ingegneria sismica
International Journal of Earthquake Engineering
Anno XLIII - Num. 1 - 2026

A Systematic Cultivation Strategy of Generalized Cognitive Ability in Music Teaching in the Context of Interdisciplinary Multi-Art Integration

Qian Meng[1,*]

[1] School of Music and Dance, Hubei Preschool Teachers College, Wuhan, Hubei, 430223, China

SUMMARY: *Music curriculum is the carrier of spreading art and culture, and it is also the main way to cultivate students' music appreciation ability. The current research study is mainly focused on the area of generalized cognitive ability in music education, where a total number of 51 individuals was selected in order to conduct the quasi-experimental research for assessing an experimentally developed approach of cultivating the generalized cognitive ability based on perceptual cognition through bodily senses (hearing, vision, smell, and touch). The event-related potentials were used for recording the data through real-time EEG measurements and understanding the processing mechanisms of music working memory during music perception while evaluating the ability of music perception and generalized cognitive ability of the subjects. Significant differences in post-tests between the experimental and control groups have been found in terms of the generalized cognitive ability in music, which implies that the cultivation strategy is better in enhancing such ability of students. In terms of behavioral and electroencephalographic indicators, subjects in the experimental group may have stronger conflict monitoring and motor inhibition abilities in response inhibition tasks.*

KEYWORDS: *music perception; generalized cognition; music ability; ERP*

1 Introduction

With the continuous improvement of education level, the teaching mode of interdisciplinary integration has gradually spread to the whole compulsory education stage [1]. In many areas of teaching, interdisciplinary integration has become a very key teaching tool. The interdisciplinary integration of multiple arts also plays a very important role in music teaching. Music interdisciplinary teaching mode is centered on music teaching, through the knowledge system of different disciplines for music teaching design, to involve the knowledge of different disciplines, teachers in the explanation of music knowledge as well as teacher-student interaction should be innovative teaching methods [2-6]. Compared with the traditional music teaching mode, the teaching mode of music interdisciplinary integration is more flexible and more in line with students' interests, which can broaden students' musical horizons and improve their creativity [7-9].

Music teaching should not only promote students' understanding of music knowledge, but also enrich students' music perception. In music teaching, teachers should mobilize students' multiple senses, such as hearing and vision, to give students a multi-sensory experience. The feelings between the senses are common, i.e., “common sense”. Tongshen is a kind of “common sense”, tongshen is a psychological activity that starts with feeling, takes imagination as a

*xiximq1972@163.com
https://doi.org/10.65102/is2026180 Published: 30 April, 2026

bridge, and takes emotion as a driving force [10, 11]. In the process of music appreciation, guiding students to combine audio and visual senses can help students establish a connection between musical notes and visual representations, so that students can actively imagine and visualize the relevant visual images in their minds when listening to music [12-14]. This kind of music generalization, generally accompanied by listening, is a multi-sensory linkage, pointing to the aesthetic experience of music, which is people's comprehensive perception of music, and this kind of generalized cognitive ability has become the core literacy of music teaching [15, 16]. However, traditional music teaching focuses on students' performance skills and music theory knowledge, and does not pay enough attention to the cultivation of their general cognitive ability, so it lacks a systematic cultivation strategy [17, 18]. The background of interdisciplinary integration, however, gives the direction of innovation and optimization of the traditional teaching mode, which has the potential to be applied to the cultivation of students' generic cognitive ability.

Under the development trend of contemporary education that emphasizes interdisciplinary integration, the synergistic nurturing value of multiple arts is receiving more and more attention. This paper proposes a systematic cultivation strategy for enhancing students' music general sense cognitive ability through the multi-sensory linkage of the body senses (hearing, sight, smell, touch). Fifty-one people were selected as subjects, and experiments were set up to conduct pre- and post-tests in four dimensions of students' generalized cognitive ability in music (perceptual ability, musical expressive ability, musical creativity, and musical comprehension), to verify the effectiveness of the systematic cultivation strategy based on generalized cognition. At the same time, real-time EEG recordings were made using event-related potentials (ERP) technology, and the subjects were tested for music perceptual and cognitive abilities from the Go/No-go and Stroop tasks from the behavioral and EEG dimensions.

2 Research methodology

2.1 Subjects of study

The entire experiment consisted of three steps: a preexperimental test, a comprehensive cognitive test, and an actual test of event-related potentials. The subjects who participated in the last two steps were selected through the scores of the pre-experimental test.

Subjects: 51, 27 boys and 24 girls, age range 3-7 years old. All subjects had normal vision or corrected vision, were right-handed, and had no history of psychiatric or neurological disorders.

2.2 The practice of teaching music with generalized cognitive skills

2.2.1 Research process

The current research adopted a mixed-method research design combining elements of a literature review, a questionnaire survey, and experiment design. Within the area of early childhood music education, CTCL theory was used as the overarching paradigm in this study, whereas the implementation of a contextualized instruction strategy meant to trigger learning interest was selected as the major independent variable. Meanwhile, such variables as instructional content and grades of the students were held constant to investigate whether greater learning interest was conducive to improving four aspects of musical perception and cognition, including perceptual skill, performance skill, creativity, and music comprehension, through pre-experiment and post-experiment tests. Besides the questionnaires, which comprised a diagnostic instrument and a test instrument, the main purpose of the former was to measure the initial level of musical perception and cognition competence of the students at the start of the experiment and accordingly arrange for the personalized teaching arrangement for the experimental group participants. The latter, on the other hand, was mainly used to evaluate the improvement of this competence after the intervention.

An initial evaluation was done on both groups to determine whether there was any level of equal general intelligence regarding music among the students, and to collect relevant baseline data on the experimental group. Following this, tailored learning approaches were used for the experimental group while the control group was taught using the regular curriculum on music. At the end of the instruction phase, both groups were tested using a post-test. Lastly, the data collected from both groups was analyzed.

2.2.2 Systematic Cultivation Strategies for Music Generative Cognitive Abilities

(1) Activate students' sensory experience

As the saying goes: hearing is not believing, seeing is not believing. Although music is an auditory art, it is impossible to interpret the true meaning of the art of music by listening with ears only. The various senses of the body (hearing, seeing, smelling, touching) can make the virtual sound visible, palpable and touchable. With the ear as the eye, listening to the sound-like shape, this sensory penetration and cross enhances the charm and effect of art, so that students can experience the beauty of music in an immersive way, and fully activate the students' senses to the understanding of music.

(2) Cultivate students' musical senses

The most important thing in learning music is to cultivate the “sense of music”, and the various senses of the body are a good way to do so. The core idea is that the sense of hearing is the absolute leader, and all responses, perceptions and understanding of music must be formed from the sense of hearing. Broadly speaking, it has four main characteristics: active, participatory, practical and creative.

1) Initiative. Utilizing students' senses for linkage, this teaching method changes the way students learn, so that students change from passive learning to active learning, and can learn music more happily and simply, and experience the beauty of music.

2) Participatory. Based on the auditory senses, multi-sensory participation, the music experience will be freely expressed in their favorite way, so that students consciously participate in the classroom teaching process, to maintain a pleasant mood and a high degree of participation.

3) Practicality. In the classroom, students can better discover, try and harvest new multi-sensory experiences through sensory linkage, and then share and reflect on their discoveries in groups and collectively. From perception to experience, then from cognition to understanding, and finally from reflection to creation, it can expand students' knowledge of the music world.

4) Creativity. Sensory linkage provides free space for students' musical expression, and the music classroom seeks to cultivate students' practical experience of music and their ability to improvise and create, and to mobilize students' musicality.

(3) Utilizing the senses to promote the generation of musicality

In teaching, teachers should design interesting music activities, teaching content and methodology should be combined with the students' life world and follow their nature. Around the auditory senses as the core of the experiential activities, students through the music to stimulate the brain functions, causing another or another kind of sensory experience, so as to feel and experience music in a multi-sensory way.

2.2.3 Research questionnaires

In this study, the measurement data of four aspects and fourteen items are expressed as scores to determine the current status of students' musical ability level, and the specific scores are shown in Table 1.

The data of this study is analyzed by the method of “rounding”, for example, the average score of students' musical ability can be expressed in the following way:

The average score of students' musical perception is “18.4700”, which is rounded to take the score “18.5000”.

The average score for students' musical expression is “18.4900”, rounded to the nearest “18.5000”.

Table 1: Fractional measurement

Musical Sensibility (25 points)	Pitch (5 points)
	Volume (5 points)
	Rhythm (5 points)
	Speed (5 points)
	Melody (5 points)
Musical Expressiveness (25 points)	Sing a song (8 points)
	Perform a song (8 points)
	Improvisation (9 points)
Music Creativity (25 points)	Lyric Creation (8 points)
	Action Choreography (9 points)
	Rhythm Composition (8 points)
Music comprehension (25 points)	Emotional Understanding (8 points)
	Rhythm comprehension (9 points)
	Content comprehension (8 points)

2.3 Experimental Design and Procedures

2.3.1 Evaluation of experimental materials

A rating scale based on a five-point Likert scale was designed to rate the familiarity and logic (the extent to which the basic and formal elements of music are represented) of the musical material.

2.3.2 Pre-laboratory tests

The degree of musical perceptual ability of the selected subjects was measured by an adult version of the Musical Aptitude Profile (MAP) adapted from the MAP. A control group in the real test of event-related potentials was formed based on the results of this experimental behavioral data.

2.3.3 Comprehensive awareness experiments

Using a classic cognitive assessment tool, subjects were given a 12-item basic cognitive assessment covering multiple dimensions such as processing speed, working memory, and executive control.

2.3.4 Experiments with event-related potentials (ERPs)

ERP EEG was acquired by means of an electrophysiologic datalogger manufactured by Brain

Products, Germany. A 64 conductive electrode was used with a sampling rate of 500 Hz and an electrical impedance of less than 5 kΩ, and the recording electrodes, Cz point and FPz, were grounded electrode points.

Behavioral data generated from the experiments were statistically analyzed by IBM SPSS Statistics19.0 software. The extraction and analysis of event-related potentials (ERPs) were performed using the Brain Vision Analyzer software from Germany.

The experimental stimulation time course segmentation was analyzed by combining scalp electrodes. The specific operations were:

(1) The average wave amplitude of the complete music stimulus with a duration of 4000ms was analyzed;

(2) The encoding phase of musical working memory was specifically analyzed in the region after 2500 ms because the experimental design was changed at 2500 ms of the musical stimulus material;

(3) The extraction stage of musical working memory, where the 4000ms of musical stimulus material was divided into four time periods for analysis: time window 1 (1300ms-1500ms), time window 2 (1500ms-2500ms), time window 3 (2500ms-3500ms), and time window 4 (3500ms-4000ms).

The six regions of interest were divided by the following rules: the anterior-posterior dimension was divided into four levels, and the left-right dimension was divided into two levels; and the six cortical regions of interest were, in order of coding, prefrontal, central, parietal, occipital, left temporal lobe, and right temporal lobe regions.

The average wave amplitude of each area of interest in different time windows was calculated using IBM SPSS Statistics 19.0 software, and was sequentially used as the dependent variable, and repeated measures ANOVA was performed with the level of music perceptual ability, music stimulus material, time segmentation, and area of interest as independent variables. Finally, the factors of music perceptual cognitive ability, gender, and general cognitive ability were included in the analysis, and regression analysis was conducted according to the correlation and interaction between the factors.

In this study, the ERP technique was used to analyze the response data of the subjects under the “Go” and “No-go” responses through the Go/No-go and Stroop tasks, and to examine the cognitive neural mechanisms in the Stroop task.

3 Results and analysis

3.1 Results and Analysis of Music General Cognitive Skills Practice

3.1.1 Pre-test results and statistical analysis of experimental and control groups

The four dimensions of musical competence such as perception, expression, creativity, and comprehension in the experimental and reference groups were analyzed to see if the groups possessed similar levels regarding these dimensions at the beginning of the experiment. The chi-square analysis results for the experimental group are shown in Table 2 below. According to the findings, there are no statistical differences between the two groups on all dimensions and the overall level of musical competence.

Table 2: Music ability statistics before test

Item	Classes	Mean	Mean difference	Standard error	t	Sig.(bilateral)
Perceptivity	Experimental class	16.1421	0.5718	4.24712	0.382	0.749
	Control class	15.5703				
Expressive force	Experimental class	14.6200	-0.5119	5.79283	-0.522	0.699
	Control class	15.1319				
Creativity	Experimental class	16.7423	-0.5119	4.28631	0.301	0.793
	Control class	16.4382				
faculty of understanding	Experimental class	19.6778	0.8453	4.07439	1.318	0.341
	Control class	18.8325				

*P<0.05, **P<0.01

3.1.2 Post-test results and statistical analysis of experimental and control groups

For each of the four dimensions of musical competence in children, namely perception, expressiveness, creativity, and comprehension, post-test results were analyzed for both the experimental and reference groups with further comparative analysis of differences in results. The obtained data are presented below in Table 3.

After analyzing the obtained data, it was revealed that the t value for musical expressiveness between the experimental and control groups is 2.395, which makes the p-value equal to 0.039 ($p < 0.05$). This means that there is a significant difference between the two groups when comparing their abilities in terms of musical expressiveness. At the same time, a high statistical significance ($p < 0.01$) was found for the differences in musical perception, creativity, and comprehension between the two groups. Overall, it can be stated that the experimental group performed better than the control one in all dimensions mentioned above.

Table 3: Post-test results statistics of experimental class versus control class

Item	Classes	Mean	Mean difference	Standard error	t	Sig.(bilateral)
Perceptivity	Experimental class	19.3781	2.8366	3.49215	4.752	0.001**
	Control class	16.5415				
Expressive force	Experimental class	16.7247	2.2921	5.33173	2.395	0.039*
	Control class	14.4326				
Creativity	Experimental class	18.6122	2.8189	5.22811	3.011	0.007**
	Control class	15.7933				
faculty of understanding	Experimental class	21.5778	2.7625	3.37019	4.815	0.001**
	Control class	18.8153				

*P<0.05, **P<0.01

3.1.3 Pre- and post-test results and statistical analysis of the experimental group

Statistical analysis was conducted on the performance of the experimental class during the pre-test and post-test in relation to the four aspects: perception, expression, creativity, and comprehension, with the respective results shown in Table 4 below. For music perception, the average pre-test score of the experimental class is 14.7711 while the average post-test score is 19.4724, resulting in an average difference of -4.7013. The implication of the result is that the strategy of systematic cultivation led to the development of music perception among the students. In addition, the difference between the pre-test and post-test scores was highly significant (p<0.01) in relation to music comprehension in the experimental group. Also, the post-test score is higher than the pre-test score in all aspects of music competency. In conclusion, therefore, the strategy of systematic cultivation based on the concept of generalized perceptual cognition is effective in developing perceptual-cognitive ability among students through activation of senses.

Table 4: Results of the Pre-test and Post-test of the Experimental Class

Item	Test	Mean	Mean difference	Standard error	t	Sig.(bilateral)
Perceptivity	Pre-test	14.7711	-4.7013	3.97417	-4.783	0.001**
	Post-test	19.4724				
Expressive force	Pre-test	16.4065	-0.6345	5.89515	-2.245	0.044*
	Post-test	17.0410				
Creativity	Pre-test	18.6743	-0.9668	5.61296	-2.344	0.037*
	Post-test	19.6411				
faculty of understanding	Pre-test	19.4743	-2.2668	2.54192	-4.822	0.001**
	Post-test	21.7411				

*P<0.05, **P<0.01

3.1.4 Control group pre- and post-test results and statistical analysis

The findings from Table 5 indicate that there is a remarkable improvement in the area of music perception for the control group after the treatment process. However, there are no significant differences recorded in terms of expression, creativity, and comprehension (p > 0.01). Post-treatment performance by the control group does not demonstrate any remarkable improvements over pre-test results, which shows that the conventional nurturing of students has not been effective in enhancing the musical skills of the students.

Table 5: Statistical Table of Pre-test and Post-test Results in Control Class

Item	Test	Mean	Mean difference	Standard error	t	Sig.(bilateral)
Perceptivity	Pre-test	15.9200	-1	2.22972	-2.547	0.022*
	Post-test	16.9200				
Expressive force	Pre-test	15.1367	0.2	4.14391	0.283	0.811
	Post-test	14.9367				
Creativity	Pre-test	16.5367	0.6667	4.63838	0.811	0.435
	Post-test	15.8700				
faculty of understanding	Pre-test	18.9700	3.05	2.97695	0.194	0.861
	Post-test	15.9200				

*P<0.05, **P<0.01

3.1.5 Post-test results and statistical analysis of dimensions

A table depicting the post-test performances of the experimental and control groups in various dimensions of music perception namely pitch, tone intensity, rhythm, tempo, and melody is shown in Table 6. From these data, there is a statistically significant difference ($p < 0.05$) in terms of pitch, tone intensity, tempo, and melody but there is no significant difference regarding rhythm ($p > 0.05$). All in all, the experiment group performs better than the control group in these music perception parameters. Taken all together, it can be concluded that the cultivation approach using generalized cognition leads to greater improvement of the students' generalized musical cognitive ability due to multi-modal stimulation.

Table 6: The Statistics of the Dimensions of Musical Perception

Item	Classes	Mean	Mean difference	Standard error	t	Sig.(bilateral)
Pitch	Experimental class	3.6711	0.5	1.26981	2.193	0.041*
	Control class	3.1711				
The loudness of a sound	Experimental class	5.6544	0.6666	1.61644	2.301	0.034*
	Control class	4.9878				
Rhythm	Experimental class	4.4044	0.75	1.89151	2.212	0.041*
	Control class	3.6544				
Velocity	Experimental class	5.1544	1.4833	1.61644	0.577	0.579
	Control class	3.6711				
Melody	Experimental class	3.1711	-2.4833	1.15387	0.253	0.035*
	Control class	5.6544				

*P<0.05, **P<0.01

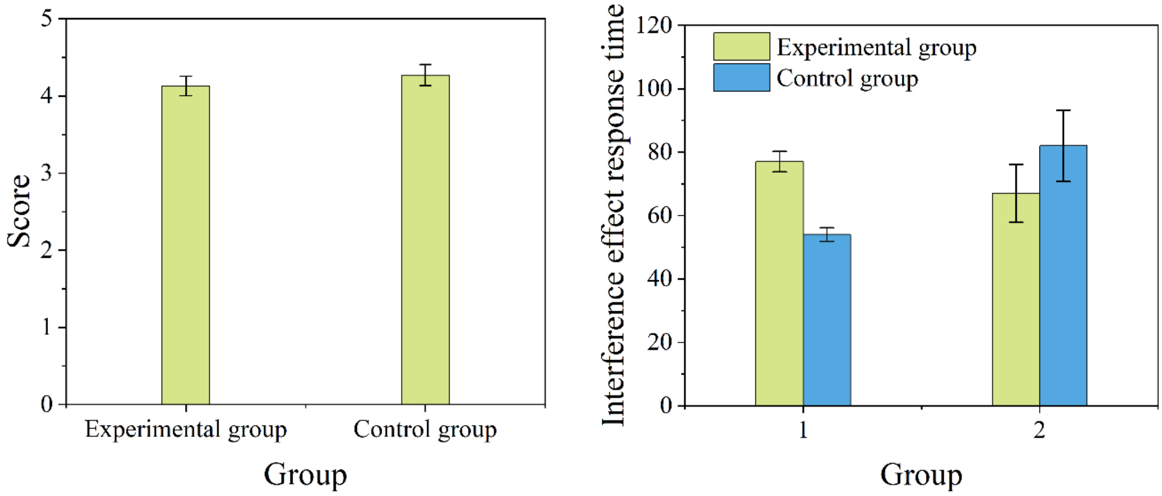
3.2 Behavioral outcomes

Figure 1 and Table 7 display performance measures from the Go/No-go and Stroop tasks among the experimental and control groups.

According to Figure 1(a) and Table 7, the ANOVA results regarding the main effect of condition on Go/No-go accuracy proved to be significant, F(1,44)=29.01, p<0.001, η_p^2=0.42. Accuracy was generally higher in Go compared to No-go trials. Neither main effect nor interaction of group and condition were reliable, i.e., F(1,44)=0.03, p=0.86 and F(1,44)=0.31, p=0.62 respectively. Also, independent-samples t-tests did not show any differences between the two groups regarding d' score, t(44)=0.09, p=0.98, or response time to Go trials, t(44)=1.82, p=0.09.

Accuracy ANOVA results for the Stroop task displayed an expected main effect of condition, F(1,44)=119.11, p<0.001, η_p^2=0.71, indicating higher accuracy in consistent vs. inconsistent condition. Moreover, main effect of group, F(1,44)=6.68, p=0.014, η_p^2=0.15, also occurred, showing better performance in the experimental vs. control group.

As shown in Figure 1(b), the interaction of group and condition achieved statistical significance, F(1,44)=5.59, p=0.027, η_p^2=0.13. Independent-samples t-tests yielded the results showing that Stroop interference (the difference between consistently correct and inconsistently correct responses) was smaller in the experimental vs. control group. Regarding the response time, the main effect of condition was statistically reliable, F(1,44)=298.21, p<0.001, η_p^2=0.89, with a smaller latency in the consistent condition. The main effect of group was also significant, F(1,44)=9.16, p=0.005, η_p^2 =0.19, with faster response time in the experimental group. Interaction between group and condition was not reliable, F(1,44) = 1.34, p = 0.28. Independent samples t-tests showed no significant difference in the Stroop interference effect (inconsistent response time minus consistent response time) between the two groups of subjects in terms of response time.



(a) Go/no-go tasks (b) Stroop tasks

Figure 1: Behavioral performance in the experimental group and control group

Table 7: Comparison of differences between the two groups of subjects

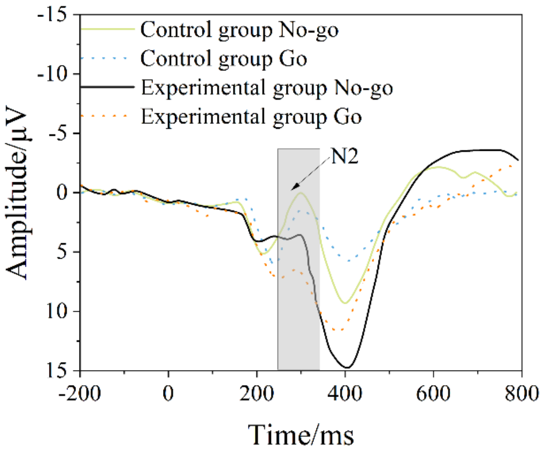
Inhibition Control	Control group	Experimental group	F (1, 44)	p
Go/no-go tasks				
Go accuracy	99.17 (1.67)	99.82 (0.62)	1.51	0.19
No-go accuracy	96.58 (4.33)	97.01 (4.58)	0.03	0.89
ERP				
GO N2	2.69 (3.28)	7.91 (4.57)	20.35	0.001***
No-go N2	1.65 (3.55)	6.35 (5.59)	6.74	0.014*
Go P3	6.42 (3.57)	12.18 (4.85)	19.41	0.001***
No-go P3	8.01 (4.02)	16.35 (6.01)	23.05	0.001***
Stroop tasks				
Consistency accuracy	88.25 (7.73)	94.15 (5.16)	4.08	0.05*
Inconsistency accuracy	76.62 (12.69)	85.26 (9.71)	7.41	0.01*
Uniform response time	638.27 (40.55)	587.44 (62.25)	12.39	0.003**
Inconsistent response time	698.51 (41.75)	659.81 (71.26)	7.33	0.018*
ERP				
Consistent N450	1.24 (2.88)	4.26 (5.19)	5.71	0.025*
Inconsistent N450	0.43 (2.49)	2.31 (4.51)	3.46	0.09
Unanimous sp	-5.04 (3.32)	-4.95 (4.48)	0.03	0.86
Atypism sp	-3.57 (3.19)	-3.55 (3.91)	0.005	0.98

Note: *p<0.05, **p<0.01, ***p<0.001

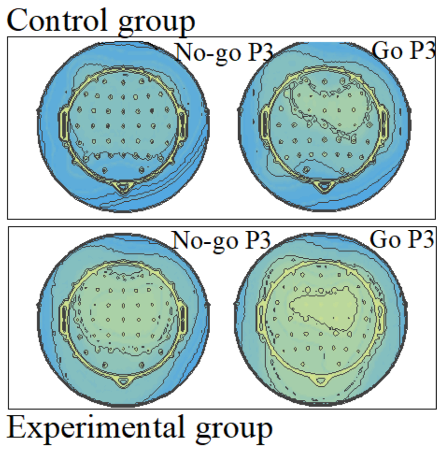
3.3 ERP results

3.3.1 Go/No-go

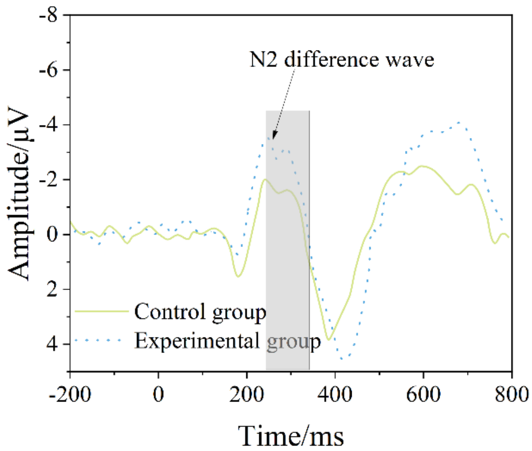
The variability of the data recorded from the Fz electrode during the Go/No-go task by two groups is shown in Figure 2. Panel (a) shows the N2 waveform recorded from the Go and No-go tasks; panel (b) shows the N2 topography, while panels (c) and (d) show the difference between the two topographies for both conditions (No-go - Go). From Figures 2(a) and 2(b), it can be seen that the analysis showed a statistically significant effect of the condition on the amplitude of the N2 response, F(1,44) = 30.05, p < 0.001, η_p^2 =0.42, with the No-go task producing larger amplitudes compared to the Go task. On the other hand, Figures 2(c) and 2(d) show a statistically significant interaction between the condition and subject type, F(1,44) = 5.51, p = 0.031, η_p^2 =0.13. IIndependent samples t-test results further showed that the N2 difference waves (No-go – Go) were significantly higher in the experimental group than the control group, t(44) = 2.39, p = 0.027, 95% CI = [-2.93, -0.25], Cohen’s d = 0.71.



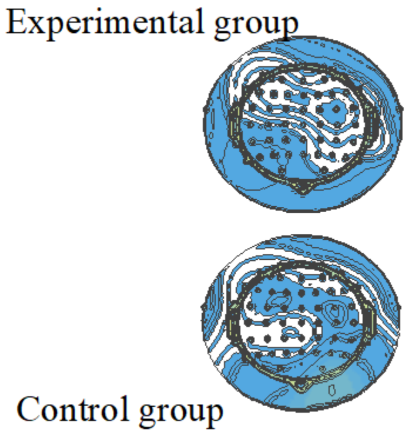
(a) Result 1



(b) Result 2



(c) Result 3

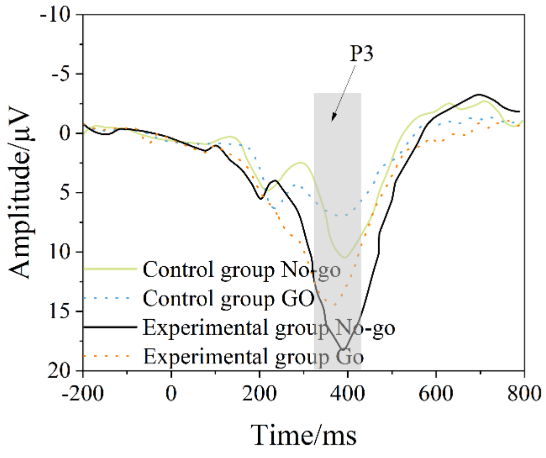


(d) Result 4

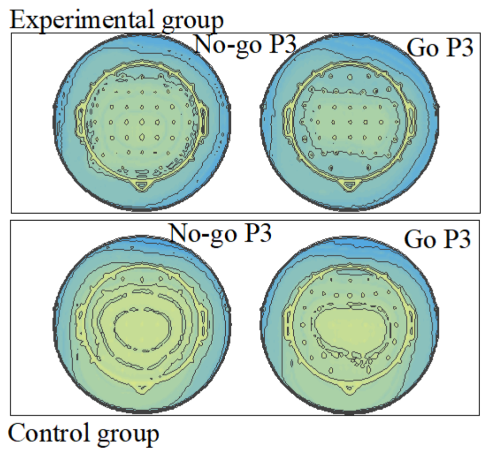
Figure 2: The experimental group and control group participants at task point Fz

Figure 3 illustrates the response patterns observed in the Fz electrode from both participant groups throughout the Go/No-go test: graph (a) illustrates the N2 responses obtained in Go and No-go conditions; graph (b) displays the N2 topography in both conditions; graph (c) displays the N2 difference wave (No-go vs. Go condition); and graph (d) demonstrates the topography of the latter.

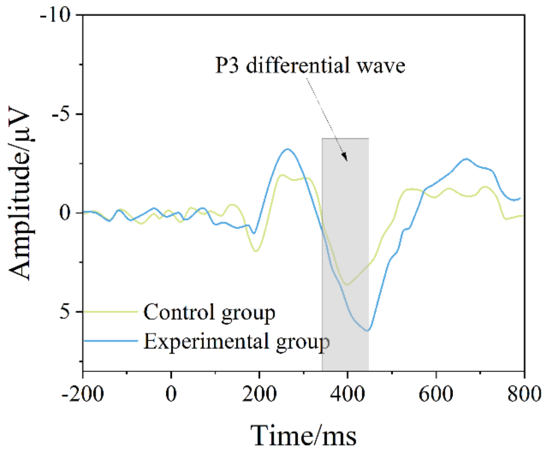
The ANOVA analysis conducted to examine the influence of conditions on mean P3 amplitude, as displayed in Figure 3(a) and Figure 3(b), showed a significant effect of condition, F(1,44)=41.23, p<0.001, η_p^2 =0.49, where the No-go condition led to the higher P3 amplitudes than the Go condition. Moreover, Figure 3(c) and Figure 3(d) demonstrated the existence of an interaction effect between the above-mentioned factors, F(1,44)=5.72, p=0.025, η_p^2 =0.12. The independent samples t-test results also confirmed that the P3 difference wave (No-go vs. Go condition) was higher in the experimental group than in the control group, t(44)=2.39



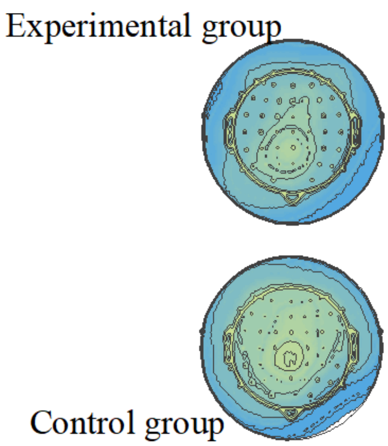
(a) Result 1



(b) Result 2



(c) Result 3



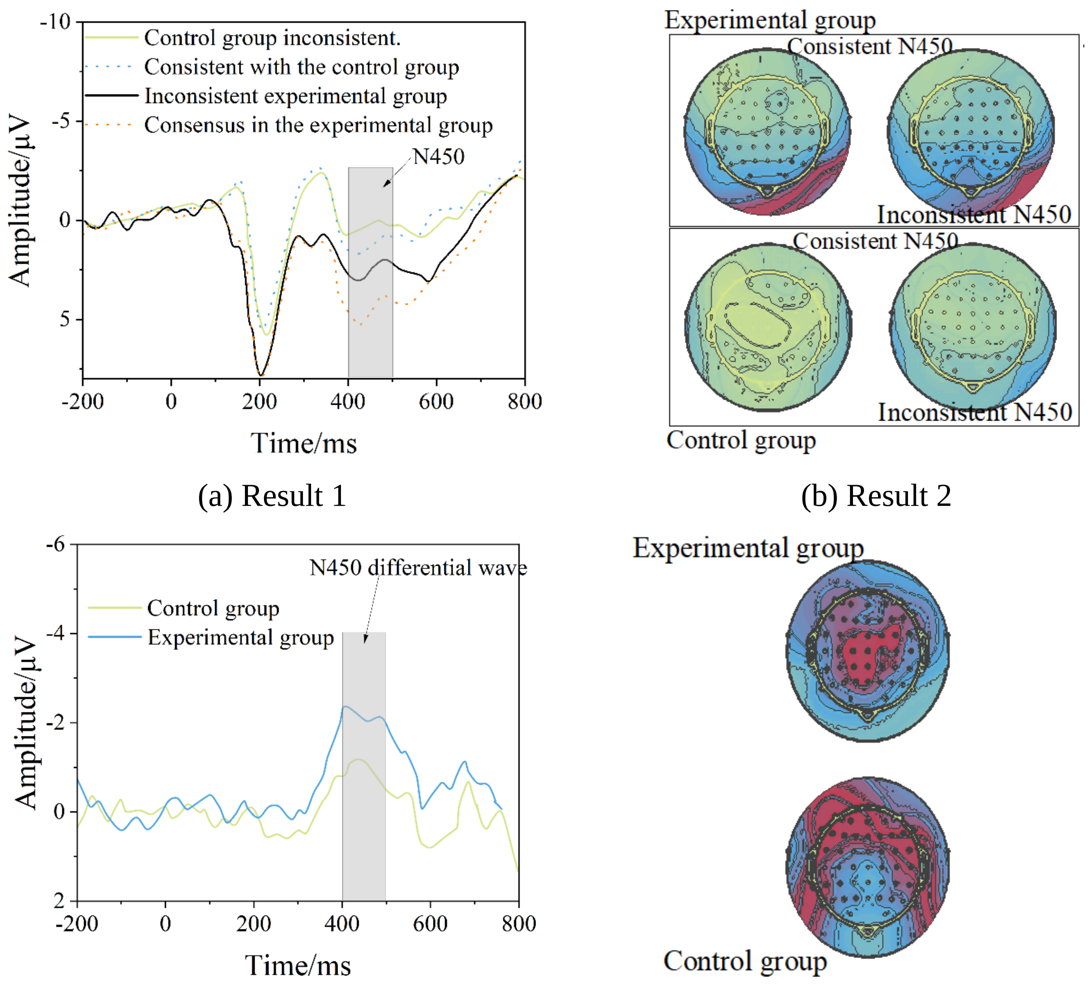
(d) Result 4

Figure 3: Participants in the experimental group and control group at task point Cz

3.3.2 Stroop

Combined with Table 7, there was a significant main effect of subject type, F(1,44) = 4.73, p = 0.035, η_p^2 = 0.10, and the N450 wave amplitude was greater in the music training group than in the control group. The wave amplitudes of the experimental and control subjects at the FCz point of the Stroop task are shown in Figure 4.

The results in Figures 4(a) and 4(b) show a significant main effect of condition, F(1,44)=27.83, p<0.001, η_p^2 =0.39, with the incongruent condition inducing a more negative N450 wave amplitude than the congruent condition; and in Figures 4(c) and 4(d), there was a significant interaction between subject type and condition, F(1,44)=4.47, p=0.043, η_p^2 =0.11. An independent samples t-test showed that the N450 difference wave (inconsistent minus consistent) was significantly larger in the experimental group than in the control group, t(44) = -2.13, p = 0.043, 95% CI = [-2.09, 0.06], *Cohen's d* = 0.64.



(a) Result 1

(b) Result 2

(c) Result 3

(d) Result 4

Figure 4: Participants in the experimental group and control group at task point FCz

4 Conclusion

Kinesthetic perception and pedagogical approaches in music education were combined in this study in order to develop a comprehensive training program for increasing the competence of musical perception-cognition. An experiment comparing two groups was designed to assess the effectiveness of this training program. In addition to event-related potentials (ERP), the method of recording and analyzing the time course of processes associated with inhibitory control was used. To test response inhibition and conflict monitoring, the Go/No-go and Stroop tasks were conducted. It is shown that a training program based on generalization of cognition produced a statistically reliable increase in the musical competence of students ($p < 0.01$) with particular emphasis on music perception and creativity. No statistically reliable differences between the groups were found in behavioral performance of the Go/No-go task. However, the difference-waves N2 and P3 were recorded in greater amplitude in the experimental group compared to the control one.

About the Author

Qian Meng, female, Associate Professor, Faculty Member, School of Music and Dance, Hubei Preschool Teachers College, Born in Wuhan, Hubei Province in December 1972. Graduated from the Music Education College of Wuhan Conservatory of Music in June 1993, member of Hubei Musicians Association, member of the Musical Theater Professional Committee, Hubei Musicians Association, member of the Piano Professional Committee, Hubei Musicians Association, member of Hubei Aesthetic Education Association. With over thirty years of teaching experience, she possesses extensive expertise in music education at the tertiary level. Her primary research focus lies in higher education music pedagogy. In recent years, she has delved deeper into exploring methods of integrating multiple arts into music education and has achieved notable results in this area.

References

[1] Klaassen, R. G. (2018). Interdisciplinary education: a case study. European journal of engineering education, 43(6), 842-859.

[2] Cuervo, L. (2018). Study of an interdisciplinary didactic model in a secondary education music class. Music Education Research, 20(4), 463-479.

[3] Boichenko, M., Nikolai, H., Linenko, A., & Koehn, N. (2020). Interdisciplinary coordination in historical-theoretical and music-performing training of future musical art teachers. Journal of History Culture and Art Research, 9(1), 225-235.

[4] Özenç-Ira, G., & Gültekin, M. (2023). Making interdisciplinary connections through music: A systematic review of studies in general schooling context in Turkey. International Journal of Music Education, 41(4), 631-650.

[5] Grozavu, D. M. (2024). Addressing interdisciplinary of music. Review of Artistic Education, (27), 135-142.

[6] Huang, N., & Li, J. (2024). An Investigation into the Design of Interdisciplinary Theme-based Learning in Junior Middle School Music under the Perspective of the New Curriculum Standard—Take" Voices of the Yao People: The Intersection of Music and Culture" for Example. Journal of Theory and Practice in Humanities and Social Sciences, 1(4), 67-75.

[7] Znidarsic, J. (2022). Interdisciplinary interaction between music education and history: Shaping the musical preferences in classical music of the 20th century. CEPS Journal, 12(2), 197-216.

[8] Johnson, G., & Moldavan, A. M. (2023). Creative learning with music and mathematics: Reflections on interdisciplinary collaborations. The STEAM Journal, 5(1), 1.

[9] Marquardt, K., Shang, Q., Hennhöfer, O., & Happe, L. (2025, June). Interdisciplinary Harmonies: A Story-Driven Course on AI and Music to Increase Interest in Computer Science. In Proceedings of the 6th European Conference on Software Engineering Education (pp. 145-153).

[10] Jensen, J. B. (2019). Music, social learning and senses in university pedagogy: An intersection between art and academe. Arts and Humanities in Higher Education, 18(4), 311-328.

[11] Yang, J. (2023). Research on music education: Integrating synaesthesia theory and colour psychology. HTS Teologiese Studies/Theological Studies, 79(4).

[12] Tarekegn, A., & Sherry, S. (2021). Synesthesia and Musical Perception. Journal of Student Research, 10(10.47611).

[13] Marjanen, K. (2021). Multisensory musical design: Views for music as a phenomenal framework for human, phenomena-based education. The International Journal of Arts Education, 15(3-4), 15-47.

[14] Yunosova, V., Alekseeva, L., Hlazova, S., Kornienko, S., & Shkola, G. (2020). Phenomenon of sound synesthesia in the development of students' creative thinking. Journal of History Culture and Art Research, 9(2), 147-164.

[15] Rudenko, S., & Cabral, J. P. (2019). Synaesthesia: How can it be used to enhance the audio-visual perception of music and multisensory design in digitally enhanced environments. In Proceedings of SMM19, Workshop on Speech, Music and Mind 2019 (pp. 60-64).

[16] Filimon, R. C. (2023). Syncretism and synaesthesia in music–unification of arts and perceptions. Artes. Journal of musicology, (27-28), 167-184.

[17] Liulingzi, X., Pattananon, N., & Khunthongchan, P. (2023). The multi-sensory teaching practice for primary music classroom in China. Journal of Modern Learning Development, 8(2), 457-464.

[18] Zhang, X. (2023). Multi-sensory research of singing visualization in pre-school music education. Interactive Learning Environments, 31(5), 2830-2840.