Proceedings of the 6th International Conference on Biological Engineering and Medical Science
DOI: 10.54254/2753-8818/2026.32024

Music and Concentration: Behavioral and Contextual Predictors in Adolescents

Lingyi Ye

The Affiliated Center of Renmin University of China, Beijing, China
yelingyi1104@gmail.com

Abstract. In modern society, background music is often used as a tool to promote learning during the learning process, but in fact, there is still widespread controversy over the effect of music. The present study investigates how music is perceived to influence concentration, with a focus on influential factors and text types. Fifty-one participants completed an anonymous questionnaire assessing music-listening behaviors, music preferences, and perceived effects of music on concentration and task performance. By using composite indices, the data shows that music can facilitate individuals' concentration overall and are influenced by music elements and text types; in contrast, the interference caused by music on attention are mainly determined by individuals' differentiation. These findings suggest that music functions depend more on how it is used and the task context than on specific musical characteristics and provide adolescents referenceable data for the use of music.

Keywords: Music and concentration, Background music, Cognitive performance, Attention and distraction

1. Introduction

Music is deeply embedded in individuals' everyday life and is frequently used as a background element during activities such as studying, exercising or relaxation. Contemporary research in neuroscience has demonstrated that music listening engages a distributed network of brain systems, including auditory, motor, limbic, and reward networks [1,2]. Through the interactions among brain system, music can affect individuals on physiological and behavioral performance. For example, fast-tempo music can elevate arousal and slower rhythms associated with relaxation and parasympathetic recovery [3].

Music also effects cognition and emotion beyond physical performance. For instance, music with lyrics often interferes with reading comprehension and verbal memory [4,5]; In contrast, instrumental music may improve attention during monotonous tasks [6,7]. These outcomes highlight that musical feature such as tempo, presence of lyrics, and personal preference critically determine whether music helps or hinders cognition performance.

Specifically, at the emotional level of cognition, much evidence supports that music can modulate mood and anxiety and can be used in pain control therapy. In current studies, researchers show that music therapy combined with CBT can significantly reduce anxiety and stress among adolescents [8], and music therapy can reduce the perceived intensity of pain [9].

© 2026 The Authors. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (https://creativecommons.org/licenses/by/4.0/).

DOI: 10.54254/2753-8818/2026.32024

In recent studies, the music effectiveness on human have been conducted in laboratory or clinical environments, there is not enough evidence to study the influence of music on teenagers because these studies mainly include adult participant and use controlled stimuli. Few studies examine how teenagers are impacted by music in daily lives, and what factors are truly impacting music effectiveness.

The present study seeks to address these limitations by investigating high school students' everyday music-listening behaviors and their perceived effects on concentration. Using a survey-based approach informed by prior literature, this study examines how musical characteristics, music behaviors and task contexts interact to shape perceived outcomes. It is hypothesized that music effectiveness is influenced by musical behaviors and musical elements, and the impact of music enhanced the amplitude of adolescents' recognition fluctuation. More broadly, this study aims to clarify how music functions as a self-regulatory tool in adolescents' daily lives and to provide practical insights into optimizing music use for learning and well-being.

2. Method

2.1. Ethics & survey design

In this study, fifty-one participants involved in this study. This study uses questionnaire to collect data. This study complies with research ethics. During the data collection process, the privacy and autonomy of the participants were well protected. Participants filled out the questionnaires anonymously and could withdraw from the data collection at any time. At the beginning part of the questionnaire, participants have read the prompts, and this study obtained the data usage permission of the participants, all of the participants are completely voluntary.

The questionnaire is well structured, containing four components: (1) Demographic information, (2) General music-listening behavior (frequency and daily duration), (3) Music preferences across genres and melody types, and (4) Perceived effects of music on concentration and task performance. The questionnaire consists of attention check questions to ensure the reliability of the answers provided by the participants. This design allowed both an overall assessment of perceived music effects and more analyses of how different factors and task contexts relate to these effects.

2.2. Measures and indices

The music impact scale is used to answer question of whether people think music is useful or not in promoting concentration level. In this part, the music impact scale contains 13 items to calculate participants' comprehensive score, which include ten questions measured positive effects and three negative items measured negative effects.

For each participant, when at least seven items (≥50%) were completed, a mean Music Impact score was calculated. Scores ranged from 1 to 5, with higher values indicating higher values indicating perceived benefits of music.

The extent to which participants were influenced by music varied. To examine which factors explained individual differences in Music Impact scores, three categories are considered: (1) Demographic factors (age, gender), (2) Music usage behavior (frequency of listening, how long to listen each day), and (3) Motivation for use (whether one consciously uses music for emotional regulation).

While Music Impact scale measured overall effectiveness, facilitation and interference indices are considered to distinct beneficial and detrimental components of music usage. The Facilitation Index

DOI: 10.54254/2753-8818/2026.32024

was calculated as the mean of five items assessing improved focus, persistence, efficiency, reduction of distracting thoughts, and intentional concentration support. The Interference Index was calculated as the mean of three items assessing distraction, difficulty concentrating, and susceptibility to distraction during negative mood states. Indices were computed only when all contributing items were available.

To discuss the context-dependence of music impact, tasks category into five contexts (logic, memory, reading, creativity, mechanics). The use of descriptive trend and single-factor ANOVA determined context-dependence facilitation and interference mode.

3. Results

3.1. Overall perceived impact of music

In the Music Impact scale discussion, the mean score of music impact ranged from 2.54 to 5.00 (M = 3.89, SD = 0.60), the distribution is generally positive (Fig.1A). This indicate that people generally considered music have positive effectiveness on study and work.

3.2. Behavioral & demographic predictors

The overall measure of music effectiveness is determined by behavioral factors (Fig.1). The music score mean have a positive correlation with daily music listening time (Fig.1B). According to Q4, the music impact score increase when the frequency of listening increase, as shown in ANOVA analyses ($F(2,48) = 13.67$, $p < .001$, Fig.1C).

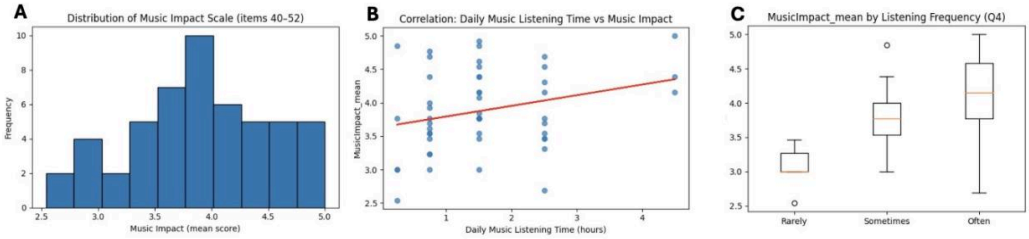

Figure 1. Music Impact scale and behavioral predictors

(A) Distribution of mean Music Impact scores. (B) Association between daily music listening time and Music Impact scores. (C) Music Impact scores across listening-frequency groups, with higher scores among frequent listeners (one-way ANOVA: $F(2,48)=13.67$, $p<0.001$).

Analyses indicated that demographic variables were not significant predictors of perceived music impact. Hierarchical regression results showed that age and gender accounted for minimal variance in Music Impact scores ($R^2 = .029$). The addition of music behavioral causes a significant increase in Music Impact scores ($R^2 = .381$, Fig.2), the addition of emotion motivation only causes infinitesimal increase ($R^2 = .385$).

According to the Hierarchical regression, the significant differentiation caused by music behavioral factor indicate that music behavioral is the core factor that impact music effectiveness. The impact of demographic and emotion motivation can be excluded. This exclusion explained that in perceived music impact, nor music preferences are influenced by individual differences

DOI: 10.54254/2753-8818/2026.32024

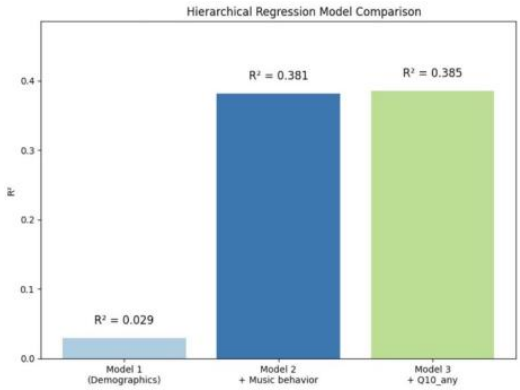

Figure 2. Hierarchical regression results

Music-behavior variables substantially increased explained variance; task-type preference showed minimal additional effect.

Music preference variables did not significantly predict overall perceived effects of music. One-way ANOVAs revealed no significant differences in Music Impact scores across melody preference groups ($F(2,44) = 1.02$, $p = .37$, Fig.3A), or across genre preference groups ($F(4,46) = 0.59$, $p = .67$, Fig.3B). These results indicate that music preferences substantially cannot explained individual differences in perceived music impact.

3.3. Structure & context dependence of music effects

To further examine the structure of perceived music effects, facilitation and interference indices were compared. Across participants, facilitation scores were moderately high ($M = 3.64$, $SD = 0.92$), whereas interference scores were notably lower ($M = 2.42$, $SD = 0.95$), indicating that perceived benefits generally outweighed perceived costs.

Group comparisons revealed that participants who listened to music while studying or working reported significantly higher facilitation scores than those who did not ($t = 5.07$, $p < .001$). However, these participants also reported significantly higher interference scores ($t = -3.82$, $p = .003$). These results indicate that music use was associated with both enhanced facilitative effects and increased susceptibility to distraction, the music effectiveness cannot simply category into positive or negative, its effectiveness essentially enhanced the volatility of cognitive states.

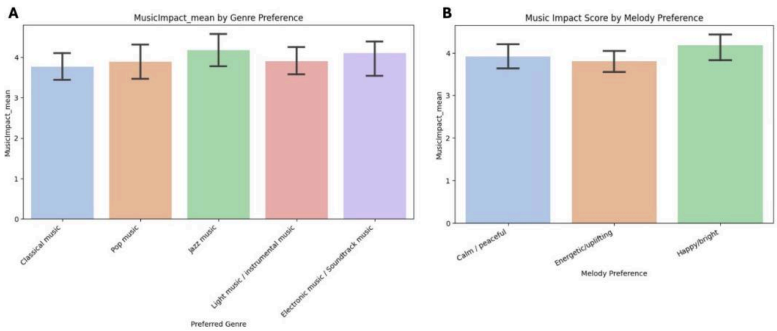

Figure 3. Music Impact scores across melody and genre preferences

(A) Music Impact scores across melody-preference groups; no significant differences (ANOVA). (B) Music Impact scores across genre-preference groups; no significant differences (ANOVA).

DOI: 10.54254/2753-8818/2026.32024

Facilitation effects varied by task type. The facilitation index shows trend differences among tasks (F = 2.16, p = .063). There is no significant index differentiation in interference index (p = .25). According to the One-way ANOVAs data, the promotion effect of music is more influenced by the type of task, the detrimental effect of music is more likely to be an individual stabilize characteristic. For this differentiation between music impacts on individuals, the promoting effect of music on people is more worthy of reference by different individuals.

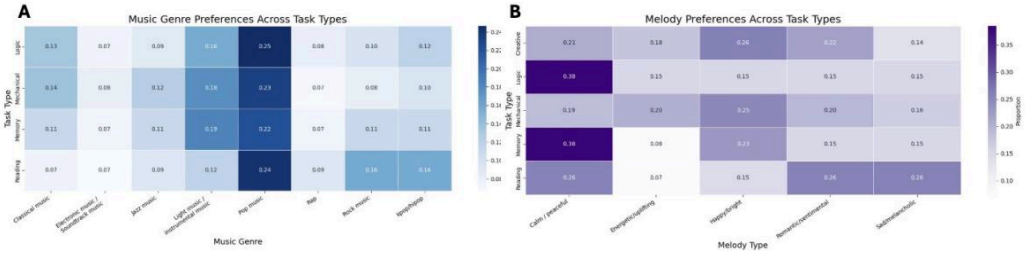

Figure 4. Music genre and melody preferences across task types

(A) Heatmap of genre preferences across task types. (B) Heatmap of melody preferences across task types. No significant differences across tasks (chi-square tests).Although visual patterns suggest modest task-specific trends, chi-square tests demonstrated that neither genre nor melody preferences differ significantly across task types (Fig.4A-B), indicating that task category does not strongly influence participants' music selection.

4. Discussion

This study examined how music influences people's concentration during study and work. Overall, participants tend to view music as beneficial; however, further analyses revealed that the effects of music are neither uniform nor purely facilitative, it affects the amplitude of cognitive fluctuations in people and generates a two-way influence. Also, the music impacts can be influenced by task context types, indicating that these impacts may relate with cognitive load.

One key finding of this study is that the effects of music are influenced by music behaviors. In the Music Impact scores, the listening frequency and daily listening duration are accounted for substantial factors. Neither Demographic characteristics, such as age and gender show little variance, nor music preference variables which include genre preference and melody preference cause significant differences in music impact effectiveness. These results indicate that music functions are less dependent on inherent characteristics, music is more of a tool whose effectiveness depends on patterns of use.

In further analysis, the separation of music effects into facilitation and interference clarifies the nature of the music effectiveness. The data shows that the facilitation index is generally higher than interference index, suggesting that music impacts provide benefits more than cost on average. However, participants who listened to music while study and work have reported a greater susceptibility to distraction. This dual pattern indicates that music may amplify cognitive sensitivity and increase both engagement and vulnerability to interference.

In the discussion of the connection of music and context types, the facilitation and interference index show different trend: facilitation index shows trend differences between varies text types, while interference index remains relative stable. According to Li et al. , background music may introduce additional cognitive load that interacts with task demands, such that its facilitative role

DOI: 10.54254/2753-8818/2026.32024

becomes less evident in cognitively or demanding tasks because it will need little cognitive load [10]. Therefore, when context types vary, the music effectiveness on people may also alter.

This study has limitations, the lack of experimental design makes it impossible to infer cause and effect result. Also, a very small sample size makes the study results less convincing. Experimental designs can be carried out to further obtain appropriate practical music strategies to assist people in their work and study. In the future study, during experiment studies, individuals' difference such as concentration control differentiation and sensitivity differentiation toward music can be discussed between individuals.

References

[1] Terry, P. C., Karageorghis, C. I., Curran, M. L., Martin, O. V., & Parsons-Smith, R. L. (2020). Effects of music in exercise and sport: A meta-analytic review. Psychology of Sport and Exercise. https: //psycnet.apa.org/fulltext/2019-75018-001.html

[2] Thakare, A. E., Mehrotra, R., & Singh, A. (2017). Effect of music tempo on exercise performance and heart rate. Journal of Clinical and Diagnostic Research. https: //pmc.ncbi.nlm.nih.gov/articles/PMC5435671/

[3] Bradt, J., Dileo, C., & Shim, M. (2021). Music interventions for improving psychological and physical outcomes in adults. Cochrane Database of Systematic Reviews. https: //www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD006911.pub4/full

[4] Souza, A. S., & Barreiros, R. (2023). Should we turn off the music? Music with lyrics interferes with cognitive performance. Psychology of Music.https: //pubmed.ncbi.nlm.nih.gov/37152835/

[5] Sun, Y., Zhang, X., & colleagues. (2024). Impact of background music on reading comprehension. Frontiers in Psychology.https: //www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2024.1363562

[6] Kiss, L., Linnell, K. J., & Rowe, S. J. (2020). The effect of preferred background music on task focus in sustained attention. Psychological Research.https: //pubmed.ncbi.nlm.nih.gov/32748062/

[7] Bottiroli, S., Rosi, A., Russo, R., Vecchi, T., & Cavallini, E. (2014). The cognitive effects of listening to background music on older adults. Aging Clinical and Experimental Research. https: //pubmed.ncbi.nlm.nih.gov/25360112/

[8] Egenti, N. T., et al. (2019). Randomized controlled evaluation of the effect of music therapy combined with cognitive behavioral therapy on social anxiety in adolescents. Medicine. https: //journals.lww.com/md-journal/abstract/2019/08090/randomized_controlled_evaluation_of_the_effect_of.13.spx

[9] Lin, C.-L., Hsu, W.-C., & Chen, Y.-C. (2020). Effect of music therapy on pain after orthopedic surgery: A systematic review. Medicine.https: //onlinelibrary.wiley.com/doi/10.1111/papr.12864

[10] Li, F., Wang, Z., Ng, J. T. D., & Hu, X. (2021). Studying with learners' own music: Preliminary findings on concentration and task load. In Proceedings of the 11th International Learning Analytics and Knowledge Conference (LAK21) (pp. 613–619).https: //dl.acm.org/doi/10.1145/3448139.3448206