

The Effects of Musical Elements on Emotional Arousal in College Students

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Abstract: This study aims to investigate the effects of musical elements on emotional arousal levels in college students. A total of 22 undergraduate students participated in the experiment, and their emotional states before and after listening to different musical excerpts were assessed using the Chinese Mood Adjective Checklist (CMACL). The results showed significant changes in the “Pain and Sadness” dimension after listening to Musical Work 1 and Musical Work 2 ($p < 0.001$). In contrast, no significant differences in emotional responses were observed after listening to Musical Work 3 ($\chi^2 = 1.41$, $p = 0.312$) or Musical Work 4 ($\chi^2 = 5.946$, $p = 0.111$). The findings indicate that music with a fast tempo, higher pitch register, and dense rhythmic structure can effectively enhance emotional arousal, whereas music with a slow tempo, lower pitch register, and sparse rhythm is more likely to evoke contemplative and sad emotions. In addition, lyrical content plays a clear cueing and guiding role in shaping emotional experiences.

Keywords: Musical Elements; College Students; Emotional Arousal; Psychological Intervention

1. Introduction

With the intensification of social competition, college students face multidimensional pressures related to academic performance, employment prospects, and interpersonal relationships, which have increasingly affected their mental health [1]. Data from the past decade indicate a marked rise in the prevalence of anxiety, sleep disorders, and depression among Chinese college students [2]. As a ubiquitous medium in daily life, music has become an important tool for emotional regulation among college students and plays an irreplaceable role in promoting psychological well-being [3].

Previous studies have demonstrated that musical elements are among the key factors influencing emotional responses [4]. According to emotional arousal theory, musical characteristics such as rhythm, tempo, and harmonic patterns can modulate physiological arousal levels, thereby eliciting different emotional experiences [5]. Emotional responses also arise from individuals' direct perception and cognitive processing of changes in tempo, timbre, rhythm, and dynamics [6]. Musical consonance has been shown to be closely related to emotional intensity, with highly consonant music eliciting stronger emotional responses [7]. Cross-cultural research further suggests that major modes in Western music and Gong modes in traditional Chinese music tend to induce positive emotions, whereas minor modes and Yu modes are more likely to evoke negative emotions [8].

Despite the growing body of research on the emotional effects of musical elements, systematic investigations focusing specifically on college students remain limited. Therefore, this study aims to examine how musical elements influence emotional arousal in college students, providing empirical evidence for individualized psychological interventions.

2. Methods

2.1 Participants

Participants were undergraduate students recruited from a university. All participants underwent a preliminary mental health screening and provided informed consent prior to inclusion. Individuals with diagnosed psychological disorders or currently receiving psychological treatment were excluded to ensure sample representativeness. A total of 22 participants were included, comprising 7 males and 15 females, representing five academic disciplines (see Table 1).

2.2 Research Design

Four musical excerpts differing in style, tempo, pitch register, and timbre were selected as experimental stimuli (see Table 2). Musical elements were categorized based on tempo and rhythmic density. Participants' music genre preferences are shown in Table 3. The experimental procedure consisted of four stages: pre-listening emotional assessment, relaxation training, music listening, and post-listening feedback. The total duration of the experiment

was approximately 30 minutes.

Table 1. Demographic Characteristics of Participants

	n	Percentage (%)
Male	7	31.8
Female	15	68.2
Arts & Humanities	7	31.8
Sciences	2	9.1
Engineering	5	22.7
Arts (Music/Fine Arts)	7	31.8
Other	1	4.5

Table 2. Characteristics of Musical Excerpts Used in the Experiment

No.	Musical Excerpt	Musical Characteristics	Type
1	I Once Thought About Dying	Medium tempo, mid-low pitch register, sparse and varied rhythm	Vocal
2	Butterfly Lovers (Farewell at the Pavilion excerpt)	Slow tempo, mid-high pitch register, sparse and regular rhythm	Instrumental
3	Good Luck	Fast tempo, mid-high pitch register, dense and varied rhythm	Vocal
4	Spring Festival Overture	Fast tempo, mid-high pitch register, dense and regular rhythm	Instrumental

Table 3. Distribution of Participants' Music Genre Preferences

	Western Classical Music	Traditional Chinese Music	Popular Music	Light Music	Other Genres
Frequency	9	8	16	16	2
Percentage (%)	40.9	36.4	72.7	72.7	9.1

2.3 Measurement Instrument

The Chinese Mood Adjective Checklist (CMACL) was used to assess emotional changes before and after music listening. The CMACL has demonstrated good reliability and validity [9]. The adapted version used in this study [10] categorizes emotional responses into positive and negative emotions. "Happiness and Excitement" (HE) represents positive emotions, while "Irritability" (F), "Pain and Sadness" (PS), and "Anger and Hatred" (AH) represent negative emotions

2.4 Data Analysis

Data were analyzed using SPSS version 26.0.

3. Results

The emotional effects of the four musical works are presented in Table 4. Significant differences in emotional responses before and after listening were observed for Musical Work 1 ($\chi^2 = 52.77$, $p < 0.001$) and Musical Work 2 ($\chi^2 = 42.65$, $p < 0.001$), with 81.8% of post-listening responses concentrated in the "Pain and Sadness" dimension. No significant differences were found for Musical Work 3 ($\chi^2 = 1.41$, $p = 0.312$) or Musical Work 4 ($\chi^2 = 5.946$, $p = 0.111$).

Table 4. Differences in Emotional Responses before and After Music Listening

	Measurement Time	HE	F	PS	AH	χ^2	p
Work1	Pre-test	22(100%)	0(0%)	0(0%)	0(0%)	52.77	<0.001
	Post-test	1(4.5%)	1(4.5%)	18(81.8%)	2(9.1%)		
Work2	Pre-test	22(100%)	0(0%)	0(0%)	0(0%)	42.65	<0.001
	Post-test	3(13.6%)	0(0%)	18(81.8%)	1(4.5%)		
Work3	Pre-test	22(100%)	0(0%)	0(0%)	0(0%)	1.41	0.312
	Post-test	21(95.5%)	1(4.5%)	0(0%)	0(0%)		
Work4	Pre-test	22(100%)	0(0%)	0(0%)	0(0%)	5.946	0.111
	Post-test	18(81.8%)	2(9.1%)	2(9.1%)	0(0%)		

4. Discussion

4.1 Effects of Tempo on Emotional Arousal

Music with a faster tempo and clearer rhythmic

structure is more likely to elicit positive emotions, whereas music with complex or slower rhythms tends to evoke negative emotional experiences [11]. In this study, Musical Works 1 and 2 employed slower tempos

(60–80 BPM), with prolonged note durations and subdued melodic contours that induced pronounced negative emotions. Both works showed higher scores in the “Pain and Sadness” and “Anger and Hatred” dimensions. In contrast, Musical Works 3 and 4 featured fast tempos (>120 BPM), activating the sympathetic nervous system, increasing heart rate and adrenaline secretion, and thereby eliciting high-arousal positive emotions [12]. However, some participants reported irritability in response to the repetitive melodic structure of Musical Work 3.

4.2 Effects of Pitch Register on Emotional Arousal

Musical Works 1 and 2 primarily utilized lower pitch registers and exhibited lyrical characteristics. Their relatively smooth melodic lines and moderate pitch ranges contributed to emotionally restrained experiences. Musical Work 3 and 4, by contrast, employed brighter timbres and higher pitch registers, which enhanced neural excitation and were associated with significantly higher emotional arousal scores. These findings further support the emotional regulatory role of pitch register design.

4.3 Effects of Rhythm on Emotional Arousal

Rhythmic characteristics shape the dynamic quality of music and guide listeners' emotional experiences through factors such as note density, rhythmic regularity, and accent distribution [13]. Sparse rhythmic structures, as found in Musical Works 1 and 2, tended to evoke contemplative or sad emotions, whereas dense rhythmic patterns, as in Musical Work 3, more readily induced excitement and pleasure. Rhythmic effects were further modulated by harmonic structures, with different harmonic strategies producing distinct emotional outcomes.

5. Conclusion

This study examined the effects of musical elements on emotional arousal in college students and reached the following conclusions: (1) music with a fast tempo, higher pitch register, and dense rhythm effectively enhances emotional arousal and positive emotional experiences; (2) music with a slow tempo, lower pitch register, and sparse rhythm is more likely to evoke contemplative and sad emotions; and (3) lyrical content provides emotional cues that

further reinforce the emotional impact of music. Musical elements directly influence the emotional and psychological states of college students. Accordingly, music can be strategically used for emotional regulation in different contexts.

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