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Comparison of the Effectiveness of Yoga Training with Emotion Regulation Training on Students' Working Memory and Cognitive Flexibility

Samieh Fakhary Nejad
Ph.D. Candidate, Department of Psychology, Islamic Azad University, Roudehen Branch, Iran
Mina Mojtabaie*, Ph.D.
Department of Psychology, Faculty of Psychology, Islamic Azad University, Roudehen Branch, Roudehen, Iran
Malek Mirhashemi, Ph.D.
Department of Psychology, Faculty of Psychology, Islamic Azad University, Roudehen Branch, Roudehen, Iran

Abstract

This study aimed to compare the effectiveness of yoga training with emotion regulation training on students' working memory and cognitive flexibility. The research methodology was quasi-experimental designed as pretest and posttest with control and follow-up groups. Entire second-grade female high schoolers in the 2nd District of Tehran, during 2018-19 academic year, constituted study's statistical population, of whom 54 students were chosen using cluster random sampling method, and randomly assigned into three groups. The pretest of N-back and Denis and Wenderval's cognitive flexibility (2010) was administered for all three groups; and then the experimental groups received yoga training and emotion regulation intervention and finally posttest was implemented followed by 4-week follow-up test. Data analysis used by analysis of variance with repeated measurements exhibited that, both trainings significantly resulted in an increase in components of Different recognition and recognition time of working memory and cognitive flexibility (p≤/001). Yoga training had more effect on the component of different recognition and psychological flexibility than on emotional regulation training (p≤/001), while the impact of both two interventions had not a significant difference on the component of recognition time.

Keywords: Cognitive flexibility, emotion regulation, working memory, yoga

Introduction

Academic achievement occupies one of the study areas in the education system. Many scholars today regard the role of executive functions in academic achievement as undeniable (Staff, Hogan, Williams, & Whalley, 2018). Executive functions encompass a wide spectrum of mental processes that enable the individual to consider the information received and respond appropriately to the tasks being performed. Executive function is a reflection of one's efficiency in three areas of cognitive abilities, including working memory (temporary storage and information processing in the mind), inhibition control (controlling attention or behavior, so as to avoid impulsive response, or current robust but inappropriate behavior) and cognitive flexibility (adjusting flexible behavior to meet new demands of the position) (Chan & Morgan, 2018). Executive functions such as working memory (Collins & Frank, 2012) and cognitive flexibility (Kercood, Lineweaver, Frank, & Fromm, 2017) directly affect students' academic achievement.

Working memory has the ability to receive stimuli, process them in the mind, and provide goal-based responses, which are one of the most important neuropsychological functions to adapt humans to the external environment (Baddeley, 2012). Another key ability in cognitive executive functions is cognitive flexibility, which is built on the ability to adapt quickly to changing environmental demands, adjusting prioritizations according to the needs of the environment, and complying with changes while sustaining candid and different perspectives. Cognitive

* **Corresponding Author**
Email: mojtabaie_in@yahoo.com

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flexibility remains exceedingly important for creativity, learning, and directing attention and is closely linked to social cognition and interpersonal relationships (Mittal, Mehta, Solanki, & Swami, 2014). The components of executive functions play an important role in the development of the essential educational and social skills of childhood and adulthood, and in the development of children's skills and abilities, such as mathematical ability (Van der Ven, Kroesbergen, Boom & Leseman, 2012), interpersonal abilities and emotion regulation (Chan & Morgan, 2018). In addition, deficiencies of working memory and cognitive flexibility are associated with many childhood and adulthood disorders, such as learning disorders (Peng, Congying, Beilei & Sha, 2012), attention deficit and hyperactivity disorder (Gehan & Samiha, 2011), anxiety, obsessive-compulsive (Kamaradova et al., 2016) and psychotic (Guimond, Chakravarty, Bergeron-Gagnon & Lepage, 2016). Therefore, rehabilitation, treatment, and enhancement of functions pertained to working memory and cognitive flexibility are among the primary needs in improving the performance of individuals in academic and social areas as well as in the treatment of clinical populations.

There are many ways to improve executive and cognitive functions, among which pharmacological, neurological, cognitive, cognitive-behavioral, meta-cognitive, aerobic and yoga interventions can be underlined (Gehan & Samiha, 2011; Van der Straten, Huyser, Wolters, Denys & Van Wingen, 2018). For example, Meiron and Lavidor (2013) concluded that the direct electrical stimulation of the brain by the skull influences working memory. Today, there is a growing emphasis on non-pharmacological methods to improve cognitive and executive functions, one of which is yoga. Yoga consists of physical movements (asanas), deep relaxation, breathing control (pranayama), observatory processes (kriyas), and mental and physical concentration, and is designed to ensure total health and physical and mental purification through mind and body controlling. Gothe, Pontifex, Hillman and Mc Auley (2013) examined the impact of yoga exercises on executive functions in a study and showed that post-yoga executive functions performed at much better levels than before training. Another study unveiled that yoga exercises enhance the function of key hormones playing a key role in the physiology of mood problems by improving circulation in the endocrine glands, which in turn ameliorate mood and subsequently executive functions. These researchers have suggested that improved mood leads to promoted executive functions, such as cognitive flexibility and the ability to plan and organize effectively (Mullur, khodnapur, Bagali & Aithala, 2012).

In addition to yoga, another influential teaching method for students is emotion regulation training. The relationship between emotion and cognition has been a topic of interest to psychologists and researchers. In the relationship between cognitive and emotional processes, Zelazo and Cunningham (2007) have presented a model in which emotion is a motivational aspect of cognition for goal-related problem solving. Developmental neuroscience findings confirm that emotion regulation and executive functions are indirectly linked and contribute to information analysis and activity execution (Bell & Wolfe, 2004). Furthermore, effective emotional regulation has been associated with positive outcomes for health, job and academic performance, and improved relationships (John & Groos, 2004) while linking hardship in emotional regulation to mental disorders (Burnham et al., 2003). .

One of the most principal emotion regulation models is the Gross emotion regulation model (Gross & Thompson, 2007). Based on the emotion generation quality model, Gross presented the emotion regulation process model, which consists of five stages (initiation, positioning, attention, evaluation, and response). Gross believed that each stage of the emotion generation process has a potential ordering purpose, and emotion regulation processes can be applied at different points in the process (Gross & Thompson, 2007). The results of cognitive developmental researches undisguised that emotional regulation development is strongly underpinned by several nuclei of executive functions such as attention control, inhibition of inappropriate behaviors, decision making, and other high-level cognitive processes (Tottenham, Hare & Casey, 2011). Cognitive sciences development also supports the claim that executive functions and emotional regulation are intricately interconnected, while both working for information processing and action execution (John & Gross, 2004). In addition, it is likely that both emotion regulation and executive functions influence each other. Emotion can be used to help organize one's thoughts, learning and practice, and cognitive processes also receive feedback from adjusting one's emotions. It can be stated that working memory and cognitive flexibility can be conceptualized as executive functions (Barclay, 2011), although a disagreement exists in this regard, however, working memory and cognitive flexibility are directly related to academic performance and can be reinforced (Steph, Hogan, Williams & Wally, 2018), While some studies have confirmed the role of emotional variables, e.g., emotional regulation, in

enhancing memory skills and cognitive ability (Ocak Karabay, 2019), other similar studies have highlighted the combined role of cognitive and physical exercises, including yoga, in enhancing cognitive skills (Joice, Manik, & Sudhir, 2018). Therefore, based on aforementioned statements, the current study dealt with comparing the effectiveness of yoga training and emotion regulation training on students' working memory and cognitive flexibility.

Method

The research methodology was quasi-experimental designed as pretest and posttest with control and follow-up groups.

Participants

All second-grade female high schoolers in the 2nd district of Tehran in the academic year 2018-19, make up the study statistical population, that according to a request from the Tehran Department of Education, the total number was 125,348. Multistage cluster random sampling was employed to select the sample in this study. In the first stage, of multiple educational districts of Tehran city' 2nd district, one district (District 4) was selected randomly, then out of these schools comprising 29 schools (public and nonprofit, it should be noted that the gifted and talented schools were excluded), 3 schools were randomly selected. In the following, 18 students were randomly chosen from the first, second, and third second-grade high school students that collectively amounted to 54 students which were randomly assigned to three groups. The criteria for admitting students to the sample group included high school education, occupying in education while conducting research, personal consent in accordance with ethical requirements for participation in the study, a second-grade high schooler and physical health acquisition. Exclusion criteria also included acute psychiatric disorder, receiving medication or psychotherapy, absence of training sessions for 3 sessions and more. The methodology sought a way that, after performing the necessary steps and coordinating with education and schools, the researcher visited schools and after randomly selecting and assigning experimental and control groups and before implementing yoga training sessions and emotion regulation, the study participants were subjected to an introductory session with the aim of preliminary acquaintance with students, establishing a therapeutic relationship, building trust in the subjects, and collecting pretest data. During the same introductory session for pretest data collection, the N-Bak test was performed individually and the cognitive flexibility questionnaire was administered to the students. Eventually, the first and second experimental groups were exposed to yoga training in 8 sessions of 70 to 90 minutes (according to Table 1) and emotion regulation training (according to Table 2). After completing eight sessions of both groups, students were re-evaluated and assessed using research tools during another short session to collect posttest data. Finally, the follow-up data were collected 4 weeks after the training sessions and posttest data collection using the research tools. Because of having more than two test sessions (pretest, posttest and follow-up), the data collected were analyzed using analysis of variance with repeated measures. The following tools have been used in this study as:

Instruments

Cognitive Flexibility Inventory (CFI): This questionnaire developed by Dennis JP, and Vander Wal (2010), is a short 20-item self-report tool. The scoring method is based on a 7-point Likert scale. The researchers in a study showed that the questionnaire owns a good factor structure, convergent validity and concurrent validity, that two factors of perception of different options and behavior justification convey unified meaning and the control factor was considered as the second subscale. The researchers calculated reliability using Cronbach's alpha for the whole scale, controllability perception, and perception of different options, respectively, 0.91, 0.91, and 0.84, and using retest as 0.81, 0.75, and 0.77, respectively. In Iran, Soltani, Shareh, Bahraini and Farmani (2013) reported Cronbach's alpha coefficient of scale by 0.90.

N-Back Test: this test remains one of the most commonly used tools for measuring working memory in which a series of visual stimuli appearing 1800 milliseconds serially on the screen and the subject must compare each stimulus with the preceding one and, in case of similarity, press the corresponding key. The time interval for displaying each image with the previous is 2 seconds. The test uses a set of 32 images containing meaningless images, and the response time is recorded by the computer (Ajilchi, Ahadi, Nejati, Delavar, 2013). The output of this test is presented as the number of correct and incorrect answers. The validity and reliability of the N-Back test have been evaluated and affirmed in various studies (Bush et al., 2008).

Procedure

After the necessary implementation and coordination with education and schools, the researcher visited schools to select and to design research groups

randomly. Before conducting yoga and emotion regulation sessions, the participants of the study were provided with an introductory session aimed at preparing students, establishing a therapeutic relationship, building confidence in the subjects, and collecting pre-test data. During the same introductory session, the participants were asked to answer the pre-test data, Cognitive Flexibility Questionnaire and N-Bak test. Finally, Experimental Groups 1 and 2 were divided into 8 sessions of 70 to 90 minutes of yoga training and emotion regulation training. After completing eight sessions in both groups, the participants were re-assessed using research tools during another short session to collect the post-test data. Finally, the follow-up data were collected 2 weeks after the training sessions and post-test data collection using the research tools.

Table 1.
Yoga Training

Session	Summary of sessions content
1	This session first defines yoga and explains its impact on the body and mind, and then briefly discusses the purpose of yoga training and its importance in promoting working memory and cognitive flexibility (15 minutes). Pavan mukta asana (ankle bending, ankle tilting, knee bending, knee tilting, Uttanpadasana motion, wrist bending, elbow straightening and bending, shoulder ups and downs, head and neck straightening and bending, shoulder rotation) in three sleeping, sitting and standing postures, stomach stretching status cat posture, standing posture, palm tree posture in all sessions are dedicated to Shavasana for late 10 minutes of class.
2	Repeating Pavan mukta at the beginning of all sessions including all kinds of stretches in supine position (type 1: aligned hand and leg stretch, type 2: unaligned hand and leg stretch, type 3: both arms and legs concurrent stretch) - leg lock posture (type 1: with legs individually, type 2: both legs concurrently) - rabbit status - quadruple position - manual milling position type 1- standing position - bending readiness (forward bending, side bending, backward bending) – mobile palm tree position, drainage techniques – standing twisting - Shavasana
3	Repeating Pavan mukta - comfortable abdominal sleeping position, half grasshopper position (type 1: raising legs individually) - semi-butterfly position (sleeping) - cat Status – two-knee posture – twist in two-knee posture - hands raising (standing) position- Chakrasana position (preliminary) - forward bending status (preliminary) – drainage techniques - proper hale and exhale training – Shavasana
4	Repeating Pavan mukta, proper walking posture, right standing, drainage techniques, shoulder ups and downs position (explosive exhale) - triangle position type 1. manual milling position (seated) rabbit posture – right seat posture and eye exercises, simple twist posture – Sukh Brak breathing - Shavasana
5	Repeating Pavan mukta and stretching moves - raising hands - proper walking - bow and arrow status - refreshing posture - simple forward bending - quadruple position - double knee - margery-rabbit - simple twist - eye exercise - abdominal breathing - Shavasana
6	Repeating Pavan mukta - perrynayum - Kati Chakrasana - triangle - tree Status (type 1) – two-person exercise - drainage exercises - canoeing – twist-sitting posture - child position - abdominal breathing - Shavasana
7	Repeating Pavan mukta - sleeping stretching position - lizard status – half-grasshopper status – twist sleeping- Sphinx - cradle and swinging status – drainage exercises – half-cycle sun salutation- daikon status - breathing awareness (focus) – Shavasana
8	half-cycle sun salutation - standing stretch move - Nataraj - daikon - tree status and drainage exercises- Chakarasana ship, repeating Pavan mukta - repeated sitting pawns- cat status - eye exercises - breathing awareness (focus) - Kati Chakrasana

Table 2.
Summary of Gross-Based Emotion Regulation Training Sessions

Session	Summary of sessions content
1	A) Getting group members familiarized with each other and starting a mutual relationship with the group leader (psychologist) and members. B) Presentation of the group's main and subordinate goals and discussion of the members regarding personal and collective goals. C) Explaining the logic and stages of intervention. D) Presentation of framework and rules for participating in the group.
2	Position selection, purpose: providing emotional training; session agenda: recognizing emotions and motivational situations through teaching performance difference of emotional diversities, information on different dimensions of emotion, and short and long-term emotional effects.
3	Position selection, purpose: evaluation of vulnerability level and emotional skills of members; session agenda:

Session	Summary of sessions content
	members' dialogue about function of emotions in the human adaptation process and their benefits, the role of emotions in making communication with others and influencing them and also organizing, stimulating human behavior and providing examples of real-life group experiences.
4	Position modification, purpose: making change in emotion stimulating position; session agenda: a) prevention of social isolation and avoidance. B) Training problem solving strategy. (C) Training interpersonal skills (dialogue, assertion and conflict resolution).
5	Attention extension, purpose: changing attention; session agenda: a) halting thought rumination and worry. B) Attention training.
6	Cognitive assessment, purpose: cognitive assessments modification; session agenda: a) Identifying misconceptions and their effects on emotional states. B) Teaching marketing strategy.
7	Target response adjustment: changing emotion's behavioral and physiological consequences; session agenda: a) Identifying the extent and how to use the inhibition strategy and evaluate its emotional consequences. B) Exposure. C) Emotion expression training. (D) Behavioral modification by changing environmental enhancers. E) Emotional discharge training, relaxation and reverse action.
8	Purpose evaluation and application: re-evaluating and removing barriers to application; session agenda: a) evaluating the extent to satisfy individual and group goals. B) Application of the skills learned in session-free natural environments. C) Reviewing and removing barriers in doing homework.

Findings

In this study, Participants included 54 girl students' aged 16 years old who were divided into three groups of emotion regulation training, yoga training and control were studied.

Table 3.
Multivariate Analysis of Variance Results to Investigate Differences in Working Memory Scores over Three Different Time Periods

Component	Effect	Stats	Value	Df1	Df2	P	Effect size	Test power
Difference diagnosis	**time**	Pylayy effect	0.29	2	56	0.01	0.29	1.00
		Wilks Lambda	0.70	2	56	0.01	0.29	1.00
		Hotelling effect	0.41	2	56	0.01	0.29	1.00
		Roy's Largest Root	0.41	2	56	0.01	0.29	1.00
	time*group	Pylayy effect	0.23	2	114	0.01	0.11	1.00
		Wilks Lambda	0.77	2	112	0.01	0.12	1.00
		Hotelling effect	0.29	2	110	0.01	0.13	1.00
		Roy's Largest Root	0.29	2	57	0.01	0.23	1.00
Diagnosis time	**time**	Pylayy effect	0.50	2	56	0.01	0.51	1.00
		Wilks Lambda	0.49	2	56	0.01	0.51	1.00
		Hotelling effect	1.03	2	56	0.01	0.51	1.00
		Roy's Largest Root	1.03	2	56	0.05	0.08	1.00
	time*group	Pylayy effect	0.15	2	114	0.05	0.08	1.00
		Wilks Lambda	0.84	2	112	0.05	0.08	1.00
		Hotelling effect	0.18	2	110	0.05	0.08	1.00
		Roy's Largest Root	0.17	2	57	0.05	0.15	1.00

Multivariate analysis of variance results show that there is a significant difference between the three time periods in recognizing differences and their recognition time based on the value of Wilks Lambda and f. To state differently, the mean of working memory scores in the three pretest, posttest and follow-up periods are significantly different, on the other hand, the significance value of interactive effects for time *****also indicates that the degree of recognizing differences in the three time periods differs depending on the group levels (experimental and control); in addition, Table 4 presents in-group variance results to examine the significance of in-group effects.

Table 4.
In-Group Multivariate Analysis of Variance for the Components of Working Memory

Component	Effect	Sum of squares	Df1	Mean of squares	f	p	Effect size
Recognition of differences	**time**	516.67	2	258.33	14.53	0.01	0.20
	time*group	322.38	4	80.59	4.53	0.01	0.14
Recognition time	**time**	7123.90	2	3561.95	34.67	0.01	0.38
	time*group	1313.60	4	328.40	3.19	0.01	0.10

The results of the Table 4 show that the difference of scores in the variables of working memory components based on the main effects of time and the interactive effects of time and group is also significant, so as primary effects of time are significant, it shows that yoga training influenced the enhancement of the scores of the working memory components in the posttest and this fashion was maintained at the follow-up. On the other hand, increasing yoga-related changes was more than those in emotion regulation training, as shown in the table 5.

Table 5.
Comparison of Paired Groups on Working Memory Components

Component	Source		Difference of means	Standard deviation	p
Difference recognition	**Emotion regulation**	yoga training	-2.51	0.97	0.03
	training	Control	3.78	0.97	0.01
	yoga training	Control	6.30	0.97	0.01
Recognition time	**Emotion regulation**	yoga training	5.35	3.77	0.48
	training	Control	-3.40	3.77	0.99
	yoga training	Control	-8.75	3.77	0.07

The group comparison table demonstrates that the amount of changes in difference recognition component in the yoga training group was more than that of emotion regulation training. It also uncovers that there is no significant difference in the amount of variations in recognizing differences in the two experimental groups, in other words, despite the high reduction in the duration of differences in the yoga training group, this decrease or difference is not statistically significant, and whose diagram has been illustrated.

Table 6.
Presents Repeated Measures Analysis of Variance for Cognitive Flexibility

Effect	Stats	Value	Df1	Df2	P	Effect size	Test power
Time	**Pylayy effect**	0.54	2	56	0.01	0.54	1.00
	Wilks Lambda	0.45	2	56	0.01	0.54	1.00
	Hotelling effect	1.21	2	56	0.01	0.54	1.00
	Roy's Largest Root	1.21	2	56	0.01	0.54	1.00
time*group	**Pylayy effect**	0.36	2	114	0.01	0.18	1.00
	Wilks Lambda	0.64	2	112	0.01	0.20	1.00
	Hotelling effect	0.56	2	110	0.01	0.22	1.00
	Roy's Largest Root	0.55	2	57	0.01	0.36	1.00

The results of multivariate analysis of variance show that there is a significant difference in the rate of recognizing differences between three time periods based on the f-value and the Wilks Lambda. In other words, the mean scores of cognitive flexibility were significantly different in the three pretest, posttest, and follow-up periods. Besides, the significance of the amount of time ***** group interactive effects also showed a difference in the rate of recognizing differences in the three time periods in terms of group levels (experimental and control). In addition, the results of in-group variance test are also reported in Table 7 to examine the significance of in-group effects.

Table 7.
Results of In-Group Multivariate Analysis of Variance for Cognitive Flexibility

Effect	Sum of squares	Df1	Mean of squares	f	p	Effect size
Time	5488.23	2	2744.12	40.55	0.01	0.42
Time*group	2632.93	4	658.23	9.73	0.01	0.25

The results of Table 7 show that the difference in scores on the cognitive flexibility variable based on the main effects of time and the interactive effects of time and group is also significant. So due to being significant, principal effects of time indicate that yoga training affects increased cognitive flexibility in the posttest, so that this increase sustains its stability in the follow-up phase. On the other hand, the increase in yoga-related changes was more than those in emotion regulation training, as shown in Table 8.

Table 8.
Comparison of Paired Groups on Cognitive Flexibility

Source		Difference of means	Standard deviation	p
Emotion regulation training	**Yoga training**	-90.21	3.70	0.05
	control	4.76	3.70	0.61
Yoga training	**Control**	13.98	3.70	0.01

The group comparison table shows that the amount of cognitive flexibility changes in the yoga training group was more than the emotion regulation training; therefore, yoga training was more effective in enhancing cognitive flexibility than the emotion regulation training.

Descriptive results showed that yoga training and emotion regulation training increased students' active memory and cognitive flexibility and also showed that this increase was sustained in the follow-up test, in order to infer inferential research and compare the effectiveness of two yoga training approaches. And emotion regulation is used by repeated measure variance analysis with follow-up test as given in the tables

Discussion and Conclusion

This study aimed to compare the effectiveness of yoga training with emotion regulation training on students' working memory and cognitive flexibility. The research's first result revealed that the amount of working memory changes in the component of difference recognition in the yoga training group was higher than that of the emotion regulation group, but no significant difference was seen in the degree of working memory changes in the component of the time to recognize differences in the two experimental groups. In other words, despite the high rate of decrease in duration of differences in yoga training group, this reduction or difference is not statistically significant, The effectiveness of yoga on active memory has been demonstrated in various studies, such as those of Sedigh and Niusha, 2017; Irandoust, Taheri and Thaqi al-Islam, 2014; Kauts, and Sharma, 2012; Lantrip, Isquith, Koven, Welsh, andRoth, 2015, and the present study findings on the effectiveness of yoga on working memory are in line with the studies cited. In this regard, Davy and Rutter's (2018) study showed that yoga exercises affect increased attention, concentration, memory and all cognitive processes and even can convey more lasting effects than other ways of increasing memory; Lantrip et al. (2015) have also emphasized the persistence of the effects of yoga practices, even to the middle-aged and old. In other words, yoga practices performed at every age will have a lasting effect for later ages. These findings reflect that the efficacy of yoga on memory processes is more effective and sustained than other methods such as emotion regulation training and yoga exercises affect the brain's central nervous system, yielding increased sustained attention and, consequently, promoted memory. On the other hand, the present study proposed that the effect of yoga training and emotion regulation training on the duration of recognizing differences was not significant, meaning differently that both yoga training and emotion regulation training had the same effect on reducing the time of difference recognition.

Antithetical to the poor effectiveness of emotion regulation on identifying differences, the same effectiveness of yoga-assisted emotion regulation on the duration to recognize differences remains

controversial, this is because that task of differences recognition is wholly a cognitive activity, and emotion regulation method carries little effect on enhancing cognitive skills. However, reduced recognition time of differences can be attributable to emotions, whereas decreasing reaction rate in cognitive tasks can be influenced by one's level of concentration (Sörqvist et al, 2016), and on the other hand, managing the disturbing emotions involved in the concentration also directly increases the concentration and consequently is effective in enhancing the reaction rate (Dumitru, Chraif, & Aniţei, 2014). It can be stated that emotion regulation helps to manage disturbing emotions in the concentration of the senses and results in increased reaction rate.

The second result of the study imputed to higher amount of cognitive flexibility changes in the yoga training group compared to the emotion regulation group. The effectiveness of yoga exercises training on cognitive flexibility as a subset of executive functions, as discussed in previous hypotheses, has been advocated in many studies (Avari et al., 2018, Badavi & Zeinali, 2019; Mullur et al., 2012). In this regard, Badavi and Zeinali's recent study (2019) among the women's community found that yoga training was effective on their cognitive flexibility, coupled with Avari et al. (2018) in their article aimed at examining the effects of yoga exercises on cognitive flexibility among US veterans concluded that yoga exercises grows skills linked to cognitive flexibility among veteran retirees. As stated in the previous assumptions, the concept of cognitive flexibility is based by cognitive adaptability in unfamiliar, challenging and new situations, so that one in such situations can be able to curb effective situations and variables (Zong et al., 2010). These are consistent with the principles of yoga theory. In this regard, Cramer et al. (2013) consider thinking adaptation to the goals of yoga, believing that yoga causes one to not have a dogmatic thinking towards the phenomena of the universe and to see the world and phenomena transiently. They are always trying to have flexible and logical approaches in different situations, so their behavior and attitude conform to the principles of cognitive flexibility; therefore the increased effectiveness of yoga training on cognitive flexibility in comparison with emotion regulation training among the students seems to be logical, given the emphasis on the theoretical and philosophical foundations of yoga on intellectual and emotional flexibility.

Application of questionnaires or self-reporting tools usually transpires biased research results, as the limitations of the present study are the use of questionnaires, hence caution should be taken in interpreting the results. Since experimental studies have always played a major role in limiting the research, the present study also included variables such as previous sports skills, physical abilities, intelligence, family support and social class in the present study. Given the findings and limitations of the study, it is suggested that researchers in other cities and other schools, may also conduct similar research. Furthermore, based on qualitative studies, they can identify the factors affecting students' weakness in cognitive flexibility or working memory. Finally, future researchers could examine the moderating role of gender or ethnicity in the effectiveness of yoga or emotion regulation on the variables of working memory and cognitive flexibility.

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