



Original Article

The effectiveness of modular cognitive behavioral therapy on mathematical anxiety and assertiveness in students

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Abstract

Introduction: The purpose of this study was to investigate the effectiveness of Modular Cognitive Behavior Therapy (MCBT) on the mathematical anxiety and self-assertiveness of girl students in the 10th grade of experimental field.

Materials and Methods: This research conducted with pre-test and post-test with control group. The statistical population of this study included all girls in high school in 10th grade of experimental field in Neishabour city, and the sample consisted of 24 students who were selected through voluntarily and convenient sampling method. They randomly divided into two experimental and control groups. Student's math anxiety and self-assertiveness level were measured in two stages (pre-intervention and post-intervention) through Math Anxiety Questionnaires (MARS-R) as well as the Gambler and Ritchie Self-Assertiveness Scale, respectively. Data were analyzed by using SPSS software, descriptive statistics, multivariate and single-variable covariance tests.

Results: The findings showed that there was a significant difference between the two groups in mean scores of math anxiety and assertiveness. In other words, after performing different stages of MCBT in the experimental group, we observed reduction of math anxiety and improved assertiveness skills ($P < 0.001$).

Conclusion: In general, the results of this study confirm the effectiveness of MCBT on reduction of girl student's math anxiety. Therefore, this method is recommended for them.

Keywords: Cognitive behavioral therapy, Math anxiety, Self-assertiveness, Students

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Introduction

Anxiety can be considered the most complicated response to a stressful stimulus. Anxiety is an unpleasant excitement that we have experienced in fear, tension, dandruff, and anxiety (1). Anxiety is a warning sign that is aware of an imminent danger and prepares a person for coping. All humans experience anxiety and if it is moderate, it is not only harmful, but it is considered as an adapted

response, and it makes people always prepare themselves to deal with sudden and threatening hazards. This kind of anxiety can be considered natural, useful, constructive, and at the same time one of the components of the personality structure. But, on the other hand, there is anxiety that causes failure and obstruction of normal activities (2). In general, the causes of anxiety are referred to by the following three factors:

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- 1) Physical factors: Physical factors cause abnormal levels of some hormones in the anxious person's blood.
- 2) Social factors: Many social factors cause anxiety in people, such as family problems, feelings of separation, deprivation, and so on. Also, the pattern of parenting behavior and learning and repetition of their work plays an important role in the anxiety of children.
- 3) Hereditary genetic factors: One of the most important causes of anxiety is genetics; the probability of anxiety in children of anxious people is very high (3).

One of the types of anxiety that students face during their studies is math anxiety which appears in the student at the time of performing mathematical assignments. Excitement and mental disorder are one of the main characteristics of this anxiety when doing math, fear and anxiety (4). This term was first introduced in 1975 by Dergler and Aiken to describe the difficulty of student attitude with regard to mathematics (5). Based on numerous interviews with people with math anxiety, this anxiety is described in several ways:

- A) Anxiety and worry when people are asked to do mathematics (for example, if the responsibility for sharing the restaurant bill is given to such a person, it will be a terrible thing for him)
- B) Avoid participating in mathematics classes until the last moments
- C) Feeling of physical illness, weakness and panic
- D) Failure to perform math tests
- E) Achieve very little success, even after having received private tutoring (6).

One of the variables whose relationship with mathematical anxiety has been investigated is the expression of existence (7). Expression means expressing ourselves directly and accurately and for valorizing our thoughts and feelings, and recognizing our strengths and weaknesses. This skill helps to improve self-esteem and the satisfaction of human life, because it creates the ability to face up to the external conditions that may be tense (8). Expressions of the person are: to deny the unreasonable demand of others without anxiety and discomfort, to express certain personal limitations, such as misinformation in some areas, preparation for non-approval, admission that sometimes their application may be rejected or received a negative response, initiation of relationships to socializing, starting

to talk with strangers, expressing positive emotions, accepting your praise, asking others to change their behavior, resisting the imposition of others' values, and avoiding harming the feelings and personality of others, deregulation in career, education, and social situations And readiness to express opinions The ability to say no when necessary (9).

A model of the assertion has been made by Kelly, Fredericksen, Fitz and Philip, which categorized it into two types of expressions of coping and admiration:

Expression of the coping: The ability to confront and resolutely deal with others
 praiseworthy expression: Capacity to express sentimental feelings towards others (10). In many situations, which require the expression of daring behavior, if one fails to do the right thing, he will be harmed. For example, a teenager who, in the face of complicity with his friends in the use of substances, has no ability to "say no", he may be trapped in addiction (11).

There has been a lot of research on the relationship between social anxiety and the expression of existence. Among them, Saler, believed that those who lacked arrogant behavior, had social anxiety and social fear, and appeared in many social interactions as deterrent and non-prejudicing which gave them the name of "deterrent character" (12).

Arndel, Syndromen, Hagman and Pickerzgil examined multiple expressions of assertiveness in clinical and non-clinical trials. In eight studies, they found that there is a relationship between non-hostile behavior with social fears, social anxiety, inner aggression, shyness, lack of self-esteem and low self-esteem. They also found that there was a negative relationship between non-hostile behavior with independent behaviors, self-esteem (social), self-esteem and high self-esteem (12).

In general, the various behaviors that a person can show when expressing his existence are divided into three categories:

1- Aggressive behaviors: These behaviors are completely separate from "expressing a healthy existence." It is a mistake to imagine those who perceive aggression as a form of self-expression. Aggression in psychopathology is considered a behavioral disorder, and someone who regularly shows these negative qualities in his or her behavior must necessarily refer to a psychologist, including a counselor or psychiatrist. Evidence of this claim is a variety

of studies that show the direct relationship between various aggressions and behavioral disorders.

2- Passive behaviors: In passive behaviors, the individual pretends to be as opposed to his inner aspiration as if it was a matter of course and in accordance with his wishes; but in reality, this kind of behavior is a non-expressive behavior of existence. In this kind of behavior, the individual acts in spite of his inner desire and in fact wants to win the other side and ignores his right by giving the right to the opposite. Such people often respond positively to their requests and do not use the word "no" in dealing with other people.

3- Self-assertive behaviors: Expression-based behaviors refer to behaviors that the person performs whatever he wants - while his behavior is not contradictory to the rights of others. In this kind of encounter, the so-called psychologists are "self." "Being" is a very important issue that psychologists often recommend. During counseling sessions the counselor may ask the person to "be yourself" to solve your problem. When you "yourself" show selfish behaviors that do not violate the rights of others; in fact, your behavior is based on self-expression (13).

In general, forms of behavioral self-expression may include problems such as depression, anger, distress, disappointment and lack of control in life, and anger among others, frustration, anger explosion, avoidance anxiety, weakness in interpersonal relationships, and disability in positive and negative emotions and child-bearing problems (14). To reduce anxiety so far, several approaches have been considered, one of which is cognitive-behavioral approach. But this approach has many challenges. For example, Kendall, receiving 47% of children who had behavioral cognitive studies, had anxiety indications in assessments, and Barrett found that more than 43% of children who did cognitive-behavioral therapy exhibited anxiety symptoms after treatment (15).

Therefore, it can be concluded that one of the causes of the ineffectiveness of cognitive behavioral therapy in certain circumstances is its inflexibility. Although these methods have to be balanced with respect to individuals, lack of solutions in this area has led to poor outcomes in the cognitive-behavioral treatment protocol (16). One-way cognitive-behavioral cognitive therapy approach is one of the most

common approaches to cognitive-behavioral therapy in the treatment of anxiety, first introduced in 2000 by Churpita creating a high level of flexibility through the use of individual functional guidelines, along with maintaining the standard benefits of cognitive-behavioral protocols, is the goal of this approach. For this purpose, the main intervention in this treatment is exposure - a systematic experience of scary position. For further work, other skills are taught only if necessary to help with this initial educational goal. It is the first step in the process of deciding whether or not this child with anxiety disorder needs treatment. A multifaceted assessment that examines different domains (affection, behaviors, symptoms, references, diagnosis, environment, and performance) is the best way to understand children's anxiety (17).

In the "quadrilateral" process of cognitive-behavioral therapy, the treatment unit is a central part of the treatment protocol in the face of need to prepare. This first involves identifying what should be addressed, what, or what are the pangs of fear, and then prepare the child for successful participation, as well as the advancement of treatment and the end of it, it is necessary to determine how the exposure works, have a review. It is not logical to start immediately at the beginning of the treatment or to leave it immediately at the end of treatment. Exposure to a pure form, alone, is difficult to detect from repeated fears of the individual, and thus there will be no success in the treatment.

Therefore, as part of the treatment axis, it is suggested that all children receive at least four main trends, which provide the main elements of treatment under the heading "four axes". These axes are:

- 1) Provide a list of fears ("fear ladder")
- 2) Anxiety education ("learning about anxiety")
- 3) Practicing scary situations ("exercises" that can be alive or imagined);
- 4) Teaching how to maintain achievements and skills ("keeping").

The first two stages, essentially prepare the stage for encounter (third stage), in such a way that a list of goals and trends is provided for the purpose of evaluating those goals and for providing the logic of encounter. The fourth trend, basically encouraging the child to continue this lifestyle, includes the habit of approaching and exposing at times when

anxiety is problematic. Therefore, the whole issue is the "plan of treatment", a program that we believe should be implemented for all children who receive the protocol (17). If we look at the results of applying a cognitive-behavioral approach to treatment of anxiety, we will look at the effectiveness of this model in treating or reducing anxiety problems. For example, Galla, Wood, Chiu et al. (18), in a one-year study, investigated the use of cognitive-behavioral cognitive therapy to address the anxiety disorders of children in elementary schools. In this study, 24 children (aged 5 to 12 years old) were tested and controlled by two groups and a one-year follow up showed that 71.4% of children who received cognitive-behavioral therapy received a positive response after one year and 83.3% were also found to be free from any anxiety. Wilhelm (19) and his colleagues demonstrated the efficacy of this treatment on patients with debilitating body disorder. Wiese et al. (20) tested unitary and standard unit models for psychotherapy for depression, anxiety and behavioral problems in young people. The results of regression analysis showed that treatment caused significant improvements compared to conventional and standardized on a few shortcomings and evaluation scales cause major problems. Young people who received unit treatment received significant less diagnosis after treatment than younger patients receiving conventional therapy. In contrast, the results of standard manual treatment were not significantly different from the results of conventional treatments.

Therefore, in this research, on math anxiety and student expression in the form of two hypotheses: 1- Cognitive-behavioral therapy is an effective tool for students' mathematical anxiety and 2- Cognitive-behavioral therapy is effective in expressing students' existence.

Materials and Methods

This study was conducted with a trial of 30093 trials with a pre-test-post-test with control group. The statistical population of this study included all female high school students (tenth grade) in Neishabour during the academic year of 2012-13. Islamic Azad University, Neishabour Branch, has confirmed this study.

A sample of this study included 24 female high school students (ninth grade) in Neishabour city who were selected through targeted sampling. In the first stage, the researches referred to the

Neishabour Education Department and, according to a high school student's diagnosis, two of the schools in Neishabour where their students had more mathematical anxiety were introduced. Then by referred to those schools and talked to its officials, it was randomly selected as one of the 10th experimental bases for pre-test execution. Then, among the students of those classes, among the subjects who reached the cut-off point of the mathematical anxiety questionnaire, and according to the Morgan table, 24 patients were randomly selected, and were randomly divided into two groups of 12 subjects as the experimental group and the control group. After performing 10 sessions of cognitive behavioral therapy, the unit was re-evaluated from both groups of post-test and the results were compared. Data were analyzed by SPSS-22 software using descriptive statistics (mean and standard deviation) and inferential statistics (multivariate analysis of covariance analysis). The criteria for entering this research were: female students of the 10th grade, experimental discipline, residency in Neishabour, reaching the cutting point of MARS-R mathematical anxiety questionnaires and expressing the existence of Gambler and Ritchie. Exit criteria included: absence from more than one session at the medical sessions as well as the individual's decision to leave the program. Among the ethical considerations observed in this project are the following: Students participating in this study were allowed to abstain from a maximum of 1 session of treatment classes and if someone had more than one absentee session, they would be removed from the sample group. At the end of the study, in order to observe ethical issues, 1 session of relaxation was administered to the control group to control the anxiety.

Cognitive-behavioral group therapy sessions based on Cognitive Behavioral Anxiety Therapy in Children's Curriculum Approach (2007) were developed and implemented.

Session 1: Build a fear ladder

Session 2: Training on anxiety and symptoms (behavioral, physiological, cognitive), training on math anxiety, preparing people for exposure exercises

Session 3: Implementation of the rehabilitation unit (over estimated probabilities), recording two-column thoughts, recording five-column thoughts

Session 4: Implementation of the Reconstruction Unit (Disastrous thinking), column thoughts recording
 Session 5: Selecting the stairs below the fear ladder to conduct exposure during the session, scoring the fear thermometer
 Session 6: Train the steps of changing the negative attitude, cite some examples of negative thoughts and complete the session timetable
 Session 7: Training on Social Skills Unit (meeting new people)
 Session 8: Training on Social Skills Unit (non-verbal communication)
 Session 9: Training on how to preserve achievements and prevent the return of disease, complete the sheet for this unit.
 Session 10: Review the entire sessions and fix the bug, perform a post-test

Research instrument

A) *Revised Mathematical Anxiety Scale (MARS-R)*: The mathematical anxiety scale was developed by Richardson and Sine in 1972 and has 25 grades, which was reduced by Balluglow and Zell Hart in 2007 by using factor analysis from 25 to 20 grades. In front of each set, the four-dimensional spectrum of the zero-point score (at all = 0, quantitatively = 1, somewhat = 2, very = 3, very much = 4) (21), the higher scores represent the higher the anxiety of the math. At the beginning, the tool was translated into Latin. Subsequently, the terms translated by a doctorate degree in English were re-translated into English (original), and the issues were corrected, and then two forms were compared. In the end, the translated clauses were reviewed and these items were given to a number of students to examine the formal and

material validity of the content, and to remove some ambiguities and words. Rajabi and Haravi, in examining the corroborative factor structure of this scale, concluded that the scale of this scale had intrinsic coordination. Meanwhile, the highest coefficient of reliability is related to the "numerical assignment test" factor. This subtotal examines the anxiety caused by basic mathematical activities such as multiplication and division (22).

B) *Gambler and Ritchie's Expression Scale*: This scale contains 40 substances, created by Gambler and Ritchie in 1975. The questionnaire has two parts, one that focuses on measuring the degree of discomfort of a person, and the second part is devoted to the occurrence of daring behaviors (17,18).The factor validity of the various articles of this questionnaire was obtained with the results of Gambler and Ritchie's evaluation of 0.81. The reliability coefficient of this test is Gambler and Ritchie for a degree of discomfort of 0.87 and a likelihood of occurrence of 0.81 (Jalali, 2001). The validity of this questionnaire was evaluated by the experts of Allameh Tabatabai University of Science and Education and Isfahan University in the years 74-75 and content validity was confirmed by them. The reliability coefficient obtained by Bahrami was 0.71 through an open test on the degree of discomfort and 0.88 was about the probability of occurrence of behavior (23).

Results

The pre-test descriptive indexes of this research are as follows:

The post-test descriptive indexes of this research are as follows:

Table 1. Pre-test descriptive indexes in mathematical anxiety and assertiveness variables

	Variable	Mean	Standard deviation	Minimum	Maximum
Experimental group	Mathematical anxiety	66.24	11.06	8	40
	Assertiveness	16.151	29.37	97	188
Control group	Mathematical anxiety	91.44	13.60	21	62
	Assertiveness	122.50	24.61	75	152

Table 2. Post-test descriptive indices in math anxiety and assertiveness anxiety variables

Dependent variable	Sum of squares	Degrees of freedom	Average squares	Statistics	Significance level	ETA squared
Assertiveness	4622.11	1	4622.11	9.04	0.00	0.30
Error	10735.01	21	511.19			

The first hypothesis of the research was that cognitive-behavioral therapy of the unitary unit was effective on students' mathematical

anxiety. To analyze this hypothesis, one-variable covariance analysis was used.

Table 3. Summary of the results of the covariance analysis test for the effect of unit-based cognitive-behavioral therapy

Group	Variable	Mean	Standard deviation	Minimum	Maximum
Experimental group	Mathematical anxiety	45.75	11.01	34	60
	Assertiveness	130.25	26.90	77	188
Control group	Mathematical anxiety	45.50	7.46	37	61
	Assertiveness	128.58	31.14	43	155

As shown in Table 3, there is a significant difference between the research groups and the value of the significant level obtained (less than a thousandth) is smaller than the alpha value with Bonferron's correction ($\alpha = 0.016$). As a result, with a probability of 99% of cognitive-behavioral therapy, the unit is effective on

improving students' mathematical anxiety and the rate of this effect is about 57% according to Eta. The second hypothesis of the study was that cognitive-behavioral unitary therapy is effective in expressing the presence of students. To analyze this hypothesis, one-variable covariance analysis was used

Table 4. Summary of the results of the covariance analysis test for the effect of MBCT

Dependent variable	Sum of squares	Degrees of freedom	Average squares	Statistics	Significance level	ETA squared
Mathematical anxiety	2289.69	1	2289.69	28.34	0.00	57.0
Error	1696.50	21	80.78			

As shown in Table 4, the results obtained from the comparison of the post-test of assertiveness in the two groups by controlling the pre-test effect indicate that after participating in cognitive-behavioral therapy sessions, the units of the scores for expressing the presence of the subjects who participated in the experimental group were compared to Those who were replaced in the control group had a significant decrease and the rate of this effect with respect to the ETA squared is %30.

Discussion

As seen in Tables 3 and 4, this treatment led to a decrease in student anxiety and increased self-esteem. In explaining the hypothesis that cognitive-behavioral therapy is effective on students' mathematical anxiety, it can be said that among the causes of math anxiety, the student's past misconceptions about mathematical lessons that have led them to believe in mathematics have trouble as a result, they underestimate their abilities and distance themselves from this lesson and they will be

anxious when they are forced to do math assignments.

One of the causes of math anxiety is too great a misconception. As a result, the belief in the weakness of the mathematical course is strengthened in them. Uniform Cognitive-Behavioral Therapy is an effective way of challenging students' misconceptions and exposing them to scary mathematical situations, enhancing their individual skills and self-esteem in this lesson. Because they find that false beliefs can be replaced by misconceptions about this lesson, and unreasonable anxiety can be reduced. Also gave each event a fairly logical meaning and did not consider the events as too negative.

According to Seligman's theory, when people realize that their voluntary behavior is unaffected by the consequences of their behavior, they are learned from helplessness. However, in cognitive-behavioral therapy, the challenge is to challenge people's misconceptions and confront them with a fearsome event, self-confidence, and they

believe that they themselves play a role in determining their outcomes.

The findings of this study were compared with the results of the researches of Galla et al. (18), Baker et al. (24), Helmi (25), Adabi (15) is the same. Weis et al. tested standardized unitary departments for psychotherapy for depression, anxiety, and behavioral problems in young people. The results showed that young people who received unit treatment were significantly less diagnosed after treatment than those receiving conventional therapy. In contrast, the results of standard manual treatment were not significantly different from the results of conventional treatments. Galla et al. tracked cognitive behavioral therapy unit therapy for the treatment of children's anxiety disorders in an elementary school environment for 1 year (18). Analyzing the results showed that about 83% of the children who received the treatment were free from any anxiety detection within 1 year. Baker et al. also examined the use of special units in cognitive-behavioral therapy for unitary anxiety disorder youth and their relationship with the treatment and response process. The findings indicate that those who are newly trained in the clinic do not use cognitive-behavioral units of equal frequency and some units are not effective as a key therapy (ie, the implementation of that unit does not have a significant effect on treatment). Therefore, therapists need to perform specific modules (units). Helmi also compared the efficacy of cognitive-behavioral therapy and cognitive hypnotherapy in reducing children's anxiety (25). According to this study, both methodological and behavioral processes as well as cognitive hypnotherapy lead to anxiety in children. Cognitive Hypnotherapy resulted in a significant reduction in the cognitive-behavioral unit-to-unit cognitive-behavioral therapy anxiety. Also Adabi evaluated the effectiveness of cognitive-behavioral unit therapy on reducing anxiety symptoms and improving cognitive-emotional order of adolescents. The results showed that cognitive-behavioral unit therapy significantly reduced the level of anxiety in the experimental group compared with the control group (15). Also, the results of this study showed that cognitive-behavioral therapy of unitary units led to improvement of maladaptive strategies and promotion of adaptive strategies of the experimental group compared to the control group. In cognitive-behavioral therapy, a unit

through the teaching of the verbal and non-verbal social skills unit, the students are introduced to the correct way of expressing their self-awareness by practicing their skills and improving their skills. Also, through frequent exposure to certain situations in which an individual is anxious and unable to express daring behavior, his self-esteem is strengthened and his self-expression skills improve.

The findings of this study are consistent with the results of Guven (26) and Sarcova et al. (27). Guven examined the levels of self-expression and problem-solving skills in undergraduate students. The findings indicate that increasing the level of assertiveness leads to an increase in problem-solving skills. Sarcova et al. studied the relationship between self-esteem, mental health and self-esteem in adolescents. The results showed that people who were more anxious in situations that needed decisiveness, were less engaged in these situations. Both aspects of expression were also related to mental health and self esteem.

This study, like any other research, encountered a number of problems and constraints, which are referred to as some of them:

- 1- Since the sample of this research has been voluntarily selected, it should be cautious when generalizing its results.
- 2- Side factors that may interfere with the outcome of the study, such as familial problems, depression, genetics, and so on.
- 3- Since this research was conducted only on girls, we can not measure the role of gender differences.
- 4- Failure to follow the results of the treatment due to the completion of class time was another limitation of this study.
- 5- The subjects' mentality about the activities of the medical sessions made progress in treatment difficult. and they did not like some homework.
- 6- Given the time constraints, individuals were not matched according to the background of the curriculum and so it was difficult to set up a joint fear ladder.

It is suggested that this research be conducted among boys to determine the effect of gender differences in treatment outcomes.

This research was conducted among the 10th grade students of the experimental field. It is suggested that this study be conducted among other students in the humanities and mathematics. Regarding the personality traits of

each student and the unmatched group members due to the side effects that affect the outcome of the study, it is recommended that this treatment be performed individually.

Considering the results of the effectiveness of cognitive-behavioral unit therapy on reducing student anxiety, it is recommended that school principals be trained in the workshop on the principles and techniques of this treatment so that they can be trained according to the ease of access to students and cognitive Who have any student's educational and family background, can attend appropriate therapeutic sessions at their school level.

It is suggested that if the therapist is to use this method to reduce the students' anxiety, then, if necessary, other methods should be used to reduce the student's anxiety, and not only to the treatment. For example, give a study program for a math lesson or a class of bug fixes. This is because a significant part of students' math anxiety is because they are not fluent in this lesson. This mastery of the correct bug fixes and a suitable curriculum is advisable.

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It is suggested that the duration of the treatment be prolonged in future studies. So that students with math anxiety are treated at least once a week and for several months under the supervision of a trained therapist. Also, in order to preserve the positive effects of treatment, after the completion of treatment, follow-up sessions and reminders of the mentioned points will be held for the students.

Conclusion

In general, the results of this study confirm the effectiveness of MCBT on reduction of girl student's math anxiety. Therefore, this method is recommended for them.

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