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The Effectiveness of Music Training on Cognitive Flexibility, Empathy and Aggression in Adolescents

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Abstract: According to the studies, music has some promoting effects on mood, development empathy and social understanding. The aim of this study was to examine the effectiveness of music training in adolescents' cognitive flexibility, empathy and aggression. The present study was a quasi-experimental pretest-posttest with a control group. The statistical population was all high school male students in District 21 of Tehran in 2022. The participants were 30 people who selected by accessible sampling method and randomly assigned to experimental and control groups (15 people in each group); Data were collected using the Dennis and VanderWal (2010) Cognitive Flexibility Questionnaire, Davis Empathy (1983) and the Buss and Perry Aggression Questionnaire (1992). The experimental group received eight sessions of 60-minute music training twice per week online, but the control group did not receive any training during this period. Multivariate analysis of covariance was used to test the research hypotheses. The results showed that music training significantly increased cognitive flexibility and empathy and decreased aggression of adolescents in the experimental group ($p < .01$); Therefore, the results showed that music education is effective in improving cognitive flexibility and empathy and reducing aggression in adolescents and is suggested as an effective intervention in promoting positive psychological traits and reducing negative psychological traits.

Keywords: Music training, Cognitive flexibility, Empathy, Aggression, Adolescents

Introduction

Aggression is one of the most important problems during adolescence and it is a main reason that adolescents refer to medical and health centers (Singh & Kaur, 2015). Aggression is a negative mental state with cognitive defects and deviations and maladaptive behaviors that lead to harming another person, object, or system (Kanne & Mazurek, 2011). Aggression appears verbally, physically, emotionally, relationally, figuratively and randomly in teenagers (Shaban & Kumar, 2016). The prevalence of aggression in adolescence is very high and is about 17.7% and it is reported more in boys than in girls (Bhilwar & Kapoor, 2016). Aggression in adolescents is related to many problems in adolescence and adulthood, such as antisocial behaviors, feelings of loneliness, low life satisfaction, drug addiction, academic and family problems, mood, emotional and psychological problems (Estévez López et al., 2018).

One of the most important factors in preventing aggression is empathy (Castillo et al., 2013). Empathy is considered as a fundamental capacity in humans and it means experiencing the world from the perspective of others and the ability to perceive and be sensitive to the emotional states of others along with the motivation to care for them (Sabouri et al., 2020). Empathy includes two cognitive components (understanding or predicting what others may think, feel or do, and in fact it is a logical

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understanding of others' mental states), an emotional component (emotional connection with others and sharing in their emotional states) (Firuzabadi & Aghaei, 2021). Kaji Isfahani et al. (2017) showed that there is a significant negative relationship between empathy and aggression in a group of students. Spataro et al. (2020) indicated that understanding others' point of view (cognitive empathy) and empathic attention (emotional empathy) decreases aggressive behaviors by increasing prosocial behaviors.

Among other effective factors of emotional disturbance and aggression is cognitive flexibility; which is the ability to change cognitive cues in order to adapt to the changing stimuli of the environment (Dennis & Vander Wal, 2010). This factor requires the ability to communicate with the present and the power to separate a person from inner thoughts and experiences (Moitra & Gaudiano, 2016). Cognitive flexibility refers to the ability of people to focus on the current situation and use the opportunities of that situation to take steps in line with internal goals and values despite the presence of challenging or unwanted psychological events that enable a person to face pressures, challenges and other emotional and social issues should be dealt with appropriately and efficiently (Qiao et al., 2020). People who have less flexibility can hardly forget their early learning, they insist on their previous learning that has negative consequences for them, and this insistence harms their adaptation to new situations (Carbonella & Timpano, 2016).

The high prevalence of aggression in adolescents and its negative impact on various areas of adolescent life and later stages of life has made it very important to use appropriate therapeutic approaches to help them. One of the appropriate approaches is music education. Music education is a method of timely use of music to respond to emotional, mental and social desires, which is beneficial for any age from infancy to old age and for all diseases (Javadi et al., 2022). Music therapy is the ability to use music specifically defined by a qualified person to affect the psychological, physical, cognitive aspects, social functioning and educational issues of the individual (Hackett et al., 2013). Listening to music is an accessible, vibration-free, non-invasive and side-effect-free method that can be successfully used as a safe test (Yang et al., 2021). In the previous studies examined the effect of music on the aggressive behavior of autistic children (Gashol et al., 2014), controlling the anger of teenagers (Kianipur & Etemadi, 2012), curbing the aggression of mildly mentally retarded children (Kianipur & Etemadi, 2012), agreement and empathy (Akhshabi & Dortaj, 2022).

Indeed, the spread of aggression among teenagers is a cause of concern for many families, parents, coaches and officials of the country. If the problems of this important period of life are not studied and solved, it becomes dangerous and problematic for teenagers, and since one problem is connected with another problem, it will eventually cause many individual and social deviations and even delinquency.

Therefore, it seems necessary to better understand the variables influencing adolescent aggression, such as empathy and cognitive flexibility, and as a result, developing suitable programs for prevention and treatment, including music education in aggression. So the present study aims to determine the effectiveness of music education in cognitive flexibility, empathy, and aggression. It was conducted on

adolescents and it seeks to answer the question of whether music education is effective in cognitive flexibility, empathy and aggression in adolescents.

Material and Methods

The current research was a semi-experimental pre-test-post-test type with a control group. The statistical population was all adolescent boys in the 21st district of Tehran in 2022 who were studying in the first and second secondary levels. Participants were 30 students were selected from the target population by accessible sampling and were randomly assigned into experimental and control groups (15 people in each group). The inclusion criteria included being in secondary school, being a boy, not having mental disorders based on the counseling file, being referred by the schools to the counseling center due to aggression and informed consent to participate in the study. The exclusion criteria included non-cooperation, absence of more than two sessions in the educational intervention, and distortion of the research questionnaires. The data collection tools included the following questionnaires:

Cognitive flexibility scale: This is a 20-question scale that developed by Dennis and Vander Wal (2010). It was designed to measure three aspects of cognitive flexibility: (a) the tendency to perceive difficult situations as controllable; (b) the ability to perceive multiple alternative explanations for life occurrences and human behavior; and (c) the ability to generate multiple alternative solutions to difficult situations. The two studies presented in this manuscript describe the initial development of the CFI and a 7-week longitudinal study. Results from these studies indicate the CFI has a reliable two-factor structure, excellent internal consistency, and high 7-week test–retest reliability. Preliminary evidence was obtained for the CFI's convergent construct validity via the CFI's correlations with other measures of cognitive flexibility (Cognitive Flexibility Scale) and coping (Ways of Coping Checklist-Revised), respectively. In Iran, Roeen Fard et al. (2014) reported the test-retest reliability coefficient of the whole scale as 0.71 and the subscales of perception of controllability, perception of different options and perception of justification of behavior as 0.55, 0.72 and 0.57, respectively.

Empathy questionnaire: The empathy questionnaire has 21 questions and developed by (Davis, 1983). This scale is a commonly used instrument for measuring individual differences in trait empathy. Previous studies have reported finding a positive relationship between psychological well-being. This scale includes three components of empathic concern (1, 4, 7, 10, 14, 17, 18), perspective taking (2, 5, 9, 12, 16, 19, 21) and measure personal confusion (3, 6, 8, 11, 13, 15, 20) based on a 5-point Likert scale from completely agree with a score of 5 to completely disagree with a score of 1. The minimum score will be 21 and the maximum will be 105. Higher scores indicate more empathy in the respondent and vice versa. The reliability of the empathy questionnaire in the study of Davis (1983) was obtained with Cronbach's alpha above 0.70. Also, the validity of the questionnaire through the analysis of factors has been favorable. In Khodabakhsh and Mansori (2012) study, content validity and factor analysis were reported to be satisfactory, and test-retest reliability was reported as 0.71 and Cronbach's alpha reliability in the range between 0.71 and 0.77.

Aggression Questionnaire: This 27-question questionnaire was developed by Buss and Perry (1992) and includes four subscales of anger (questions 1-7), verbal (questions 8-14), physical (questions 15-20) and hostility (questions 21-27). It has a Likert scale (completely like me: 5 to completely different from me: 1). Therefore, the range of scores is between 27 and 135, and higher scores indicate more aggressiveness. In Buss and Perry (1992) study, the aggression questionnaire has good internal consistency (α=0.89) and test-retest reliability (r=0.80). In Samani (2008) study, four behavioral factors of anger, physical and verbal aggression, resentment and suspicion were extracted from it using factor analysis method. The reliability coefficient of this questionnaire was obtained as 0.78 by test-retest method.

In the implementation phase, the researcher contacted the students who were referred to the counseling center due to aggression after obtaining permission from the education and training department, and before distributing the questionnaires, the reasons and purpose of the research were explained. Then the pre-test was taken. For the experimental group, 8 music training sessions of 60 minutes and two sessions per week were held online, but no training was held for the control group (in order to comply with the ethical principles after the training and post-test, two music training sessions were also held for the control group), then the post-test was held for both groups. The music training sessions were taken from the music training sessions by Zadeh Mohammadi (2009). The summary of the music training sessions was presented in Table 1.

Table 1. Summary of music training sessions

Session	Title	Content
1	Pre-test with uplifting wordless music	Increasing self-confidence - self-expression, members getting to know each other, listening to CDs of classical songs, talking about how students feel about the music listened to.
2	Recounting feelings with soothing music playing	Increasing self-skills and the procedure of participation in the group, playing the rhythm of music by the therapist, performing rhythmic movements by the students.
3	Instrumental training and improvisation	Increasing self-expression - self-restraint, making instruments available to teenagers, improvisation by students
4	Teaching and practicing group songs and questionnaires in the field of emotions	Increasing self-confidence - self-expression - self-restraint, teaching a song in relation to group cooperation by a music therapist, performing a group song by students
5	Playing soothing music	Increasing self-confidence - self-restraint - self-expression, teaching a piece or rhythm by the music therapist and performing it by the therapist
6	Teaching group music by playing a piece of music	Teaching a piece or a simple rhythm and dividing the piece into two pieces of music, performing the piece of music in pairs and taking turns by the students
7	Students play instruments and perform rhythmic movements	Increasing the sense of cooperation in the group, self-expression, imitating and repeating improvisational movements and rhythm by the music therapist, performing rhythmic movements by children with instruments.
8	Teaching music composition and concert performance by students	Increasing self-control, self-confidence and cooperation, music composition training, concert performance by students

In this research, all relevant ethical principles, including the confidentiality of questionnaires, the informed consent of the participants in the research, and the right to withdraw from the research, have

been observed. Also, for data analysis, SPSS version 22 software and multivariate covariance analysis test were used at a significance level of 0.05.

Results

The mean and standard deviation of the pre-test and post-test scores of flexibility, aggression and empathy variables in the two experimental and control groups in was provided in Table 2.

Table 2. Statistical description of pre-test-post-test scores of flexibility, aggression and empathy

Variable		Phase	Control		Experimental	
			Mean	SD	Mean	SD
Flexibility	Alternatives	Pretest	20.93	2.28	27.27	4.04
		Posttest	26.67	3.88	56.67	14.71
	Control	Pretest	13.93	2.92	17	8.35
		Posttest	20.60	3.11	23.20	3.29
	Alternatives for behaviors	Pretest	4.4	3.12	5.07	3.33
		Posttest	5	2.95	10.80	3.10
Aggression	Physical	Pretest	36.20	3.10	37.67	1.95
		Posttest	33.27	6.23	21	7.65
	Verbal	Pretest	21	2.70	21.87	2.10
		Posttest	19.40	3.44	12.60	3.81
	Anger	Pretest	29.27	2.12	29.13	2.19
		Posttest	25.93	4.01	17.93	4.24
	Hostility	Pretest	33.80	2.43	34.33	2.19
		Posttest	30.47	5.42	18.93	6.20
Empathy	Empathic concern	Pretest	13	1.69	12.53	1.99
		Posttest	16.53	6.49	30.20	7.16
	Perspective taking	Pretest	9.60	2.03	8.40	1.35
		Posttest	14.27	2.84	29.27	2
	Personal disturbance	Pretest	14.20	1.97	14.53	1.60
		Posttest	16.53	3.97	32.20	4.07

In order to investigate the effectiveness of music education on the cognitive flexibility of adolescents, multivariate covariance analysis was used. The Shapiro-Wilk test was used to check the normality of the distribution of scores, which confirmed the assumption of normality of the distribution of scores due to the non-significance of the obtained values. The results of the homogeneity test of the regression slope of the pre-test and post-test scores in the experimental and control groups showed that the regression slope was the same in both groups ($P<0.05$). The results of Levin's test to check the homogeneity of the variance of dependent variables in the groups was confirmed. The results of the M-box test to check the equality of the covariance matrix of the dependent variables between the experimental and control groups also showed that the covariance matrix of the dependent variables is equal in the two groups ($p < 0.05$, $F = 1.57$, Box $M = 10.66$). After examining the assumptions of multivariate covariance analysis, the test results showed that there is a significant difference between two groups in cognitive flexibility ($p < 0.01$, $F = 8.27$, Wilks Lambda $= 0.48$). To check is there

difference between groups in cognitive flexibility components univariate analysis of covariance was done (table 3).

Table 3. The results of univariate covariance analysis of the difference between experimental and control groups in cognitive flexibility components

Variable	SS	DF	MS	F	p	Eta	Power
Alternatives	5316.70	1	5316.70	25.03	0.001	0.50	0.998
Control	2826.54	1	2826.54	25.23	0.001	0.50	0.998
Alternatives for behaviors	199.48	1	199.48	21.45	0.001	0.46	0.994

According to table 3, F statistic for the component of alternatives ($P < 0.01$, $F = 25.03$), control ($P < 0.01$, $F = 23.01$) and helping others ($P < 0.01$, $F = 21.45$). 25) are significant. These findings indicate that there is a significant difference between control and experimental groups in the cognitive flexibility. According to these findings, it can be concluded that music education is effective and has increased the cognitive flexibility of teenagers. Also, the effect size shows that music training explains 50% of the changes in alternatives, 50% of the changes in control, and 46% of the changes in alternatives of behaviors.

In order to investigate the effectiveness of music education on teenagers' empathy, multivariate covariance analysis was used. The Shapiro-Wilk test was used to check the normality of the distribution of scores, which confirmed the assumption of normality of the distribution of scores due to the non-significance of the obtained values. The results of the homogeneity test of the regression slope of the pre-test and post-test scores in the experimental and control groups showed that the regression slope was the same in both groups ($P<0.05$). The results of Levin's test to check the homogeneity of the variance of the dependent variables in the groups was approved as well. The results of the M-box test to check the equality of the covariance matrix of the dependent variables between the experimental and control groups also showed that the covariance matrix of the dependent variables is equal in the two groups ($p < 0.05$, $F = 0.40$, Box M = 2.74). . After examining the assumptions of multivariate covariance analysis, the test results showed that there is a significant difference between two groups in the empathy ($p<0.01$, $F=9.10$, Wilks Lambda=0.46). To check is there is a difference between experimental and control groups in empathy components, the univariate analysis of covariance was done (table 4).

Table 4. The results of univariate covariance analysis of the difference between the experimental group and the control group in empathy components

Variable	SS	DF	MS	F	p	Eta	Power
Empathic concern	1021.56	1	1021.56	21.94	0.001	0.47	0.99
Perspective taking	1176	1	1176	24.73	0.001	0.50	0.99
Personal disturbance	1164.22	1	1164.22	14.84	0.001	0.37	0.96

According to table 4, F statistic for the component of empathic concern (P < 0.01, F = 21.94), perspective taking (P < 0.01, F = 24.73) and personal disturbance (P < 0.01, F = 14.84) are significant. These findings indicate that there is a significant difference between the control and experimental groups in the empathy of. According to these findings, it can be concluded that music education is effective and has increased the empathy of teenagers. Also, the effect size in table 4 shows that music training explains 47% of changes in empathic concern, 50% of changes in perspective taking, and 37% of changes in personal disturbance.

In order to investigate the effectiveness of music education on adolescent aggression, multivariate covariance analysis was used. The Shapiro-Wilk test was used to check the normality of the distribution of scores, which confirmed the assumption of normality of the distribution of scores due to the non-significance of the obtained values. The results of the homogeneity test of the regression slope of the pre-test and post-test scores in the experimental and control groups showed that the regression slope was the same in both groups (P<0.05). The results of Levin's test to check the homogeneity of the variance of the dependent variables was confirmed as well. The results of the M-box test to check the equality of the covariance matrix of the dependent variables between the experimental and control groups also showed that the covariance matrix of the dependent variables in the two groups is equal (p < 0.05, F = 1.04, Box M = 12.30). After examining the assumptions of multivariate covariance analysis, the test results showed that there is a significant difference between two groups in the aggression (p<0.01, F=5.25, Wilks Lambda=0.50). To check is there is a difference between experimental and control groups in aggression components, the univariate analysis of covariance was done (table 5).

Table 5. The results of univariate covariance analysis of the difference between the experimental and control groups in aggression components

Variable	SS	DF	MS	F	p	Eta	Power
Physical	810.52	1	810.52	17.37	0.001	0.42	0.97
Verbal	214.58	1	215.58	17.60	0.001	0.42	0.98
Anger	356.86	1	356.86	20.64	0.001	0.46	0.99
Hostility	664.47	1	664.47	21.98	0.001	0.48	0.99

According to table 5, F statistic for physical component (P < 0.01, F = 17.37), verbal (P < 0.01, F = 17.60), anger (P < 0.01, F = 20.64) and hostility (P<0.01, F=21.98) are significant. These findings indicate that there is a significant difference between the aggression of the control and experimental groups. According to these findings, it can be concluded that music education is effective and has reduced the aggression of teenagers. Also, the effect size shows that music training explains 42% of physical changes, 42% of verbal changes, 46% of anger changes and 48% of hostility changes.

Discussion

The aim of this study was to determine the effectiveness of music education in cognitive flexibility, empathy and aggression of adolescents. The results showed that music education had a significant effect on increasing cognitive flexibility and its components (perception of controllability, perception of different perspectives and perception of behavior justification) in teenagers. The obtained result is in line with similar results in this field. For example, the study of Mohammadzadeh and Sajjadi (2019) revealed that music has a positive effect on cognition flexibility and its components. Also, the research of Valizadeh et al. (2021) showed that cognitive behavioral music therapy can lead to cognitive control and change of negative and self-destructive thoughts. In the explanation obtained, it can be said that music helps to transfer and perceive human feeling, emotion, perception and cognition (Gilroy & Lee, 2019); therefore, we can point to the argument that music education can help to increase flexibility considering that it facilitates access to cognition, emotions and feelings. Since, flexibility requires to be aware of all capacities and abilities and to get help from them to deal with situations. Based on this, music education can probably lead to greater flexibility by increasing awareness and access to various sources of individual abilities. In addition, it should not be overlooked that music is related to a part of the human brain structure that is also responsible for learning and expressing human emotions. For this reason, there is a direct relationship between music, learning, controlling and expressing emotions ((Gilroy & Lee, 2019). Consequently, considering that music education has an effect on learning as well as recognizing and expressing feelings, it can be considered as a facilitator of flexibility.

Another finding of the research showed that music education was effective in improving empathy and its components (empathic concern, perspective-taking, and personal confusion) of teenagers. In line with our results, Baghban Targhadri (2022) showed that musical styles have a positive and significant relationship with empathy. Akhshabi and Dortaj (2022) showed that music education can improve personal and social development, harmony and empathy, strengthen romantic feelings and emotions. In explaining the obtained result, it can be said that empathy is the ability to recognize and understand the emotions and feelings of others, as well as the ability to recognize of emotions, and considering that music contains common human emotional messages, it can facilitate empathy. On the one hand, music can provide a basis for establishing positive communication with others Gilroy and Lee (2019), and on the other hand, music is associated with learning and expressing human emotions; Therefore, according to the its role in understanding, learning and expressing emotions, music can promote concern and perspective based on empathy because music contains emotional and affective messages for teenagers (Wosch et al., 2019). In this regard, the presented intervention focused on the understanding of emotional pains and emotional messages in music, and the members of the intervention group were encouraged to express their empathic experiences in the real environment and connect them with the emotional messages in music. In addition, it should be noted that empathy requires a calm mind focused on emotions and feelings to understand them. In this regard, it seems that music can be associated with a decrease in agitation in teenagers by increasing mental peace

(Nelson et al., 2017). Based on this, it can be assumed that the provision of music education has been able to reduce the mental disturbances of the intervention group and increase their peace, leading to the improvement of the field of providing empathy in teenagers.

The last finding of the research showed that music education had a significant effect on reducing aggression and its components (physical, verbal, anger and hostility). The result obtained is in line with the results of previous studies in this field. For example, the results of the study by Gashol et al. (2014) showed that music education had a significant effect on reducing the aggressive behavior of autistic children. Kianipur and Etemadi (2012) showed that the implementation of passive music therapy could have an effect on increasing the level of anger control. In explaining the obtained result, it can be said that aggression in teenagers occurs to some extent automatically and impulsively, while music provides an environment for creating meaning around behaviors such as aggression. In other words, in music education, by using music, he talks about the functions of aggression and creates meaning. In other words, it seems that music provides an opportunity that provides teenagers with a more complete understanding and awareness of aggressive behaviors.

Considering that this increase in awareness is accompanied by an increase in the will and control of the individual's behavior, it may be accompanied by a decrease in aggression; Therefore, increasing the awareness and control of aggression as well as understanding the non-functionality of aggressive behaviors can reduce the various components of aggression in the form of physical, verbal, anger and hostility (Garofalo et al., 2018). In addition, one of the things that the members of the intervention group mentioned in the discussion about the meaning of music was that music can express messages about independence and power for them. In the survey about the perception of independence and personal power, it was found that the members in question believe that the application of various aggressive behaviors can be an expression of power and in order to maintain their independence. In this regard, an effort was made to focus on other messages of music, such as the enjoyment of life and creating a good mood in life, and to focus on these positive aspects of music instead of aggression as a way to maintain independence. In addition, in the process of making meaning and making meaning around the functions of aggression, it was revealed that aggression does not have a desirable function and its consequences can reduce a person's independence and have destructive consequences; Therefore, there is a possibility that the perception of the negative consequences of aggression and its ineffectiveness in order to maintain independence and a sense of power may have reduced the intensity of the components of aggression.

One of the most important limitations of the current research is the impossibility of holding face-to-face meetings, the lack of control of intervening variables such as the social and economic status of the participants, and the lack of follow-up courses. Therefore, it is suggested to follow up the results to check the stability of the results. In general, according to the results of the present research, it can be said that music education can be effective in improving people's psychological problems. These results, while creating a clear and practical horizon for therapists and counselors, will be effective in improving adolescent problems, including reducing aggression.

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