the family-based intervention. The family-based intervention means that this intervention was held by the presence of parents beside children as supportive figures. Parents accompanied the children step by step to give them emotional security and learn how to work with their children.

The present study aimed at evaluating the effectiveness of family-based cognitive rehabilitation (that is new and researcher-made) on the executive functions and social skills in the context of family involvement.

2. Materials and Methods

Thirty intellectual disabled students (with the range of 10-14 years old) were randomly selected from the exceptional schools of Tehran, Iran; they were assigned to the experimental (n=15) and control (n=15) groups. In this research, 4 students did not continue sessions and were excluded; so, the researcher excluded 4 students from the control group. The inclusion criteria included intelligence quotient between 55 and 70 (mild to the border), as well as the age between 10 and 14 years. The exclusion criteria included having comorbid disorders and receiving other interventions.

Research tools

Vineland Social Skill Scale

This measure is a tool that evaluates adaptive behaviors; it was introduced by Doll for the first time in 1936 and was revised in 1984. In 1978, it was validated by Boraheni, Okhovat, and Loghman in Iran [28]. This scale is used for 0- to 25-year-old individuals. It is applicable to mental disability subject. This scale is completed by one, who knows the subject very well and is rated by 0, 0.5, and 1. This tool has 8 levels, including general self-help, self-help in eating, self-help in clothing, self-guidance, employment, communication, socialization, and movement. Reliability is reported by Cronbach alpha as 0.99 and the construct validity is reported as 0.92 by factor analysis method [28].

Boshra Test (Cognitive Inhibition)

Boshra test is used for cognitive inhibition and impulse control that became standard and validated by Rafih khah et al. Samples for this validating were 225 students at the elementary level (117 girls and 108 boys) that were sampled by the selected method. The results of the re-test (after 2 weeks) showed that the reliability coefficient of the cognitive inhibition test was 0.74 for the interference score and 0.84 for time ($P < 0.0001$). In addition, the correlation between the Boshra and Stroop tests of color-words was on average. The correlation coefficient was 0.48 for the interference score and 0.42 for time ($P < 0.001$). Also, column figures for time and interference scores showed the normality of scores. The results showed that the Boshra test had good validity and it can be used as a good tool for measuring cognitive inhibition and impulse control [29].

Working Memory Test Battery for Children

Working Memory Test Battery for Children is a global measure for working memory capacity, phonological loop, visual-spatial sketchpad, and central executive of 5- to 15-year-old individuals. This test was introduced and developed by Pickering and Goddard in 2001 and includes 9 subscales based on 3 main components of working memory. This is used by psychologists to evaluate memory in children and adults. Elicit of the index to use in the test is performed based on the working memory model in a few decades, and it seems that it becomes an influential model for working memory [30]. The re-test reliability for each subscale was calculated by the Pearson correlation coefficient. Auditory recalling for the first and second years has high re-test reliability (0.83) and auditory recalling for the fifth and sixth years has low re-test reliability (0.38).

The test re-test reliability coefficients were 0.45 to 0.83 [31]. Arjmandnia and Seif Naraghi used Cronbach alpha to calculate the reliability coefficient. The results showed that the Cronbach alpha coefficient was 0.9. This test has high validity (all coefficients are significant at the level of 5%). The sub-scores of the test are correlated with the 3-component model of working memory of Baddeley and Hitch for 5- to 15-year-old children [30].

Integrated Visual and Auditory (IVA) performance (assessing attention, concentration, and inattention/hyperactivity)

IVA is a continuous visual/auditory test that takes 13 minutes to perform and evaluates reaction control and attention. This test was introduced and developed by Sandford and Turner in 1994. This is based on the Diagnostic and Statistical Manual of Mental Disorders, fifth edition and differentiates sub-types of Attention Deficit Hyperactivity Disorder (ADHD). This is considered the most accurate tool for the diagnosis of ADHD. It distinguishes between 5 types of attention, including concentrated attention, continuous attention, selected attention, divided attention, and shifting attention in the visual and auditory levels. This test is used for 6-year-old individuals up to adults. It takes 20 minutes to perform. The task of the test is reaction or non-reaction to 500 test targets. Each target is presented only 1.5 seconds. The results showed the sensitivity of this test as 0.92 and prediction power as 0.89 for the diagnosis of ADHD. It is a useful tool for the evaluation of cognitive rehabilitation effects, the early identification of Alzheimer's, and the evaluation of learning methods and learning disabilities [31]. It is worth noting that this tool is translated into the Persian

language and is considered as the standard global test since it does not depend on the cultural text and its items are only based on 1 and 2 scores; thus, standardization was not done.

Behavior Rating Inventory of Executive Function (BRIEF)

BRIEF is considered the most validated tool for measuring executive function. This questionnaire was written by Jerard and et al. in 1963; it includes 86 items. This tool is designed so that each item measures one dimension of executive function. Executive function dimensions are selected by writers because of the theoretical, clinical, and previous studies. These dimensions include inhibition, attention transference, emotional regulation, working memory, planning, control, initiation, and organization. This list has 3 versions for 3 age groups; pre-school version (2-5 years old), child and adolescent version (5-18 years old), and a version for parents/teachers (18-90 years old). The internal consistency of this test was calculated by Cronbach's alpha from 80 to 98 in 1951 for the parents' and teachers' forms. The internal consistency of the parent form is 0.82 to 0.98 and test-retest reliability is 0.72 to 0.84. In Iran, the validity of each subscale in the parent form is reported as follows: control (0.76), organization (0.79), planning (0.85), working memory (0.85), initiation (0.80), emotional control (0.79), shifting attention (0.79), and inhibition (0.84) (33). In this research, the present questionnaire measures only working memory and inhibitions are used.

Procedure

Firstly, a recommendation letter was got from the university management; then, the researcher referred to Special Education Organization to get a necessary allowance and after all, the researcher went to the exceptional schools (based on the clustering sampling method). Thirty subjects were selected based on the simple random sampling method. The importance of this intervention was explained for families and written consent was obtained for holding the intervention for 12 sessions (1 hour for each week). The researchers performed family-based cognitive rehabilitation (this rehabilitation package was designed and developed by authors based on the existing definitions and general principles with reviewing structures, contents of current tests, as well as based on a book titled "improvement working memory" translated and written by authors). Executive functions (attention, working memory, response inhibition) and social skills were assessed for both groups before and after the intervention to evaluate the effectiveness of the intervention. Cognitive rehabilitation protocol was designed based

on the executive functions (attention, working memory, and inhibition) from easy to difficult levels and delivered during 12 sessions. Table 1 presents the content of the sessions.

3. Results

According to the nature of the present research, the findings are presented in descriptive statistics and inferential statistics. In the descriptive part, the distribution of statistical samples is presented, and in the inferential part, assumptions are evaluated by Analysis of Covariance (ANCOVA) (one variable) and Multivariate Analysis of Covariance (MANCOVA) (more than one variable).

According to Table 2, the experimental group had better performance after the intervention, while the control group had no significant differences in performance between pre-test and post-test. The following addressed the inferential statistics to explain the differences. Before analyzing the data, the normality (by the Wilks-Shapiro test), the homogeneity of the matrix, and the equality of error variance (by the Levene's test) were tested for each dimension. With regard to meeting the assumptions, ANCOVA was used for assessing the effectiveness of family-based cognitive rehabilitation on executive function (working memory, attention, and response inhibition) of the mentally-disabled children.

Based on Table 3, the two groups were different after removing the Pre-test effects ($P < 0.01$), suggesting that cognitive rehabilitation has significant effects on working memory except on the central executor component. According to Table 4, the results of MANCOVA suggested that F is significant in the level of $P < 0.001$ with a degree of freedom of 2 and 17. The findings suggest that both group are different after removing the Pre-test effects in working memory and inhibition ($\eta^2 = 0.17.56$ $P < 0.01$; $fd = 2,71$; $F = 12.22$; Pillai's Trace = 0.17). To understand and make more clear effects of independent variables on each dependent variable, the cross-effects of variables are presented in Table 4.

As Table 5 suggests, both groups are different after removing the Pre-test effects ($P < 0.001$); thus, family-based cognitive rehabilitation had significant effects on the executive functions (working memory and inhibition). Therefore, our hypothesis is approved.

According to Table 6, both groups are different after removing the Pre-test effects ($P < 0.01$); thus, family-based cognitive rehabilitation had significant effects on the executive functions (attention). Therefore, our hypothesis is approved.

Table 1. Content of family-based cognitive rehabilitation emphasizing the variable

| Number | Content |
|--------|--|
| 1 | The general session for all families that participate in this research. It contains explanations for the importance of family-based cognitive rehabilitation emphasizing working memory, sustained attention, and response inhibition in daily life, educational success, as well as social skills. The general trend of sessions and family roles in this intervention are introduced, and procedures and protocol will be introduced. |
| 2 | 1. Working memory: Practice for memorizing memory cards based on the instruction 2. Inhibition: Reverse response by using yes or no and pantomime of sitting and standing 3. Sustained attention: Practices based on IVA and CPT (visual with geometric figures) Training all practices to families and giving home works |
| 3 | Reviewing the previous session and family feedback for practices 1. Working memory: Practice for memorizing pattern (patterns of geometric figures and sticks) according to the instructions. 2. Inhibition: Practice for number matching (writing and mathematics) 3. Sustained attention: Practices for sustained attention based on IVA and CPT (visual with numbers) Training all practices to families and giving home works |
| 4 | Reviewing the previous session and family feedback for practices 1. Working memory: Practice for memorizing numbers with blocks (visual and auditory) according to the instructions 2. Inhibition: Practice for word inhibition. 3. Sustained attention: Practices for sustained attention based on IVA and CPT (auditory with focus on target word) Training all practices to families and giving home works |
| 5 | Reviewing the previous session and family feedback for practices 1. Working memory: Practice for memorizing colorful channels and cars according to the instructions 2. Inhibition: practice for lights and driving signs 3. Sustained attention: Practices for sustained attention based on IVA and CPT (auditory with focus on the target verb and doing that verb) Training all practices to families and giving home works |
| 6 | Reviewing all 5 sessions and getting feedback from families |
| 7 | Reviewing the previous session and family feedback for practices 1. Working memory: Practice for memorizing colorful blocks and glasses and memorizing words according to the instructions 2. Inhibition: Practice for the inhibition of geometric figures, numbers, and colors 3. Sustained attention: Practices for sustained attention based on IVA and CPT (visual and auditory) Training all practices to families and giving home works |
| 8 | Reviewing the previous session and family feedback for practices 1. Working memory: Practice for memorizing letters and words blocks according to the instructions 2. Inhibition: Practice for guidance signs and counting forward and backward numbers 3. Sustained attention: Practices for sustained attention based on IVA and CPT (visual and auditory) Training all practices to families and giving home works |
| 10 | Reviewing previous session and family feedback for practices 1. Working memory: practice for memorizing doing verbs according to the instructions, for memorizing words, omitting target letters, and recalling new words (auditory) 2. Inhibition: practice for picture matching and heterogeneous names, and practice for researcher-made software based on spatial Stroop 3. Sustained attention: Practices for sustained attention based on IVA and CPT (visual and auditory) Training all practices to families and giving home works |
| 11 | Reviewing the previous session and family feedback for practices 1. Working memory: Practice for trying cloth and memorizing the color of cloth and name of people 2. Inhibition: practice for naming the picture on center of cart and non-recalling pictures on the edges of carts, practice for researcher-made software based on step signal. 3. Sustained attention: Practices for sustained attention based on IVA and CPT (visual and auditory) Training all practices to families and giving home works |
| 12 | Reviewing the previous session and family feedback for practices 1. Working memory: reviewing the optimization of package and the optimization of working memory book (visual and auditory). 2. Inhibition: Reviewing the previous sessions and delay practices in response to guidance lights 3. Sustained attention: Practices for sustained attention based on IVA and CPT (visual and auditory) Training all practices to families and giving home works |

Table 2. Descriptive statistics of Mean±SD of dependent variables based on group and stage

| Variable | Stage | Mean±SD | | |
|----------------|---------------------------|--------------|-------------|------------------|
| | | Experimental | Control | |
| Working memory | Central executor | Pre-test | 56.36±1.29 | 57.09±1.92 |
| | | Post-test | 56.73±1.62 | 56.45±1.57 |
| | Visual- spatial sketchpad | Pre-test | 58.18±4.05 | 59.09±3.65 |
| | | Post-test | 66.09±4.57 | 58.64±3.93 |
| Boshra | Phonological loop | Pre-test | 56.82±3.37 | 58.64±3.93 |
| | | Post-test | 68.73±4.86 | 60.45±4.18 |
| | Interference | Pre-test | 9.91±6.09 | 10.36±4.76 |
| | | Post-test | 6.36±3.53 | 9.73±4.84 |
| Social skills | Time | Pre-test | 64.18±17.16 | 61.55±16.08 |
| | | Post-test | 51.36±8.94 | 52.91±20.21 |
| | Working memory | Pre-test | 14.55±2.73 | 13.55±2.54 |
| | | Post-test | 11.82±3.06 | 14.00±2.97 |
| | Inhibition | Pre-test | 15.09±2.21 | 13.82±2.09 |
| | | Post-test | 12.45±2.07 | 13.64±2.16 |
| IVA | Social skills | Pre-test | 66.27±3.61 | 665.00±5.46 |
| | | Post-test | 67.45±3.01 | 66.18±5.74 |
| IVA | Attention | Pre-test | 36.05±10.35 | 37.8236.45±10.06 |
| | | Post-test | 56.36±1.29 | 37.82±11.84 |

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Table 3. The results of the cross-effects of the mean of the dependent variable (working memory test)

| Dependent variable | Source | Three Types of Sum of Squares | Degree of Freedom | F | Sig. | Eta S |
|--------------------------|----------|-------------------------------|-------------------|-------|-------|-------|
| Central executor | Pre-test | 19.71 | 1 | 12.26 | 0.001 | 0.41 |
| | Group | 4.87 | 1 | 3.02 | 0.001 | 0.15 |
| Visual-spatial sketchpad | Pre-test | 252.34 | 1 | 54.6 | 0.001 | 0.76 |
| | Group | 286.41 | 1 | 61.97 | 0.001 | 0.78 |
| Phonological loop | Pre-test | 185.78 | 1 | 16.39 | 0.001 | 0.49 |
| | Group | 471.27 | 1 | 41.59 | 0.001 | 0.71 |

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To evaluate the effectiveness of cognitive rehabilitation on social skills, ANCOVA was used. However, before analyzing the data, the equality of the error variance (by the Levene's test) was tested for social skills. [Table 7](#) presents the results of the ANCOVA.

According to [Table 7](#), the results of ANCOVA suggest that the mean of the corrected scores after examining the social skills had no differences after removing the Pre-test effects ($P>0.05$); thus, family-based cognitive rehabilitation had no effects on the social skills of the mentally-disabled children.

4. Discussion

The main aim of this research was designing cognitive family-based rehabilitation (sustained attention, working memory, and inhibition) and evaluating its effects on the executive functions and social performance of male children between 10 and 14 years old.

The first assumption: cognitive family-based rehabilitation (sustained attention, working memory, and inhibition) has effects on the executive functions of male children between 10 and 14 years old.

Table 4. MANCOVA test for BRIEF in the effectiveness of the intervention on working memory and response inhibition in ID

| Test | Value | F | Degree of Freedom | Degree Freedom of Error | Sig. | Eta Square |
|--------------------|-------|-------|-------------------|-------------------------|-------|------------|
| Pillai's Trace | 0.71 | 0.001 | 17 | 2 | 21.23 | 0.71 |
| Wilks lambda | 0.71 | 0.001 | 17 | 2 | 21.23 | 0.28 |
| Hotelling s trace | 0.71 | 0.001 | 17 | 2 | 21.23 | 2.49 |
| Roy s largest root | 0.71 | 0.001 | 17 | 2 | 21.23 | 2.49 |

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Table 5. The results of the cross-effects of the mean of dependent variables (BRIEF test)

| Dependent Variable | Source | Three Types of Sum of Squares | Degree of Freedom | F | Sig. | Eta S |
|--------------------|----------|-------------------------------|-------------------|-------|-------|-------|
| Inhibition | Pre-test | 144.65 | 1 | 98.33 | 0.001 | 0.85 |
| | Group | 51.47 | 1 | 34.99 | 0.001 | 0.66 |
| Working memory | Pre-test | 54.79 | 1 | 34.39 | 0.001 | 0.65 |
| | Group | 24.57 | 1 | 15.42 | 0.001 | 0.46 |

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Given the multi-variable covariance, it seems that there is a significant difference between the two groups that is consistent with some studies (5-8), but it is non-consistent with previous studies [15-21].

According to IVA+ test and MANCOVA, there is a significant difference between the two groups in sustained attention ($P < 0.01$). Also, according to the Boshra test and BRIEF, this intervention was effective ($P < 0.01$) and increasing scores in these tests after the intervention suggested the effectiveness of the intervention in terms of working memory and inhibition. That effectiveness was not unexpected because children with ID have difficulties underlying

ing the processes of executive function that were targeted by the present intervention.

To explain this assumption, it can be said that the executive functions are a general term for cognitive capacities; working memory and cognitive flexibility, as the main components of the executive functions, play an important role in learning and goal-centered behavior. Children with ID have memory difficulties; so, they have difficulties in educational tasks and executive functions [6].

Therefore, the intervention in this field may help children to overcome their difficulties; given the fact that

Table 6. The results of ANCOVA (IVA test for the effects of the intervention on attention)

| Dependent variable | Source | Three Types of Sum of Squares | Degree of Freedom | F | Sig. | Eta S |
|--------------------|----------|-------------------------------|-------------------|--------|--------|-------|
| Attention | Pre-test | 2302.39 | 1 | 200.53 | 0.0001 | 0.91 |
| | Group | 167.56 | 1 | 14.59 | 0.0001 | 0.43 |

JMR

Table 7. The results of ANCOVA for social skills

| Dependent variable | Source | Three Types of Sum of Squares | Degree of Freedom | F | Sig. | Eta S |
|--------------------|----------|-------------------------------|-------------------|-------|------|-------|
| Social skills | Pre-test | 15.4 | 1 | 34.1 | 0.2 | 60.0 |
| | Group | 057.0 | 1 | 018.0 | 0.8 | 10.0 |

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cognitive rehabilitation based on flexibility and self-recovery of brain makes low-active regions of brain more excited and creates synaptic changes and since families spend more time with children than the other units of the society and contribute to the generalization of effects to different real situations, the presence of families during intervention may add the effectiveness of the intervention. In addition, since this intervention was held by helping parents for home works, children with ID showed improvement by supports of the parents.

The second assumption: cognitive family-based rehabilitation (sustained attention, working memory, and inhibition) has effects on the social skills of male children between 10 and 14 years old. With regard to the Vineland questionnaire and ANCOVA, there was a significant difference between the two groups ($P < 0.01$). According to the findings, this assumption was not approved. This finding was not consistent with the previous studies [24-26]. For explaining this finding, it can be said that improving social skills through some training sessions is partly impossible; also, the non-significant effects of cognitive rehabilitation on the social skills does not mean that such intervention is not useful rather it implies that targeting the underlying mechanism of social skills (adaptive behavior and executive functions) should be addressed early and for long period, as well as in a continuous way, since this population show the improvement of social skills in different settings. Using the family approach may be useful in achieving goals because of the interaction with adults and peers in the group intervention.

So, there is a necessity to evaluate all levels of social skills to demonstrate the effectiveness of rehabilitation. It was impossible for this research; thus, this may be a topic for future studies. Impairments in the social skills for this clinical population is the result of environmental limitation in learning social skills, doing skills, and enforcing skills. The decrease of impairments in social skills depends on the family support system; the effectiveness of this system will be decreased by decreasing stress and increasing adaptation to limitations.

Also, this research indicates that the combined rehabilitation and family activities improve working memory, social skills, and attention among children because this program adds innovative elements to the traditional training programs. The family-based program, which contains domain-specific content of the executive functions, social interactions, and attention strategies, integrates family activities and domain-specific cognitive rehabilitation. Trainers often find it difficult to reach ap-

proaches to teach strategies of memory, attention, and social skills for children. This program helps the children to recognize different cognitive and social skills and positive interactions with adults. This rehabilitation program provides temporary storage of knowledge in the period of cognitive activities and social skills among children, which appears to play a basic role in working memory, sustained attention, inhibition, and minting social skills in different and practical situations for children with ID. Furthermore, the benefits of this program enable its implementation in educational centers for exceptional children and in early childhood classrooms, which increases attention, working memory, and social skills.

In most studies, social skills were targeted directly through intervention because children with ID have problems in the generalization of training to other situations; so, they may need more training to change performance and social growth. Therefore, cognitive family-based rehabilitation (sustained attention, working memory, and inhibition) had no effects on the social performance of male children between 10 and 14 years old.

The present research can be considered as supplementary intervention along with other cognitive and behavioral interventions to address the difficulties of children with ID, but it has some limitations. Firstly, the samples included male students; thus, the generalization of the findings to the female gender, as well as to other pages, should be done cautiously. The evaluation of an exceptional population like ID is a complex and long process; so, it is suggested that future studies focus on long-term intervention in a continuous way. It is suggested that the present family-based cognitive rehabilitation be held for other populations with similar problems like ADHD group and the results be compared to each other. The present intervention may be useful for the teachers and families of children with ID for applying at a broad level and in schools and care centers.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles were considered in this article.

Funding

This article has got no funding from any organization or institution.

Authors contributions

All authors contributed to preparing this article. All of them were active in conceptualization and data analysis. Solmaz Ghasemi was responsible for implementing intervention and gathering data, as well as writing the final manuscript.

Conflict of interest

The authors declared no conflict of interest.

References

- [1] Groome D. An introduction to cognitive psychology. 3rd ed. London: Psychology Press; 2013. [DOI:10.4324/9781315871554]
- [2] Titz C, Karbach J. Working memory and executive functions: Effects of training on academic abilities. *Psychological Research*. 2014; 78(6):852-68. [DOI:10.1007/s00426-013-0537-1] [PMID]
- [3] American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed. Arlington: American Psychiatric Publishing; 2013. [DOI:10.1176/appi.books.9780890425596]
- [4] Peng P, Fuchs D. A meta-analysis of working memory deficits in children with learning difficulties: Is there a difference between verbal domain and numerical domain? *Journal of Learning Disabilities*. 2016; 49(1):3-20. [DOI:10.1177/0022219414521667] [PMID]
- [5] Ghorbanzadeh B. [Effect of rhythmic exercise on memory and attention in children with intellectual disability (Persian)]. *Journal of Sport Management and Motor Behavior*. 2018; 14(27):43-54. [DOI:10.22080/JSMB.2018.7636.2041]
- [6] Carretti B, Lanfranchi S, Mammarella IC. Spatial-simultaneous and spatial-sequential working memory in individuals with Down Syndrome: The effect of configuration. *Research in Developmental Disabilities*. 2013; 34(1):669-75. [DOI:10.1016/j.ridd.2012.09.011] [PMID]
- [7] Danielsson H, Zottarel V, Palmqvist L, Lanfranchi S. The effectiveness of working memory training with individuals with intellectual disabilities - a meta-analytic review. *Frontiers in Psychology*. 2015; 6:1230. [DOI:10.3389/fpsyg.2015.01230] [PMID] [PMCID]
- [8] Pumacahua TT, Wong EH, Wiest DJ. Effects of computerized cognitive training on working memory in a school setting. *International Journal of Learning, Teaching, and Educational Research*. 2017; 16(3):88-104.
- [9] Kirk HE, Gray K, Riby DM, Cornish KM. Cognitive training as a resolution for early executive function difficulties in children with intellectual disabilities. *Research in Developmental Disabilities*. 2015; 38:145-60. [DOI:10.1016/j.ridd.2014.12.026] [PMID]
- [10] Najarzagdegan M, Nejati V, Amiri N, Sharifian M. [Effect of cognitive rehabilitation on executive function (working memory and attention) in children with Attention Deficit Hyperactivity Disorder (Persian)]. *Scientific Journal of Rehabilitation Medicine*. 2015; 4(2):97-108.
- [11] Rostaman H, Talepasand S, Nazifi M. [The effect of executive function training on executive performance and behavioral symptoms of children with Attention Deficit Hyperactivity Disorder (Persian)]. *Journal of Clinical Psychology*. 2013; 5(1):93-106.
- [12] Hosseini M. [Comparison of executive functions in normal and intellectual disability (Persian)]. *First Conferences of Social-Individual Empowerment of Exceptional People*, Ghaen Branch Azad University. 2015. Available from: https://www.civilica.com/Paper-ISEPP01-ISEPP01_109.html.
- [13] Najian A, Nejati V, Akbarpoor F. [Evaluation of cognitive rehabilitation based on improvement of movement on cognitive skills of ADHD (Persian)] [MA. thesis] Tehran: Shahid Beheshti University; 2018.
- [14] Tamm L, Menon V, Reiss AL. Maturation of brain function associated with response inhibition. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2002; 41(10):1231-8. [DOI:10.1097/00004583-200210000-00013] [PMID]
- [15] Nesayan A, Asadi Gandomani R. [Effectiveness of social skills training on behavioral problems in adolescents with intellectual disability (Persian)]. *Journal of Rehabilitation*. 2016; 17(2):158-67. [DOI:10.21859/jrehab-1702158]
- [16] Azizi A, Mir Drikvand F, Sepahvand MA. [Effectiveness of cognitive rehabilitation training on continuous attention, working memory and visual - motor perception in primary school students with specific learning disability (Persian)]. *Quarterly Journal of Social Cognition*. 2017; 6(1):135-46.
- [17] Kumar GS, Venkatesan S. Reappraisal of research on executive function training in children with learning disabilities. *International Journal of Psychology and Psychiatry*. 2014; 2(1):7-18. [DOI:10.5958/j.2320-6233.2.1.002]
- [18] Steenbergen-Hu S, Makel M, Olszewski-Kubilius P. What one hundred years of research says about ability-grouping and acceleration on K-12 students' academic achievement: Findings of two second-order meta-analysis. *Review of Educational Research*. 2016; 86(4):849-99. [DOI:10.3102/0034654316675417]
- [19] Schuiringa H, van Nieuwenhuijzen M, Orobio de Castro B, Matthys W. Executive functions and processing speed in children with mild to borderline intellectual disabilities and externalizing behavior problems. *Child Neuropsychology*. 2017; 23(4):442-62. [DOI:10.1080/09297049.2015.1135421] [PMID]
- [20] Farghaly WM, Ahmed MA, El-Tallawy HN, Elmestikawy TA, Badry R, Farghaly MS, et al. Construction of an Arabic computerized battery for cognitive rehabilitation of children with specific learning disabilities. *Neuropsychiatric Disease and Treatment*. 2019; 14:2123-31. [DOI:10.2147/NDT.S155987] [PMID] [PMCID]
- [21] Giuliani F, El Korh P. Social skills group for adults living with intellectual disabilities. *Clinical Psychiatry*. 2016; 2(2):9. [DOI:10.21767/2471-9854.100022]
- [22] Barnes TN, Wang F, O'Brien KM. A meta-analytic review of social problem-solving interventions in preschool settings. *Infant and Child Development*. 2018; 27(2):e2095. [DOI:10.1002/icd.2095]

- [23] Corbett BA, Key AP, Qualls L, Fecteau S, Newsom C, Coke C, et al. Improvement in social competence using a randomized trial of a theater intervention for children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*. 2016; 46(2):658-72. [DOI:10.1007/s10803-015-2600-9] [PMID] [PMCID]
- [24] Christ SE, Stichter JP, O'Connor KV, Bodner K, Moffitt AJ, Herzog MJ. Social skills intervention participation and associated improvements in executive function performance. *Autism Research and Treatment*. 2017; 2017:5843851. [DOI:10.1155/2017/5843851]
- [25] Homayounnia Firoozjah M, Sheikh M, Hemayattalab R, Shahrbanian Sh, Homayouni AR. [The effect environmental approach (affordances) approach to metacognitive of children with mental disorders (Persian)]. *Journal of Neuropsychology*. 2018; 4(3):59-72.
- [26] Adeniyi YC, Omigbodun OO. Effect of a classroom-based intervention on the social skills of pupils with intellectual disability in Southwest Nigeria. *Child and Adolescent Psychiatry and Mental Health*. 2016; 10(1):29. [DOI:10.1186/s13034-016-0118-3] [PMID] [PMCID]
- [27] Demily C, Rigard C, Peyroux E, Chesnoy-Servanin G, Morel A, Franck N. «Cognitus & Moi»: A computer-based cognitive remediation program for children with intellectual disability. *Frontiers in Psychiatry*. 2016; 7:10. [DOI:10.3389/fpsy.2016.00010] [PMID] [PMCID]
- [28] Saatchi M, Kamkar K, Asgarian M. [Psychological tests (Persian)]. Tehran: Virayesh; 2010.
- [29] Rafi khah M, Arjmandnia A, Mohajerani M, Nodeci KH. [Construction, normalization, and validation of Boshra Test (Cognitive Inhibition Assessment) (Persian)]. *Cognitive and Behavioral Sciences Research*. 2016; 6(2):1-14.
- [30] Arjmandnia AA. [Working memory: From assessment to intervention in clinical and academic settings (Persian)] 1st ed. Tehran: Roshd Farhang; 2016.
- [31] Hou J, Zhang Y, Xu M. Study on integrated visual and auditory continuous performance test in ADHD children. *Journal of Nantong University (Medical Sciences)*. 2006; 3(6):23-45.
- [32] Damhari F, Alizade A and Pezeshk sh. [Desining and writing social-psychological program and evaluation of its effectiveness on executive functions and challenging behaviors of autistic children with high functions (Persian)] [MSc. thesis]. Tehran: Allameh Tabatabaei University; 2016.