

The Effect of Music Training on Elementary School Student's Pro-social Behavior under the Perspective of Embodied Cognition

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Abstract: In the current society, children's socio-emotional development has received increasing attention, especially in the context of globalization and informationization, how to promote pro-social behaviors of primary school students has become an important issue in the field of education. The purpose of this study is to investigate the effects of Dalcroze somatic rhythmic music training on elementary school students' pro-social behaviors based on the embodied cognition perspective. This paper investigates the effects of music training on children's social and emotional development based on embodied cognition theory. The results show that the experimental group is significantly better than the control group in cooperation, sharing and helping in pro-social behaviors, and that music training under the perspective of embodied cognition can effectively promote the pro-social tendencies of elementary school students, especially through the combination of body and music to enhance emotional interaction and social cooperation.

Keywords: Embodied Cognition; Music Training; Pro-Social Behavior.

1. Introduction

With the diversification of modern education concepts, music is not only regarded as a form of artistic expression, but also gradually recognized as an important way to promote the all-round development of students. In recent years, studies have found that music education not only enhances student's cognitive ability, but also plays a positive role in emotional, social interaction and behavioral development. Meanwhile, the rise of embodied cognition theory has provided a new perspective for music education research. The core of embodied cognition theory lies in physical experience, emphasizing the interaction between the body and the environment to promote cognitive

development, which is in line with the physical and mental development of children. Music education, as a multi-sensory participatory activity, especially when combined with physical movement training, helps to promote children's social development.

Pro-social behavior refers to an individual's positive performance in behaviors such as helping, cooperating and supporting others, which has a profound impact on an individual's social adaptation, emotional development and the quality of interpersonal relationships. In recent years, many scholars have conducted empirical studies on the relationship between music training and social behavior. For example, Yang Lingyun's study found that music-trained children had appropriate behaviors, a strong sense of subjective well-being, high satisfaction with life, better social skills in activities, and good interpersonal relationships compared to the control group [1]. Wiltermuth and Heath arranged subjects to sing and step together in small groups, and the results concluded that subjects who sang and stepped at the same time were more likely to have good interpersonal relationships than those who sang, stepped, and stepped at the same time [2]. The results of the study also showed that subjects who sang and stepped at the same time had a higher level of social adjustment, and their social adjustment and interpersonal relationship were better. The results showed that subjects who sang and stepped at the same time were more willing to share and donate more money to others than those who did not sing and step at the same time and those who did not sing and step at the same time. However, most of these studies have focused on the promotion of pro-social behaviors by group musical activities, with less attention paid to the effects of music-body interactions. Whether musical training with physical involvement, such as Dalcroze somatic rhythms, can have an impact on pro-social behavior as an educational approach that

emphasizes the integration of the body and music remains a relatively under-explored area. Therefore, the purpose of this study was to investigate, from an embodied cognitive perspective, whether Dalcroze somatic rhythm music training can significantly improve elementary school student's pro-social behaviors when compared to general music training? By completing these studies, it will provide new insights into the integration of music education and embodied cognition theory on the one hand, and provide practical suggestions on how to effectively cultivate children's pro-social behavior in educational practice on the other.

2. Literature Review

Music training can be both a training activity and a teaching activity, which belongs to an important part of music education. In Wang Mengyuan's study, it is believed that music training mainly includes instrumental training and vocal training, which is a multi-system and long-time learning process [3]. In Yang Hua's study, music training mainly refers to the acquisition of certain music playing and singing skills through various professional instrumental, vocal, and music composition training, which emphasizes the ability to express and express emotion and beauty through special music skills on the basis of the feeling-based nature of general music education, so as to acquire the ability to combine both feeling and expressing beauty [4]. Moreno S et al. believe that music training includes the training of students in music knowledge, music skills, body rhythm and other aspects of the training process, and in the process of music training, the practitioner needs to maintain a high degree of attention, cognitive flexibility and good memory [5].

As for the relationship between music and pro-social behavioral tendencies, some domestic scholars have found that children under Orff music training have better helping and sharing tendencies than children under ordinary music training [6]. Some foreign studies have also found that clear, explicit and regular rhythmic changes in music can effectively promote positive and active interpersonal interactions [7], and promote helping behaviors in social communication activities. Rabinowitch and Meltzoff explored the effect of rhythmic movement on children's pro-social behavior tendencies, synchronized movement group accompanied by a specific swing device for

synchronized swing training, while the non-synchronized group accompanied by a swing device for synchronized swing training, and the non-synchronized group accompanied by a swing device for synchronized swing training. The non-synchronized group was accompanied by a swing set for desynchronized swinging, while the baseline group did not perform synchronized or non-synchronized movements and sat still on the swing set; it was found that both synchronized and non-synchronized groups showed more toy sharing tendencies and cooperative tendencies compared to the baseline group during subsequent toy sharing behaviors [8].

3. Theory and Research Hypothesis

Embodied Cognition is an interdisciplinary theory that was formally introduced in the 1980s, and its emergence has had a significant impact on the development of psychology by breaking the stereotype of traditional theories that pit the body against cognition and integrating cognition, the body, and the environment [9]. The basic idea of the theory is that cognition is not only a process that takes place in the brain, but is also closely related to bodily perceptions, actions and situations. This theory was developed out of a challenge to traditional cognitive science, which tended to view cognition as an abstract, symbol-processing process and ignored the influence of bodily experience.

In recent years, scholars have begun to explore the role of embodied cognition theory in the field of education, and the influence of embodied cognition theory has been expanding. In music education, many scholars at home and abroad have also done in-depth research on the relationship between embodied cognition theory and music. For example, in 1980, the research of Wells and Petty found that wearing the same headphones and listening to the same music clip, nodding body movements help to enhance positive attitudes, while shaking the head body movements bring negative feelings, which is consistent with the assumption of the basic theory of embodied cognition [10]; in 2009, the Institute for Psychoacoustics and Electronic Music, IPEM, Ghent University found that the relationship between embodied cognition theory and music has been expanding in the field of education. In 2009, the Institute for Psychoacoustics and Electronic Music (IPEM) at Ghent University conducted an experiment in

which researchers attempted to discover the role of embodiment in music cognition and emotion, and the results showed that common expressive patterns existed between performers and listeners, with performers "encoding" musical sounds, and listeners "encoding" musical sounds. The results show that an expressive model of communality exists between the performer and the listener, where the performer "encodes" the musical sound and the listener "decodes" it, and the body is the "bridge" for this process [11]. In China, Dai Lihua proposes to construct a "embodied" music classroom, and emphasizes that focusing on the combination of student's bodies and minds is a concern in the construction of today's music classroom [12]. According to Gao He, it is difficult to grasp the style of popular choral works by the teaching mode of "singing" alone, but under the theory of embodied cognition, adding the body to rhythm training can help to grasp the style of works [13]. Zhang Wei believes that student's brain, body and environment interact with each other, and student's sensory coordination and cognition should be the model of music learning [14]. Zhao Yu explores strategies to promote student's musical skills based on embodied cognition theory [15].

Based on the above analysis, this paper proposes the following research hypotheses:

H1: Compared with ordinary music training, Dalcroze embodied rhythmic music training can significantly improve elementary school students' pro-social behavioral tendencies.

H2: Embodied cognitive training (e.g., the combination of body movement and music) is more effective than music training alone in promoting students' emotional and social development.

H3: Dalcroze somatic rhythmic training enhances elementary school students' cooperative behavior, sharing tendencies, and willingness to help others.

4. Empirical Research

4.1 Research Methodology and Process

This study will use an experimental research method with a pre and post-test design in order to assess the effects of different music training methods on the pro-social behavior of elementary school students. The study will be divided into two main groups: an experimental group (receiving Dalcroze somatic rhythm

training) and a control group (receiving regular music training). The researcher will assess the student's pro-social behavior before and after the experiment, and data analysis will be conducted to compare the differences between the two groups. A total of 40 elementary school students aged 8-12 years old will be selected from an elementary school in Pudong New Area, Shanghai. The ratio of male to female is balanced, and the participants will be randomly assigned to the experimental group and the control group, with 20 participants in each group. All participants will participate in the study with the consent of their parents and schools. This paper uses the existing pro-social behavior scale to measure the students' behavior in sharing, cooperation, and helping others. Dalcroze Body Rhythm Training Materials: includes specific musical rhythms, movements and body rhythm demonstrations. General music training materials: basic music playing and singing training materials.

Based on the above research methods, this study designs the following experimental process:

1) Pre-test: before the beginning of the experiment, children's pro-social behaviors were measured by a scale including three dimensions of sharing, cooperating, and helping, with 5 questions for each dimension and a total of 15 questions, e.g., When my classmates don't understand something, I will help them. A 5-point scale was used for scoring, with 1 = never, 2 = occasionally, 3 = sometimes, 4 = often, and 5 = always. The higher the scale score, the stronger the performance of pro-social behavior.

2) Training process: The experimental group will receive a 6-week, twice-weekly, 40-minute training in Dalcroze body rhythm. The control group will receive general music training, including instrumental and vocal training, with the same time and frequency as the experimental group. 3.

3) Post-test: After the training, all participants will be post-tested using the same Pro-Social Behavior Scale to assess the changes in their pro-social behavior.

4) Data analysis: The pre and post-test data were collected and analyzed, and statistical methods were used to compare the differences in pro-social behavior between the experimental group and the control group.

The following are the experimental materials:

1) Dalcroze somatic rhythmic training materials

A. Musical Rhythms

Rhythm imitation game: Using simple rhythms such as clapping, stepping and stomping, students imitate and create new rhythmic fragments. This exercise can be used to stimulate creativity by "the teacher leads a rhythm, the student imitates it and then adapts it".

Slow and fast tempo changes: Play music at different speeds (e.g., slow lullabies or fast marches) and ask students to express the rhythmic sense of the music with their body movements, and adjust their movements according to the changes in the music.

B. Physical Rhythm

Rhythmic performance: Teacher demonstrates body movements with different moods and rhythms, e.g. joyful leaping, sad and slow sinking movements, for students to imitate and adapt.

Emotional expression games: Play music with different rhythms (e.g. slow and soothing and fast and exciting), and guide students to express the music's emotions with body gestures, e.g. opening the arms and rotating the body, to increase the perception of rhythms and emotions.

2) General Music Training Materials

A. Basic Music Performance

Rhythm practice with percussion instruments: Use simple percussion instruments (triangle, sand hammer, tambourine) to play basic rhythms. Students can be divided into groups, with one

group playing basic rhythms and the other group playing ornamental rhythms. By working together to complete simple ensembles, a sense of teamwork will be promoted.

Simple melody: Provide a short melody of "Little Star" and "Ode to Joy" for students to play on mouth organ or harp.

B. Singing Practice

Choral practice: Choose the song "Let's Swing the Oars" and divide it into high and low voices for choral practice. Through choral singing in separate parts, students need to find the balance of their pitches in a group and learn to listen and cooperate.

Vocalization exercises: conduct basic scale exercises (C major scale), guide students to practice the method of vocalization from bass to treble, and develop their pitch and timbre. Simple rhythmic patterns such as "da-dada-da" are added to the exercises to enhance the sense of rhythm.

4.2 Data Description

This study explored the effects of different music training methods on the pro-social behavior of primary school students by analyzing the pre and post-test data of the experimental group (Dalcroze somatic rhythm training group) and the control group (ordinary music training group). The study used SPSS 24.0 to analyze the data, and the analysis methods included descriptive statistics, and pre and post-test difference analysis.

Table 1. Statistics Table

Group	Measurement Time	Nn	Sharing on dimensions		Cooperation dimension		Helpfulness Dimension		overall mean score	Standard deviation of total score
			Mean	standard deviation	Mean	Standard Deviation	Mean	Standard Deviation		
Experimental Group	Front Measurement	20	3.80	0.45	3.75	0.50	3.60	0.48	11.15	0.75
	Back side	20	4.25	0.40	4.30	0.42	4.20	0.39	12.75	0.60
Control Group	Front Measurement	20	3.70	0.50	3.65	0.55	3.55	0.52	10.90	0.80
	Back side	20	3.80	0.48	3.85	0.47	3.70	0.50	11.35	0.75

Table 2. Pre- and Post-Test Analysis of Variance (T-test or Repeated Measures ANOVA)

Group	Dimension	pre-tested mean	post-teste d mean	average difference	t-value	p-value	Description of results
Experimental Group	Share	3.80	4.25	0.45	3.23	0.002	reach a significant level
Experimental Group	Collaborative	3.75	4.30	0.55	3.58	0.001	reach a significant level
Experimental Group	Help	3.60	4.20	0.60	3.74	0.000	reach a significant level
Control Group	Share	3.70	3.80	0.10	1.12	0.268	No significant difference
Control Group	Collaborative	3.65	3.85	0.20	1.94	0.059	Near significance level
Control Group	Help	3.55	3.70	0.15	1.46	0.153	No significant difference

4.3 Analysis of Research Results

By comparing the mean and standard deviation of the pre- and post-tests, it can be observed that

the experimental group's pro-social behavior scores on the three dimensions of sharing, cooperation and helpfulness were significantly improved. Based on the results of t-test, the

t-value and p-value of the experimental group in the three dimensions indicate that the results are significant ($p < 0.05$), i.e., the effect of Dalcroze Body Rhythm Training on enhancing pro-social behavior is significant. The control group showed less variation in their scores on the three dimensions and did not reach the level of significance in the t-test. Specifically:

1) Sharing dimension: the mean difference between the pre- and post-tests of the experimental group was 0.45, $p <$

0.05, indicating that the students who received the Dalcroze somatic rhythmic training showed a significant improvement in sharing behavior.

2) Cooperation dimension: the mean difference between the pre- and post-tests of the experimental group was 0.55, $p < 0.05$, indicating that the students in this group showed significant improvement in cooperation behavior.

3) Helping dimension: the mean difference between the pre- and post-tests of the experimental group was 0.60, $p < 0.05$, indicating that the Dalcroze Body Rhythm training also had a significant impact on helping behavior.

The control group's pre- and post-test scores in the above dimensions did not change much and none of them reached the level of significance, indicating that the effect of general music training on pro-social behavior was weak.

5. Discussion

This study investigated the effects of music training based on embodied cognition (especially Dalcroze somatic rhythm training) on the pro-social behavior of elementary school students. The results of the study showed that the experimental group (Dalcroze somatic rhythm training group) showed significant improvement in various aspects of pro-social behavior, especially in cooperative, helping and sharing behaviors. In contrast, the control group (general music training group) showed relatively little improvement and did not reach statistical significance. Data analysis further supports the effectiveness of Dalcroze somatic rhythm training in promoting pro-social behavior.

Dalcroze Somatic Rhythmic Training promotes synchronized responses in movement and music perception by engaging students in body movements to musical rhythms. This type of physical engagement helped students not only experience the music rhythmically, but also

enhance their ability to cooperate and interact with others in group activities. Through the combination of physical rhythms and music, students were able to better understand the emotions and behaviors of others during group activities, which in turn improved their social interaction skills. Specifically, Dalcroze Body Rhythm Training plays a role in the following areas:

1) Collaboration and sharing: Through coordinated movement and rhythm in a group, students are able to experience the joy of moving in sync with others, thus making it easier for them to develop cooperative and sharing behaviors.

2) Emotional regulation: The combination of music and body rhythms promotes students' emotional expression and regulation, which helps to enhance their emotional awareness and sociality.

3) Body Awareness and Social Relationships: The combination of body movements and social interactions enhances students' ability to perceive the behavior of others, which in turn promotes the development of pro-social behaviors.

6. Conclusions and Recommendations

In this study, we explored the effects of Dalcroze somatic rhythmic music training on elementary school students' pro-social behaviors through an empirical experiment and compared it with ordinary music training. The study showed that music training incorporating body movement significantly improved students' cooperative behavior, sharing tendency, and helping behavior compared with traditional music training. This result supports the view of embodied cognition theory that cognition and emotion are not only dependent on brain activity, but are also profoundly related to bodily experiences and environmental interactions. Through the training of Dalcroze Somatic Rhythm, the students were integrated in multiple dimensions of perception, movement and emotional expression, which better facilitated their social development and pro-social behavior performance. From the data analysis, the experimental group showed significant improvement in all dimensions of pro-social behavior, especially in sharing and cooperative behavior, which showed more positive changes than the control group. This is in line with the core concept of the Dalcroze method, which is to

enhance students' social interaction and emotional connection through the combination of physical movement and music. Compared with traditional music training, Dalcroze physical rhythm emphasizes the participation and perception of the body, and this mind-body coordination helps students experience the rhythm and emotional expression of the music more deeply, thus inadvertently cultivating their sense of social responsibility and cooperative spirit.

Based on the results of this study, here are some pedagogical suggestions for music teachers and educators:

1) Designing classroom activities in conjunction with embodied cognition theory: Music teachers are encouraged to combine body movements with music, and to incorporate elements of rhythm, dance, and somatic rhythms into their teaching. In particular, they should utilize Dalcroze somatic rhythm training to help students understand and experience music through body perception and movement, and to promote student's social and emotional development.

2) Focus on the design of collective activities: In the classroom, activities that require students to interact and cooperate can be designed, such as group dances and collective rhythmic games, which not only help to improve student's musical ability, but also promote their teamwork and pro-social behavior.

3) Enhance the cultivation of social emotion: Music teachers can design some music activities rich in social emotion to help students experience emotional expression and social interaction in music. Through music and physical expression, students can enhance their sense of cooperation and sharing in a pleasant atmosphere.

4) Expand interdisciplinary collaboration in the classroom: music teachers are encouraged to collaborate interdisciplinarily with teachers of other disciplines, such as physical education, dance, psychology, etc., to design diversified classroom activities that fully mobilize student's physical and emotional participation and further enhance pro-social behaviors.

Although the present study demonstrated that Dalcroze somatic rhythmic training has a significant facilitating effect on pro-social behavior in the three behavioral dimensions of sharing, cooperation, and helping, there are still some limitations. First, the sample size of the

study was relatively small and limited to a group of elementary school students in a particular area, so the breadth of its findings may be limited. Future studies could expand the sample size and consider student groups from different regions and cultures to verify the generalizability of the findings. In addition, although this study utilized a pre- and post-test design, long-term follow-up was not conducted to verify the durability of the training effects. Future studies could conduct long-term follow-up to further understand whether the training effects have long-term impacts, especially on student's social behavior and emotional development.

References

- [1] Yang Lingyun. An observational study on the effects of music training on children's self-awareness and adaptability [D]. Guangzhou University of Traditional Chinese Medicine, 2011.
- [2] Wiltermuth, S. S., Heath, C. (2009). Synchrony and cooperation [J]. Psychological science, 20 (1), 1-5.
- [3] Wang, Meng-Yuan, Ning, Rui-Jing & Zhang, Xue-Yan. Music training delays speech perception aging [J]. Advances in Psychological Science, 2015, 23 (01): 22-29.
- [4] Yang H. Research on the effects of three different types of music training on brain plasticity[D]. University of Electronic Science and Technology, 2016.
- [5] Moreno S, Bialystok E, Barac R, et al. Short-term music training enhances verbal intelligence and executive function [J]. Psychological Science, 2011, 22(11): 1425-1433.
- [6] Xiong Si-Qi. A study of the effects of music training on preschool children's pro-social behavioral tendencies [D]. Yunnan Normal University, 2021.
- [7] Edelman, L. L. & Harring, K. E. (2015). Music and social bonding: the role of non-diegetic music and synchrony on perceptions of videotaped walkers [J]. Current Psychology, 34, 613-620.
- [8] Rabinowitch, T. C. & Meltzoff, A. N. (2017). Synchronized movement experience enhances peer cooperation in preschool children [J]. Journal of Experimental Child Psychology, 160, 21-32.
- [9] Liu Denghun, Bian Bingbing. Returning and transcending: The design of teaching

- contexts under the perspective of embodied cognition[J]. Contemporary Educational Science, 2021 (8): 49-54.
- [10] Wells, G.L.& Petty, R.E. The effects of over the admovement sonpersuasion: compatibility and incompatibility of responses. Basic and Applied Social Psychology, 1980, (3).PP.219-230
- [11] Leman M. Sharing Musical Expression Through Embodied Listening: A Case Study Based on Chinese Gu qin Music. Music Perception, 2009, (3).pp. 263-278.
- [12] Dai, L.H.. Reconstruction of Elementary School Sound Music Classroom under the Concrete Visualization [J]. Art World, 2020 (06): 125-126.
- [13] Gao He. Exploring the teaching of high-efficiency chorus class under the perspective of embodied cognition [J]. The Voice of the Yangtze River, 2021 (14):93-96.
- [14] Zhang Wei. Embodied Cognition: Paradigm Transformation of Sound Music Teaching[J]. Jiangjian Education, 2019 (11):82.
- [15] Zhao Yu. Relying on Embodied Cognition Theory to Promote Students' Acquisition of Music Skills [J]. Innovation, 62.