Butler Journal of Undergraduate Research

Volume 7

2021

Rockin' the GRE: The Effects of Preferred, Non-preferred, and Classical Music on College Students' Cognitive Test Performance

Hannah B. Bolander
Butler University

Sean Callahan
Butler University

ROCKIN' THE GRE: THE EFFECTS OF PREFERRED, NON-PREFERRED, AND CLASSICAL MUSIC ON COLLEGE STUDENTS' COGNITIVE TEST PERFORMANCE

HANNAH B. BOLANDER & SEAN CALLAHAN, BUTLER UNIVERSITY
MENTOR: TARA LINEWEAVER

Abstract

This paper examines the effects of preferred popular music, non-preferred popular music, and classical music on college students' reading comprehension. The reported study addressed shortcomings in the literature by presenting music to participants before rather than during testing and also by attempting to better equalize levels of arousal and mood that might be differentially affected by the various music types. After listening to each of the three music playlists, 33 undergraduate students at Butler University rated their enjoyment of the music, completed a music rating scale, self-reported their mood and arousal, and answered six GRE Reading Comprehension questions. Results showed that participants felt significantly more invigorated and less depressed after their preferred music compared to either non-preferred popular or classical music. Although participants enjoyed their preferred music significantly more than the other two music types, our hypothesis that preferred popular music would exert a greater positive influence on reading comprehension than would non-preferred popular music (which would, in turn, result in better reading comprehension than listening to classical music) was not supported. Reading comprehension scores across each of the three conditions were almost identical. Thus, the current study provides no evidence that various types of music have differentiated effects on reading comprehension. Instead, results suggest that personal song selections can be utilized to improve individuals' energy levels and mood to a greater extent than either non-preferred popular music or upbeat classical music.

Researchers have been fascinated with the effects of music on cognitive abilities for years. The "Mozart effect" became popularized with the notion that music, specifically that of Mozart, enhances people's general cognitive abilities (Cabanac et al., , 2013; Perham & Currie, 2014; Rauscher et al., 1993). In support of the Mozart effect, Cabanac et al. (2013) found that studying music leads to short-term improvements in academic performance. They examined the effects of music

on high-achieving third-, fourth-, and fifth-year students in Canada. All students were required to take a music course during their first two years of school, but during years 3–5, these courses became optional. Cabanac et al. (2013) found that students who took music courses in years 3–5 performed better in a variety of classes, such as history, science, and English, than did students who chose to focus on art or theater.

Although classical music has been found to have a general effect on cognitive abilities, not all classical music has the same effect. In one of two experiments, Schellenberg et al. (2007) looked at how the music of Albinoni (with a slow tempo and minor key) and Mozart (with a fast tempo and major key) affected cognition and mood. The researchers gave participants a measure of processing speed after listening to each type of music and found that scores were better after participants listened to Mozart than after they listened to Albinoni, indicating that classical music in a major key with a fast tempo has a greater potential to improve performance on cognitive tests. They also found that participants scored higher in depressive affect after listening to Albinoni's music than at baseline, in contrast to the decrease seen after listening to Mozart's music. Finally, these researchers found that arousal scores increased while participants listened to Mozart but decreased after they listened to Albinoni. These results indicate that different types of classical music differentially affect both cognition and mood.

Although both Cabanac et al. (2013) and Schellenberg et al. (2007) have found that classical music increased cognitive performance, additional studies have found that preferred music has an even greater effect on cognition than does classical music. Eskine et al. (2018) had participants at a predominantly African American university in Louisiana listen to hip-hop, classical music, and background noise before completing a creativity test. They found that participants were more creative after listening to hip-hop compared to when they listened to classical music or background noise. A second experiment by Schellenberg et al. (2007) also found that children who listened to familiar music, compared to classical music, were not only more creative but also more persistent in the amount of time they spent creating a drawing relative to baseline. This suggests that listening to preferred music before completing a task can lead to even better performance than listening to classical music.

Conversely, not all studies have found positive effects of preferred music on cognition. Perham and Currie (2014) had participants listen to three different types of music—disliked lyrical music, liked lyrical music (preferred music), nonlyrical music—and to no music. As they listened, participants read four

passages and completed six questions about each passage. Participants who listened to liked or disliked lyrical music while performing the reading comprehension task did significantly worse compared to those listening to nonlyrical or no music. This suggests that listening to lyrical music may disrupt reading comprehension, even when it is the participant's preferred music.

Although the literature suggests that various types of music can affect both cognition and mood, the relationship between these two responses to music is unclear. Schellenberg et al. (2007) suggested that increased arousal but not decreased depression might correspond with improvements in processing speed. In contrast, other studies have found little relationship between changes in mood and changes in cognition (Eskine et al., 2018; Gültepe & Coskun, 2016). Participants in the study by Eskine and colleagues (2018) reported feeling more excited and experiencing a more positive mood after listening to hip-hop than after listening to either classical music or noise, but the correlation between mood and creativity was not significant. Similarly, Gültepe and Coskun (2016) had participants listen to positive, negative, and neutral music for nine minutes at a time. After each type of music, participants completed a six-item mood scale. Participants then took 15 minutes to brainstorm solutions to a problem. Although positive, negative, and neutral music had different effects on cognitive flexibility, differences in the participants' self-reported mood did not correspond with increases in cognitive performance.

The current study addressed some of the shortcomings in the literature. First, this study looked at the effects of listening to preferred music before, rather than during, reading comprehension tests. We expected that listening to music before the task would have a greater positive effect because it would be less distracting than music during reading, as utilized in the Perham and Currie (2014) study. Second, this study compared preferred versus non-preferred popular music. No study to date had examined whether one's preferred music has a greater effect on cognition and mood than does highly similar music. We compared these two types of music to classical music. Third, this study design controlled for potential differences in mood and arousal that could be associated with popular versus classical music. Comparing preferred popular music to non-preferred popular music, which should be similar in their effects on mood and arousal, allowed us to differentiate whether differences in emotional responses account for the findings of previous studies or whether personally preferred music has a unique effect on cognition.

We had two primary hypotheses. Our first hypothesis was that popular music would exert a greater positive influence on cognitive performance than did classical music but that participants would experience a greater benefit from songs that they specifically selected (preferred popular music) than from other similar songs (non-preferred popular, nonclassical music). Our second hypothesis was that playlists comprising personally selected popular music or other participants' popular song selections would both generate similar levels of arousal and positive mood that would surpass the affective response associated with classical music.

Method

Participants

Participants consisted of undergraduate psychology students at Butler University. The sample included 33 students (87.9% female; 84.8% white) between the ages of 18 and 22 (M = 19.61, SD = 1.14). On average, students were in their sophomore to junior year in college (M = 2.30, SD = 1.02). All students received extra credit in a psychology course for their participation.

Materials

Profile of Mood States (POMS)

This self-report questionnaire from McNair et al. (1992) was used to assess mood and arousal. The full measure included six subscales. As in the work of Schellenberg et al. (2007), participants completed the Vigor-Activity subscale, a measure of arousal, as well as the Depression-Dejection subscale, a measure of negative mood. There were 8 items on the Vigor-Activity subscale (e.g., energetic, cheerful) and 15 items on the Depression-Dejection subscale (e.g., sad, hopeless). Participants rated each adjective on a Likert scale of 0–4 (0 = not at all, 4 = extremely) based on how they felt at that moment. The items on each subscale were averaged to provide a mean vigor score and a mean depression score that represented participants' moods after listening to each of three playlists. Possible scores thus ranged from 0 to 4 for each subscale, with higher scores reflecting greater vigor and greater negative affect.

GRE Reading Comprehension Practice Tests

Each practice test included two reading passages followed by three multiple-choice questions about each passage. Each passage comprised approximately 7–9 sentences and was approximately 190 words long. The first three GRE practice tests from the website Graduateshotline.com (2021) were used for the purposes of this study. Participants could score between 0 and 6 on each of the three reading comprehension tests.

Music Rating Scale

This scale was created for the purposes of this study. Students were asked to rate how much they liked each of the three playlists immediately after listening to it, rating on a Likert scale of 1–5 (1 = strongly dislike, 5 = strongly like). Possible ratings thus ranged from 1 to 5 for each playlist, with a higher score reflecting a greater liking of the playlist.

Demographic Questionnaire. This questionnaire gathered participant demographics such as age, gender, race, and year in school.

Procedure

Students compiled a list of their five favorite songs for a pretesting packet administered through the psychology department at the beginning of the semester. Upon completion of the list, each student received an email invitation to participate in this study. The email included an access code that allowed students to select one of several group-testing sessions to attend. On the day of the study, participants completed the informed consent, a demographic questionnaire, and a baseline POMS. Next, all participants listened to one of three music playlists through headphones for 10 minutes. After listening, participants first rated the playlist on the Music Rating Scale and then answered the items of the POMS again. Next, they had 10 minutes to complete GRE Reading Comprehension Practice Test 1. Participants then used the following 10 minutes to complete a maze that served as a filler task. After the maze, the procedure was repeated with a second playlist followed by GRE Practice Test 2, and then the third playlist and GRE Practice Test 3.

The three playlists included (1) the participant's personal playlist of preferred music, (2) a random selection of songs from other participants' preferred musical selections, and (3) classical music consisting of Mozart's compositions.

The order in which participants experienced these three playlists during their testing session was counterbalanced.

Upon completion of the testing, participants received extra credit in one of their psychology courses to thank them for their time.

Results

Differences in Reading Comprehension Following Preferred, Non-Preferred, and Classical Music

To address the primary hypothesis, we compared reading comprehension scores following preferred, non-preferred, and classical music. We utilized a within-subjects analysis of variance with the number of items answered correctly on the GRE reading subtest as the dependent variable and the type of music (preferred, non-preferred, and classical) as the independent variable. The main effect of music type did not reach significance in this analysis, $F(2, 31) < 1.0$, $p = 0.990$, $\eta_p^2 = 0.001$. Thus, we did not find any significant differences in performance on the GRE reading comprehension practice tests after participants listened to playlists of preferred ($M = 3.97$, $SD = 1.10$), non-preferred ($M = 3.94$, $SD = 1.20$), or classical ($M = 3.94$; $SD = 1.20$) music (Figure 1).

Differences in Affect Following Preferred, Non-Preferred, and Classical Music

To examine our second hypothesis, we compared participants' enjoyment levels and affect following preferred, non-preferred, and classical music. We conducted three within-subjects analyses of variance with music rating scale scores, vigor scores, and depression scores as the dependent variables and the type of music (preferred, non-preferred, and classical) as the independent variable.

When analyzing music rating scale scores, the main effect of type of music reached significance, $F(2, 31) = 84.29$, $p < .001$, $\eta_p^2 = 0.85$. Follow-up within-subjects contrast analyses indicated that when rating the playlists, participants enjoyed listening to their preferred popular music ($M = 5.00$, $SD = 0.00$) significantly more than the non-preferred popular ($M = 3.36$, $SD = 0.96$) or classical ($M = 2.94$, $SD = 1.09$) music playlists, $p < .001$ for both. Participants' ratings of the non-preferred and classical music did not significantly differ from each other, $p = .07$.

Next, we looked at self-reported vigor levels after participants listened to each playlist (Figure 2). The main effect of type of music reached significance, $F(2, 31) = 29.54$, $p < .001$, $\eta_p^2 = 0.66$. Participants described themselves as significantly more invigorated after listening to their preferred playlist ($M = 1.95$, $SD = 0.87$) than after listening to playlists of non-preferred ($M = 1.19$, $SD = 0.76$) or classical ($M = 1.00$, $SD = 0.67$) music, $p < .001$ for both. Participants' ratings of their vigor after listening to non-preferred and classical music did not significantly differ from each other, $p = .20$.

Finally, we analyzed participants' self-reported depression-dejection levels after they experienced each playlist (Figure 2). The main effect of type of music reached significance, $F(2, 31) = 4.19$, $p < .025$, $\eta_p^2 = 0.21$. Participants described themselves as significantly less depressed after listening to their preferred music ($M = .09$, $SD = 0.27$) than after listening to non-preferred ($M = 0.16$, $SD = 0.26$) or classical ($M = 0.19$, $SD = 0.31$) music, $p < .05$ for both. Participants' depression ratings after listening to non-preferred and classical music did not significantly differ from each other, $p = .29$.

Correlations Between Participants' Reading Comprehension Scores and Response to Music

Last, we analyzed the correlations between participants' affect ratings after listening to each type of music and their scores on the corresponding GRE tests (Table 1). The only correlation to reach significance was the one between depression and GRE scores after listening to the playlist of non-preferred music. Interestingly, those who felt more depressed after listening to the non-preferred playlist performed better on the subsequent reading comprehension measure.

Discussion

This study sought to address various shortcomings in the literature by comparing the effects of preferred popular, non-preferred popular, and classical music on reading comprehension. We had two primary hypotheses when conducting this experiment. Our first hypothesis was that popular music would exert a greater influence than classical music on cognitive performance but that participants would benefit more from specifically selected music (preferred popular music) than from other similar songs (non-preferred popular music). Our second hypothesis was that the playlists of preferred and non-preferred music, both comprising popular music, would generate similar high levels of arousal and low

levels of negative affect. At the same time, we expected that classical music would not influence affect as positively as the other two types of music.

Our hypothesis that popular music would exert a greater influence than classical music on participants' cognitive performance was not supported by our results, as average reading comprehension scores were almost identical following each of the three playlists. This contrasts with the findings of Eskine et al. (2018) and of Schellenberg et al. (2007), who found that participants performed better on creativity measures after listening to popular music than after listening to classical music. To build on these previous studies, we also attempted to differentiate preferred popular music from non-preferred popular music by allowing participants to select their favorite songs. Even then, selections of preferred popular songs exerted no greater influence on reading comprehension than did other forms of popular music.

Considering the results of the current study within the context of the existing literature raises the possibility that popular music might differentially affect various cognitive processes. Previous studies have demonstrated music's positive effect on divergent, or creative, thinking. Both Eskine et al. (2018) and Schellenberg et al. (2007) found that music enhanced the creativity and problem-solving abilities of participants. After listening to music, participants performed better on subsequent creativity tests and participated in creative activities, such as drawing, for longer periods of time. Similarly, Gültepe and Coskun (2016) demonstrated that various types of music differentially influence cognitive flexibility during a brainstorming task. Conversely, studies focused on analytical, convergent, thinking have not found positive benefits of popular music (Perham & Currie, 2014). As such, the results of the current study support those of Perham and Currie (2014), who similarly found that popular music did not improve reading comprehension. We originally hypothesized that the lack of positive effects of preferred music on cognition in Perham and Currie's (2014) study was attributable to participants listening to music during reading comprehension tests. Unfortunately, playing music before rather than during the reading comprehension tests did not augment the effects of preferred music on cognition in the manner that we expected.

In the current study, although the three types of music did not have varied effects on reading comprehension, they did differentially influence both enjoyment and affect, providing support for our second hypothesis. Consistent with our expectations and past research (Eskine et al., 2018), students reported more enjoyment and experienced a greater improvement in mood after listening to popular music compared to classical music. Although we hypothesized that both

preferred and non-preferred popular music playlists would generate similar levels of arousal and positive mood, we instead found strong evidence supporting the effectiveness of preferred popular music over other popular songs toward improving emotional states. Participants enjoyed their specific selections significantly more than either non-preferred popular music or classical music. In addition, we found that preferred music led to significantly higher self-reported vigor levels and lower levels of depression. This exemplifies the importance of one's personally selected music over similar popular music (such as a random selection of popular songs like that typically played on the radio) to positively influence mood. Although this study only compared preferred to non-preferred music within the popular music genre, this effect might extend to other genres as well. For example, preferred classical music might also have a greater effect on mood than non-preferred classical music, although further research would be necessary to confirm this.

When looking at the correlational results, we found little relationship between self-reported mood and subsequent performance on the associated reading comprehension test. This largely supports the results of similar studies finding that music's effect on cognition is independent of its influence on affect (Eskine et al., 2018; Gültepe & Coskun, 2016). For example, the participants in Eskine and colleagues' (2018) study reported a more positive mood after listening to hip-hop than after listening to either classical music or noise, but there was no correlation between affect and their creativity. In contrast, our study found a significant correlation between depressive affect and reading comprehension following non-preferred music listening. Interestingly, participants who reported more depressive affect after listening to their non-preferred music outperformed students who reported less depressive affect. This result raises the possibility of subtle relationships between mood and cognition following music listening, perhaps more apparent on convergent thinking tasks, such as ours, than on divergent thinking tasks, such as those of Eskine et al. (2018). Schellenberg et al. (2007) also documented relationships between post-music-listening mood and cognition, finding that participants who listened to fast-tempo, major-key classical music experienced both increased arousal and improvements in processing speed compared to when they listened to slow-tempo, minor-key pieces. This also suggests a direct relationship between music's effects on mood and its effects on cognition after listening to non-preferred music. Although future research will be necessary to rectify these contradictory findings in the literature, the inconsistent relationships between mood and cognition do not diminish the positive effect of

music. These results indicate that when music affects mood and arousal, it does not always affect cognitive abilities as well.

Limitations and Future Directions

Although our results partially supported our hypotheses, limitations of this study should be considered when generalizing these results to other contexts. First, this study included only 33 undergraduate students. Although this is a relatively small sample size, the within-subjects research design increased the power to detect significant differences across conditions. Although this study could have included more participants, the small effect size associated with the differences between reading comprehension scores following listening to the three types of music ($\eta_p^2 = 0.001$) suggests that including additional participants would not have likely changed our results.

Participants in this study composed a homogenous sample. They included mostly white, affluent undergraduate psychology students at a private university. All of these students were enrolled in classes that require the regular use of reading comprehension skills. This may have limited the potential power of music to improve these well-honed cognitive abilities. A broader participant pool could potentially have resulted in a larger effect of music. Perhaps older adults who don't frequently practice their reading comprehension skills would exhibit a greater improvement in cognition after listening to their preferred music. Future research should utilize a diverse population of participants representing a large range of ages. Comparing those who frequently employ their reading comprehension skills in the classroom to those whose jobs or daily activities require less-frequent utilization of this ability could help delineate individual differences in who is most likely to benefit from music interventions.

Another limitation of the current study is that participants listened to each playlist for only 10 minutes. This was designed to ensure that participants did not run out of music during testing sessions. Because of this short listening period, however, participants may not have experienced all of the songs on the three playlists, particularly the playlist of preferred songs. Had participants listened to more of each type of music, greater differences may have emerged between the various music types in terms of their effects on both mood and cognition.

Because each participant listened to their own unique playlist of preferred songs, these playlists comprised mixes of fast-tempo and slow-tempo songs as well as songs in major and minor modes. In addition, the classical music that participants

experienced consisted of four songs in major mode and one in minor mode, of varying tempos. Thus, this study could not determine the extent to which the tempo and mood of the music might have influenced students' enjoyment and affective response to it. Designers of future studies may want to more carefully control these aspects to determine the extent to which these factors play a role in our current results.

Last, this study lacked a no-music control. Although no differential effect existed among the three types of music on cognition, it is possible that all three had an equally positive effect. The current study could not evaluate this possibility. Future research should add a fourth experimental condition that involves participants completing a reading comprehension test after listening to no music, to determine if the three types of music included in this study had no effect on cognition or if all three music types exerted an equally positive influence on reading comprehension skills.

Conclusions and Implications

Although reading comprehension scores did not improve after participants listened to preferred music, participants' personally selected songs did have a significant and unique effect on enjoyment and mood. The benefit of personally selected songs therefore comes from the greater enjoyment, increased vigor, and diminished depression that participants experienced after listening to their favorite songs. The results of the current study provide no evidence that these three types of music have differentiated effects on cognition. In this sense, encouraging students to listen to particular types of music would not be a good intervention to help students maximize their cognitive abilities. In contrast, our results indicate that when individuals feel sad or would like to improve their moods, they might benefit from abandoning generic popular music, such as that played on the radio, in favor of personalized playlists full of their favorite songs.

References

Cabanac, A., Perlovsky, L., Bonniot-Cabanac, M. C., & Cabanac, M. (2013). Music and academic performance. *Behavioural Brain Research*, *256*, 257–260.

Eskine, K. E., Anderson, A. E., Sullivan, M., & Golob, E. J. (2018). Effects of music listening on creative cognition and semantic memory retrieval. *Psychology of Music, 46,* 1–16.

Graduateshotline. (2021). Free online GRE reading comprehension test. https://gre.graduateshotline.com/ reading_comprehension_practice.html

Gültepe, B., & Coskun, H. (2016). Music and cognitive stimulation influence idea generation. *Psychology of Music*, *44*, 3–14.

McNair, D. M., Lorr, M., & Droppleman, L. F. (1992). *Profile of Mood States (POMS)–revised manual*. Education and Industrial Testing Service.

Perham, N., & Currie, H. (2014). Does listening to preferred music improve reading comprehension performance? *Applied Cognitive Psychology*, *28*, 279–284.

Rauscher, F., Shaw, G., & Ky, K. (1993). Music and spatial task performance: A causal relationship. *Nature, 365*, 611.

Schellenberg, E. G., Nakata, T., Hunter, P. G., & Tamoto, S. (2007). Exposure to music and cognitive performance: Tests of children and adults. *Psychology of Music*, *35*, 5–19.

Table 1. Correlations Between Vigor and Depression Following Preferred, Non-Preferred, and Classical Music and their Corresponding GRE Scores

	GRE Score		
	Preferred	Non-Preferred	Classical
POMS–Vigor	$r = –.147$ $p = .414$	$r = .159$ $p = .378$	$r = .175$ $p = .331$
POMS–Depression	$r = .154$ $p = .392$	$r = .352^*$ $p = .044$	$r = –.052$ $p = .773$

$^*p < .05$

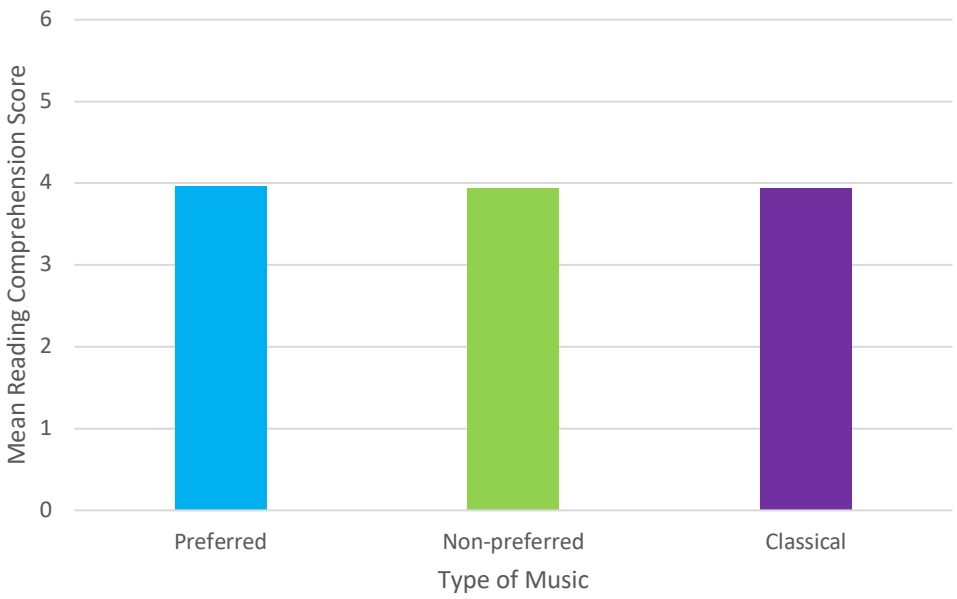

Figure 1. Mean GRE Reading Comprehension Test Scores
Note. No significant differences emerged in participants' performance on the GRE reading comprehension tests after listening to preferred, non-preferred, or classical music.

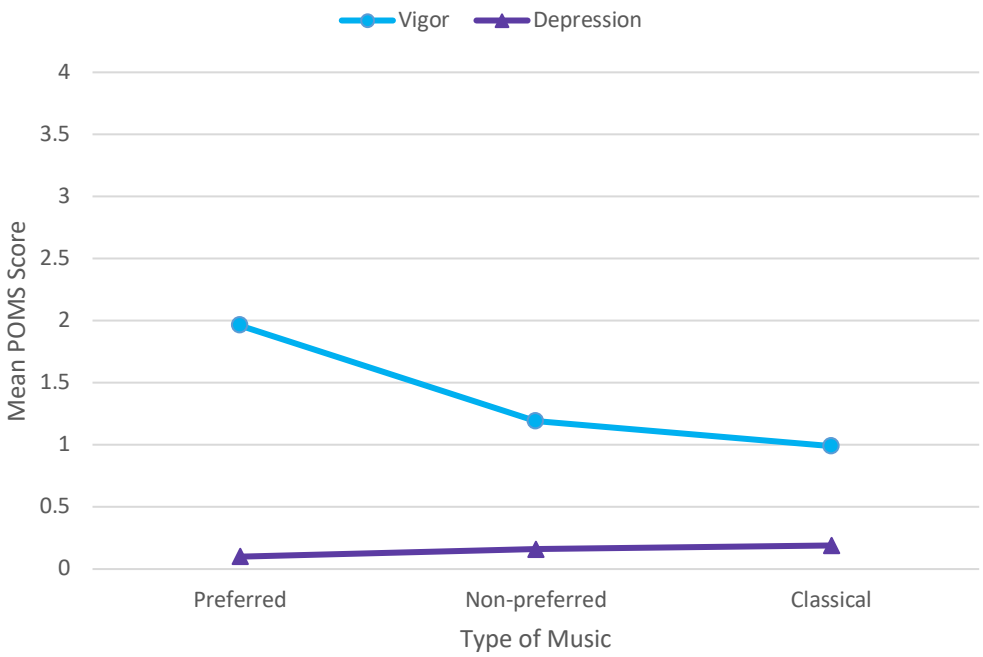

Figure 2. Mean Affect Scores After Listening to Each Playlist
Note. Participants described themselves as significantly more invigorated and less depressed after listening to their preferred music than after listening to either of the other playlists.