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The Effect of Background Music on Novel Word Encoding and Retention: Exploring the Roles of Musical Familiarity and Prior Musical Experience

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Abstract

This study examines the effects of instrumental and vocal background music on the immediate and delayed recall of unfamiliar words, while also considering the roles of musical familiarity and prior musical experience. Fifty-seven participants were randomly assigned to one of three conditions: silence, instrumental music, or vocal music. A significant effect of auditory condition was observed for immediate recall, with post hoc comparisons showing significantly higher performance in the silence condition than in the instrumental music condition. Although the vocal condition obtained a higher descriptive mean than the instrumental condition, the difference between the two music conditions was not statistically significant. No significant differences among conditions were found for delayed recall. In addition, neither familiarity with the musical stimuli nor prior musical experience was significantly associated with immediate or delayed recall performance. These findings emphasize the complex interplay between environmental auditory input and cognitive functioning, highlighting how peripheral stimuli

may influence attentional resources and memory performance, while contributing to a better understanding of how contextual factors shape cognitive performance.

Keywords: background music; instrumental music; vocal music; vocabulary learning; musical familiarity; musical experience.

Introduction

In the contemporary information age, individuals frequently encounter situations where they must engage in tasks while being simultaneously exposed to additional stimuli, resulting in divided attention. This makes maintaining focus on a specific task challenging, as multiple competing stimuli vie for attention. Therefore, attention, functioning as a spotlight that enables cognitive resources to be allocated effectively, may be diminished when confronted with irrelevant stimuli.

Despite the widely accepted view that engaging in simultaneous tasks can compromise performance, the precise influence of factors such as familiarity, automaticity, and task characteristics on attentional processes remains a subject of ongoing investigation. In this regard, examining the effect of background music, an often overlooked yet common practice, becomes particularly important. While the motivating and arousing effects of music are widely recognized, its potential to divide attention during tasks such as vocabulary learning remains unclear.

Divided attention refers to the ability to process multiple stimuli simultaneously (Cristofori & Levin, 2015). According to Kahneman (1973), attention is a limited resource that must be allocated depending on task demands. When additional stimuli such as music are present, they may compete for cognitive resources, potentially affecting the encoding of new information, including new words.

The Effect of Background Music on Attention

Research on background music has produced mixed findings regarding its effects on attention and cognitive performance. Some studies suggest that background music can improve task focus, reduce mind-wandering, and support sustained attention, particularly when tasks are relatively monotonous or cognitively undemanding (Kiss & Linnell, 2021, 2024). One explanation is that music may increase arousal to a level that helps individuals maintain engagement with the primary task.

However, background music may also function as a competing source of stimulation. Because attentional capacity is limited, processing task-irrelevant auditory information can draw cognitive resources away from the primary activity, particularly when that activity requires active encoding or temporary storage of verbal information. From this perspective, music may increase distraction, divide attention, and interfere with the efficient processing of material that must be retained in memory (Poerio et al., 2013). Such interference may be especially relevant during vocabulary learning, where learners must attend simultaneously to unfamiliar word forms and their associated meanings. This account is also consistent with Load Theory (Lavie et al., 2004), which proposes that the extent to which irrelevant information is processed partly depends

on the demands imposed by the primary task. When task demands are high, fewer resources may remain available for processing competing background stimuli.

The effect of background music may therefore depend partly on the cognitive demands of the task. During relatively simple or repetitive activities, additional stimulation may help sustain attention, whereas during tasks requiring concentrated verbal processing, background music may compete with the information being encoded. This tension between potentially facilitative and disruptive effects suggests that the influence of background music may depend on the psychological state it induces as well as the cognitive demands of the task. One theoretical account that attempts to explain such variability is the Arousal–Mood Hypothesis.

The Arousal-Mood Hypothesis

The Arousal–Mood Hypothesis, proposed by Thompson et al. (2001) and further examined by Husain et al. (2002), suggests that music may influence cognitive performance indirectly through changes in listeners' arousal and mood. According to this account, music does not necessarily influence performance directly. Instead, musical characteristics may alter listeners' levels of arousal and affective state, which can subsequently facilitate or hinder cognitive processing. Music that induces an appropriate level of arousal or a positive affective state may support attention and engagement, whereas music that produces excessive stimulation, insufficient arousal, or an unpleasant emotional response may interfere with performance.

This perspective is particularly relevant to vocabulary learning because encoding unfamiliar lexical items requires sustained attention and the allocation of limited cognitive resources. Background music may therefore influence performance not only through its presence, but also through the psychological responses it elicits in listeners. Differences in tempo, familiarity, preference, and perceived pleasantness may contribute to variation in arousal and mood (Husain et al., 2002), which may partly explain why background music has been found to facilitate performance in some studies but impair it in others.

At the same time, the Arousal–Mood Hypothesis should be applied cautiously in the present study. Although participants reported different attitudes toward the musical stimuli, arousal and mood were not directly measured. The hypothesis is therefore used as a theoretical framework for interpreting possible mechanisms rather than as a mechanism directly tested in the study.

Background Music and Word Encoding and Recall

Research examining the effect of background music on word encoding and recall has produced inconsistent findings. Several studies suggest that music presented during encoding may interfere with the processing and retention of verbal material. Musliu et al. (2017), for example, compared silence, lyrical music, and instrumental music across several short-term memory tasks and found that participants in silence significantly outperformed those exposed to music on some measures. Similarly, Ji et al. (2021) reported superior word recall under selective-attention or silent conditions compared with divided-attention conditions involving music, attributing this pattern to interference during encoding. Konantz (2012) likewise suggested that

music presented during the encoding phase may disrupt the effective processing of verbal information.

However, detrimental effects are not consistently observed. Echaide et al. (2019) found no significant difference in immediate or delayed word recall between instrumental music and silence conditions. Other studies have reported facilitative effects. Ferreri et al. (2015), for instance, found that instrumental background music enhanced both item and source memory relative to silence and environmental sounds. De Groot (2006) also reported improved foreign-language vocabulary learning under background music for some participants, although the effect was not uniform across individuals.

Taken together, these findings suggest that the influence of background music on verbal learning is not uniform. Differences in the type of music, characteristics of the learning task, timing of music exposure, and individual listener characteristics may contribute to the conflicting results reported across studies. This variability provides a rationale for examining not only whether background music influences novel-word recall, but also whether instrumental and vocal music produce different patterns and whether individual factors such as familiarity and prior musical experience are associated with performance.

Familiarity with Background Music

Familiarity with background music may influence the extent to which music interferes with or facilitates cognitive performance. Repeated exposure to a musical stimulus may make its structure more predictable and easier to process, potentially reducing the attentional resources required to monitor it. From this perspective, familiar music may become less disruptive because listeners can process it with relatively little conscious attention, allowing more cognitive resources to remain available for the primary learning task (Kang & Lakshmanan, 2017).

However, familiarity may also increase distraction. Familiar songs can evoke stronger emotional responses and activate personal or autobiographical associations, which may make the music more salient and draw attention away from the task (Blood & Zatorre, 2001; Pereira et al., 2011). Familiarity may therefore have competing effects: increased predictability may make the music easier to ignore, while stronger emotional or associative responses may make it more difficult to disregard.

These competing mechanisms may help explain why previous findings have been inconsistent. Some studies have suggested that familiarity can influence cognitive performance by increasing the emotional or associative salience of music (Pereira et al., 2011), whereas others have reported little or no reliable effect on recall performance (Wen & Michihiko, 2006). The effect of familiarity may therefore depend on the interaction between characteristics of the music, the cognitive demands of the task, and listeners' individual responses. For this reason, the present study examines whether familiarity with the selected musical compositions is associated with differences in immediate and delayed recall of unfamiliar words.

Prior Musical Experience

Prior musical experience may also shape the way individuals respond to background music during cognitively demanding tasks. Musical training involves sustained

attention to auditory features such as pitch, rhythm, timing, and melodic structure, and may therefore contribute to differences in auditory and cognitive processing. Some research has suggested that musicians may demonstrate advantages in certain cognitive tasks, while neurocognitive evidence has also identified structural differences associated with extensive musical training, including greater grey matter density in language-related regions (Sluming et al., 2002).

However, musical experience may not always be advantageous in the presence of background music. Individuals with musical training may process musical information more automatically or analytically, which could make task-irrelevant music more difficult to ignore during concurrent verbal processing. This may increase interference when attention must be divided between linguistic material and auditory input. Consistent with these competing possibilities, previous studies have reported mixed findings, with some suggesting cognitive advantages for musicians and others reporting greater interference or no reliable differences between musically trained and untrained individuals (Herath, 2018; Patston & Tippett, 2011; Ransdell & Gilroy, 2001; Terrell, 2019).

These inconsistent findings suggest that prior musical experience may interact with background music in complex ways rather than exerting a uniformly beneficial or detrimental effect. For this reason, the present study examines whether participants with substantial experience playing musical instruments differ from those without such experience in their immediate and delayed recall of unfamiliar words.

Current Study

The present study examines the effect of background music on the encoding and retention of unfamiliar words by comparing performance across three auditory conditions: silence, instrumental music, and vocal music. In addition, it investigates whether musical familiarity and prior musical experience are associated with differences in recall performance. By addressing inconsistencies in previous research, the study aims to clarify how different background-music conditions and listener characteristics may relate to immediate and delayed recall of unfamiliar words.

Specifically, the study addresses the following research questions:

1. Is there a significant difference in immediate and delayed recall across the silence, instrumental music, and vocal music conditions?
2. Is there a significant difference in immediate and delayed recall between the instrumental and vocal music conditions?
3. Is familiarity with the musical stimuli associated with immediate and delayed recall performance?
4. Is prior musical experience associated with immediate and delayed recall performance?

Method

Participants

The participants in this study were undergraduate students from the English Department at the Faculty of Educational Sciences, Mohammed V University in

Rabat. The sample included 57 students, consisting of 46 females (80.7%) and 11 males (19.3%), aged between 18 and 22 years. This relatively narrow age range was intended to reduce variability associated with age-related cognitive differences. Participants who reported at least five years of experience playing one or more musical instruments were classified as having prior musical experience. Musical-experience data were collected for the 38 participants assigned to the two background-music conditions; among them, 9 met this criterion, whereas the remaining 29 did not. Participants were excluded if they had visual or hearing impairments or a diagnosed cognitive impairment that could interfere with task performance.

Design

The study employed a between-subjects design with random assignment to examine the effect of background auditory condition on immediate and delayed recall of unfamiliar words. Participants were assigned to one of three conditions: silence, instrumental music, or vocal music. In the silence condition, participants encoded the target words without background music, whereas participants in the two music conditions were exposed to either instrumental or vocal music during the encoding phase. The primary outcomes were immediate recall and delayed recall following a 35-minute interval. The study also examined whether musical familiarity and prior musical experience were associated with recall performance. Analyses involving these two variables were restricted to the 38 participants assigned to the background-music conditions, because the relevant questionnaire items were administered only to those participants.

Materials and Measures

Familiarity Pretest

The familiarity pretest was conducted to ensure that participants were unfamiliar with the target words used in the study. Each participant received a sheet containing the nine target words and was instructed to provide either a definition or a translation for each word rather than simply indicating whether the word was familiar. This approach was intended to provide a more objective indication of prior word knowledge and reduce the risk of over- or underestimating familiarity. Establishing that the target items were initially unfamiliar was necessary for evaluating subsequent encoding and recall performance.

The Word Recall Test

Participants in all three conditions were presented with nine target words and their corresponding brief definitions for 15 seconds each, resulting in a total exposure time of 135 seconds. The target words were selected according to several criteria: low emotional load, low frequency, consistency in part of speech, uniform syllable length, and absence of French cognates. All target items were two-syllable adjectives drawn from the BNC/COCA Word Frequency Lists (Nation et al., 2012), specifically from the 10th to the 21st frequency bands. Emotionally charged words were excluded to reduce the likelihood that emotional responses or previously activated associations would influence recall.

The use of two-syllable words was intended to reduce variability associated with word length, given that longer verbal items may place greater demands on short-term memory processes (Baddeley et al., 1975). French cognates were also excluded to minimize the influence of prior linguistic knowledge. The definitions were kept brief and consisted predominantly of high-frequency vocabulary, including 64 words from the first frequency band, 8 from the second, and 3 from the third, thereby limiting unnecessary processing demands. For scoring, each correctly recalled target word in the immediate and delayed posttests received one point if it contained fewer than two incorrect letters. Responses containing more than two incorrect letters were scored as incorrect.

Musical Compositions

Two musical compositions were selected to represent the vocal and instrumental background-music conditions. "Paradise" by Coldplay, used in the vocal condition, has a tempo of approximately 140 beats per minute (BPM) and a duration of 4:38 minutes, whereas "Electra" by Airstream, used in the instrumental condition, has a tempo of approximately 83 BPM and a duration of 6:13 minutes. "Paradise" was selected as a relatively well-known vocal track, allowing familiarity with the musical stimulus to be examined, whereas "Electra" was selected as an instrumental composition previously characterized as relaxing. Importantly, the two compositions differed not only in the presence or absence of lyrics but also in tempo and potentially other musical characteristics. Because these features were not independently manipulated, any differences observed between the vocal and instrumental conditions cannot be attributed exclusively to the presence of lyrics.

The Immediate and Delayed Posttests

Immediately following the encoding phase, participants completed a free-recall test in which they were instructed to reproduce as many of the target words as possible. They were not required to recall the words in their original presentation order. A second free-recall test was administered approximately 35 minutes later to assess delayed recall. The delayed test was conducted on the same day rather than on a separate occasion in order to reduce the possibility that participants might encounter or rehearse the target words outside the experimental setting before the second assessment.

The Questionnaires

Following the immediate recall test, participants completed a questionnaire that also served as a distractor task. Participants in the silence condition completed a general version of the questionnaire, whereas participants in the two background-music conditions completed an extended version that collected information about their musical preferences, prior musical experience, and familiarity with the musical stimulus to which they had been exposed. The questionnaire contained both binary-response items with opportunities for justification and open-ended questions. In addition to collecting relevant individual-difference information, the questionnaire was intended to reduce deliberate rehearsal of the target words during the interval preceding the delayed recall test.

Pilot Study

Prior to the main experiment, a pilot study was conducted to identify potential methodological issues and refine the study procedures. Six second-year students from the English Department participated, all of whom were female and aged between 19 and 21 years. Two participants were assigned to the silence condition, while the remaining four were divided equally between the instrumental and vocal music conditions.

The pilot study identified several issues related to word familiarity, presentation timing, and task instructions. Some of the original target words were French cognates, which could have facilitated recall through participants' prior linguistic knowledge. These items were therefore replaced with low-frequency English adjectives selected to be non-cognates with French. In addition, the presentation time for each target word was increased from 10 to 15 seconds to allow sufficient processing. Finally, because some pilot participants misunderstood the recall task and attempted to memorize the definitions rather than the target words themselves, the instructions were clarified in the main experiment to emphasize that participants were required to recall the target words only.

Procedure

The researcher began by fostering rapport with participants through a lecture on the effect of metacognition on learning, following consent from their professors. Participants were informed that the study focused on memory, attention, and learning, although specific experimental details were withheld. After providing oral consent, participants received a written consent form detailing anonymity, data confidentiality, and the right to withdraw at any time. To safeguard data across multiple tests, participants were given the option to use either their real names or pseudonymous names, which they were required to use consistently throughout the study. They were also encouraged to photograph the consent form as a reminder of their rights.

The first stage involved a word familiarity task. To prevent participants from consciously retaining or discussing the target words, a Vocabulary Size Test was introduced as a distractor task. This was considered important because the experimental conditions were conducted approximately two to three days later, depending on group assignment.

For the experimental phase, participants were randomly assigned to one of three conditions: silence, instrumental music, or vocal music. Each group completed two recall tasks, one immediately after word exposure and another following a delay. To minimize distractions, classrooms were carefully selected for their quietness, and the experiments were conducted during regular class hours.

At the start of the experiment, participants were informed about the recall task and were exposed to nine unfamiliar words and their corresponding definitions for 15 seconds each, resulting in a total exposure time of 135 seconds. To mitigate the recency effect and reduce retention bias, the researcher briefly engaged participants in neutral conversations, such as asking about meals or hunger. Participants were then given 40 seconds to recall the target words on a provided sheet.

After the immediate recall task, participants completed a questionnaire exploring their musical preferences, familiarity with the songs, and whether they played musical

instruments. This served both as a source of data and as a distractor task during the approximately 35-minute interval before the delayed recall test. During this period, the researcher also engaged participants in discussions about their post-graduation plans without disclosing the upcoming delayed recall task.

Finally, participants were given another 40 seconds to recall the target words for the delayed test. Upon completion of the study, the researcher expressed gratitude for their participation and emphasized their valuable contribution to the research.

Sampling Method

The study employed convenience sampling to recruit participants from three intact classes selected on the basis of accessibility. These classes served only as the recruitment pool and did not correspond directly to the three experimental conditions. Individual participants were subsequently randomly assigned to the silence, instrumental music, or vocal music condition, resulting in 19 participants per group. Although random assignment was used to reduce systematic pre-existing differences across conditions, the relatively small group sizes meant that complete baseline equivalence could not be assumed. Vocabulary Size Test scores were therefore compared across conditions to examine possible pre-existing differences in vocabulary knowledge.

Statistical Analyses

The collected data, including participants' biographical information and scores from the recall tasks and questionnaires, were coded and analyzed using SPSS. Prior to inferential analyses, the distributions of the relevant variables were examined to assess normality and determine the most appropriate statistical procedures. To examine differences in immediate and delayed recall across the three auditory conditions, separate one-way ANOVAs were conducted for each recall measure. When significant omnibus effects were detected, Tukey's HSD post hoc tests were used to identify specific group differences. Mann–Whitney U tests were conducted to examine whether musical familiarity and prior musical experience were associated with differences in immediate and delayed recall performance among participants in the two background-music conditions. In addition, a one-way ANOVA was conducted to compare Vocabulary Size Test scores across the three auditory conditions and assess possible baseline differences in vocabulary knowledge.

Findings

Baseline Vocabulary Size Across Conditions

To examine whether the three groups differed in vocabulary knowledge prior to the experimental task, Vocabulary Size Test scores were compared across conditions. The silence condition obtained a mean score of 6326.32 (SD = 1844.16), the instrumental condition a mean of 6084.21 (SD = 2291.84), and the vocal condition a mean of 6021.05 (SD = 1614.03). Levene's test indicated that the assumption of homogeneity of variance was satisfied, p = .280. A one-way ANOVA revealed no statistically significant difference in vocabulary size across the three conditions, F (2, 54) = 0.13,

p = .877. These results indicate that the groups did not differ significantly in baseline vocabulary knowledge prior to the experimental task.

The Effect of Background Music on Immediate and Delayed Recall

The descriptive statistics for the performance of the three conditions on the immediate recall task are presented in Table 1. The silence condition obtained a mean score of 6.36 (*SD* = 1.60), the instrumental music condition obtained a mean score of 5.00 (*SD* = 1.76), and the vocal music condition obtained a mean score of 5.68 (*SD* = 1.41). Although the silence condition had the highest mean score, it was necessary to determine whether the observed differences among the groups were statistically significant. A one-way ANOVA was therefore conducted. As shown in Table 2, the analysis indicated a statistically significant difference among the three conditions, $F(2, 54) = 3.47$, $p = .038$. Because the omnibus test indicated the presence of a significant group difference, Tukey's HSD post hoc test was conducted to identify the specific conditions between which the difference occurred (Table 3).

Tukey's HSD test was selected because the assumptions required for the analysis were satisfied. The assumption of homogeneity of variance was supported by Levene's test, and the three conditions had equal sample sizes of 19 participants each. The post hoc analysis revealed a statistically significant difference between the silence

Table 1 *The Means of the Three Groups in the Immediate and Delayed Posttest*

Posttest	Condition	Mean	*N*	Std. Deviation
Immediate Posttest	Silence	6.36	19	1.60
	Instrumental	5.00	19	1.76
	Vocal	5.68	19	1.41
Delayed Posttest	Silence	5.68	19	1.94
	Instrumental	4.94	19	1.58
	Vocal	5.05	19	1.39

Table 2 *One-Way Anova Table for the Immediate and Delayed Posttest*

The Posttest		Sum of Squares	*Df*	Mean Square	*F*	Sig.
Immediate Posttest	Between Groups	17.78	2	8.895	3.467	.038
	Within Groups	138.52	54	2.565		
	Total	156.31	56			
Delayed Posttest	Between Groups	6.03	2	3.01	1.10	.340
	Within Groups	148.00	54	2.74		
	Total	154.03	56			

Table 3 *Tukey's HSD Multiple Comparisons for the Three Auditory Conditions in the Immediate Posttest*

(I) Condition	(J) Condition	Mean Difference (I-J)	Std. Error	Sig.
Silence	Instrumental	1.36*	0.51	0.02
	Vocal	0.68	0.51	0.39
Instrumental	Silence	–1.36*	0.51	0.02
	Vocal	–0.68	0.51	0.39
Vocal	Silence	–0.68	0.51	0.39
	Instrumental	–0.68	0.51	0.39

Note. SE = Standard Error. *p < .05.

Table 4 *Paired Samples T-Test for the Immediate and Delayed Recall*

		Paired Differences					*T*	*Df*	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Immediate recall Delayed recall	0.45	1.16	0.15	0.14	0.76	2.95	56	.005

and instrumental music conditions. Participants in the silence condition obtained a significantly higher mean score than those in the instrumental condition, with a mean difference of 1.36 (p = .020). However, no statistically significant differences were found between the instrumental and vocal music conditions (p = .390) or between the vocal music and silence conditions (p = .390). Thus, the significant overall effect observed in the immediate recall task was attributable specifically to the difference between the silence and instrumental music conditions.

After examining performance in the immediate recall task, a second one-way ANOVA was conducted to compare the three conditions on delayed recall. As shown in Table 1, the silence condition obtained a mean score of 5.68 (*SD* = 1.94), the instrumental music condition obtained a mean score of 4.94 (*SD* = 1.58), and the vocal music condition obtained a mean score of 5.05 (*SD* = 1.39). Although the silence condition again obtained the highest descriptive mean, the one-way ANOVA presented in Table 2 indicated that the differences among the groups were not statistically significant, $F(2, 54) = 1.10$, p = .340.

In addition, a paired-samples t test was conducted to determine whether participants' performance differed significantly between the immediate and delayed posttests (see Table 4). The analysis yielded a statistically significant difference, t (56) = 2.95,

$p = .005$, indicating that participants recalled significantly more words in the immediate posttest than in the delayed posttest.

The Effect of Familiarity on Participants' Performance

To address this research question, the distribution of recall scores was first examined using the Shapiro–Wilk test of normality. The results indicated that the scores of participants who were familiar with the musical stimuli were normally distributed for both the immediate recall task ($p > .05$) and the delayed recall task ($p > .05$). However, the immediate recall scores of participants who were unfamiliar with the musical stimuli violated the assumption of normality ($p < .05$). Given this pattern, a Mann–Whitney U test was considered the most appropriate nonparametric procedure for comparing the performance of the two familiarity groups.

As shown in Table 5, the mean ranks of participants who were familiar and unfamiliar with the musical stimuli were very similar. For immediate recall, the mean rank was 19.67 for the familiar group and 19.39 for the unfamiliar group. The Mann–Whitney U test presented in Table 6 indicated no statistically significant difference between the two groups in immediate recall, $U = 170.00$, $p = .93$. Similarly, no statistically significant difference was found in delayed recall, $U = 168.50$, $p = .90$. These findings indicate that familiarity with the musical stimuli was not significantly associated with either immediate or delayed recall performance.

The Effect of Prior Musical Experience on Participants' Performance

To address this research question, the distribution of recall scores was first examined using the Shapiro–Wilk test of normality. The results indicated that some of the

Table 5 *Descriptive Statistics of the Participants who are Familiar and Unfamiliar with the Songs*

Familiarity	*N*	Mean Rank	Sum of Ranks
Yes	15	19.67	295.00
No	23	19.39	446.00

Table 6 *Mann-Whitney Comparison of the Performance of Participants Familiar and Unfamiliar with the Songs*

	Immediate recall	Delayed recall
Mann-Whitney *U*	170.00	168.50
Wilcoxon *W*	446.0	288.50
Z	–.07	–0.12
Asymp. Sig. (2-tailed)	.93	0.90
Exact Sig. [2*(1-tailed)]	.95[b]	0.90[b]

Table 7 *Descriptive Statistics of the Participants who Play Music and do not Play Musical Instruments*

Prior experience	*N*	Mean Rank	Sum of Ranks
Yes	9	24.67	222.00
No	29	17.90	519.00

Table 8 *Comparison of the Performance of the Participants With and Without Prior Musical Experiences (Mann-Whitney)*

	Immediate recall	Delayed recall
Mann-Whitney *U*	84.00	111.50
Wilcoxon *W*	519.00	546.00
Z	–1.62	–0.67
Asymp. Sig. (2-tailed)	0.10	0.50
Exact Sig. [2*(1-tailed)]	0.11[b]	0.52[b]

score distributions met the assumption of normality ($p > .05$), whereas others did not ($p < .05$). Given this pattern, a Mann–Whitney *U* test was used to compare the recall performance of participants with and without prior musical experience.

As shown in Table 7, participants with prior musical experience obtained higher mean ranks than those without such experience in both the immediate and delayed recall tasks. However, the Mann–Whitney *U* test presented in Table 8 indicated that these differences were not statistically significant. For immediate recall, no significant difference was found between participants with and without prior musical experience, $U = 84.00$, $p = .105$. Similarly, no statistically significant difference was found for delayed recall, $U = 111.50$, $p = .521$. Although the descriptive results favored participants with prior musical experience, the findings do not provide sufficient evidence that prior musical experience was significantly associated with immediate or delayed recall performance.

Discussion

The Difference in the Encoding and Retention of Novel Words Between the Experimental and Control Groups

This study examined whether background music affected the encoding and retention of novel words. Participants in the silence condition obtained the highest mean scores, particularly in the immediate posttest, where a statistically significant difference emerged between the silence and instrumental music conditions. Although the vocal music condition also produced a lower descriptive mean than silence, this difference was not statistically significant. These findings suggest that background music may interfere with efficient word encoding under certain conditions, possibly because

task-irrelevant auditory input competes for limited attentional and working memory resources. When participants encoded words in silence, fewer competing auditory stimuli were present, which may have supported more efficient processing and recall.

These findings are consistent with previous studies showing that background music can impair the encoding and recall of verbal material by dividing attention and increasing cognitive load (Ji et al., 2021; Konantz, 2012; Mensink & Dodge, 2014; Musliu et al., 2017). The present findings therefore lend support to the view that irrelevant auditory stimulation may hinder vocabulary learning, particularly during initial encoding.

Although no statistically significant difference was found among the three conditions in the delayed posttest, the silence condition obtained the highest descriptive mean. The absence of a significant group effect prevents a firm conclusion that silence provided an advantage for delayed recall. Another possible explanation for the decline in delayed recall is the limited exposure participants received to the target words. Each word was presented only once during the encoding phase, which may not have been sufficient for stable lexical learning. Previous research has shown that repeated encounters with unfamiliar words are generally needed to support stronger retention, with Brown et al. (2008) highlighting the benefits of multiple exposures. The delayed recall findings may therefore partly reflect weak initial acquisition rather than the effect of auditory condition alone. Overall, the findings suggest that instrumental background music was less beneficial than silence during the initial encoding of unfamiliar words, while no reliable advantage of silence was established for delayed recall.

The Difference in the Encoding and Retention of Novel Words Between the Two Experimental Groups

Although the vocal music group obtained slightly higher scores than the instrumental music group, the difference between the two conditions was not statistically significant. The descriptive pattern therefore suggests less disruption in the vocal condition, but the evidence is insufficient to establish a reliable advantage of vocal over instrumental music. The findings should consequently be interpreted with caution.

This pattern is somewhat unexpected, as previous research has often suggested that vocal music may be more disruptive than instrumental music during verbal tasks because lyrics can compete with language processing (Kämpfe et al., 2011; Musliu et al., 2017; Salamé & Baddeley, 1989). In the present study, however, the instrumental condition produced the lowest descriptive performance. One possible explanation is that the effect of background music may depend not only on the presence or absence of lyrics, but also on other characteristics of the selected musical stimuli and on listeners' subjective responses to them.

Tempo may also have contributed to this pattern. The vocal and instrumental stimuli differed substantially in pace, at approximately 140 and 83 BPM, respectively. Because tempo and lyrical content were not independently manipulated, it is not possible to determine whether the observed descriptive difference between the two music conditions was related to the presence of lyrics, tempo, or a combination of musical characteristics. The lower descriptive performance in the instrumental condition

should therefore not be interpreted as evidence that instrumental music is inherently more disruptive than vocal music.

Participants also appeared to respond more positively to the vocal song than to the instrumental piece. Although some participants described the instrumental music as calming, others perceived it as boring or lacking meaning, whereas the vocal song was more often described as enjoyable and motivating. These differences in subjective response may have influenced participants' attention and engagement during the task. It is also possible that habitual exposure to lyrical music while studying made the vocal condition feel less distracting to some participants. Accordingly, the effects of background music may depend not only on whether lyrics are present, but also on listener preference, perceived enjoyment, and prior listening habits.

These subjective responses may also be interpreted in light of the Arousal–Mood Hypothesis (Husain et al., 2002; Thompson et al., 2001), which proposes that music may influence cognitive performance indirectly through changes in arousal and affective state. The more positive reactions reported toward the vocal song may have been associated with a more favorable affective state during the task, whereas less favorable responses to the instrumental piece may have been associated with less optimal arousal or mood. However, this interpretation remains tentative because arousal and mood were not directly measured in the present study.

The Effect of Musical Familiarity with Background Music on the Encoding and Retention of Novel Words

The results showed no statistically significant association between familiarity with the musical stimuli and either immediate or delayed recall performance. Participants who were familiar with the music did not perform significantly differently from those who were unfamiliar with it. This finding is consistent with previous studies that likewise reported no reliable effect of musical familiarity on cognitive performance (Mok, 2010; Sousa, 2019; Wen & Michihiko, 2006).

At the same time, previous research has produced mixed findings, with some studies suggesting that familiar music may facilitate performance, whereas others indicate that familiarity can increase distraction by eliciting stronger emotional or autobiographical associations. One possible explanation for the absence of a familiarity effect in the present study is that the vocabulary-learning task itself required substantial attentional resources. According to Load Theory (Lavie et al., 2004), when the primary task imposes high cognitive demands, fewer resources may remain available for processing task-irrelevant stimuli. Participants may therefore have allocated most of their attention to the word-learning task, limiting the extent to which familiarity with the music influenced recall performance.

The Effect of Prior Musical Experience on the Encoding and Retention of Novel Words

Although participants with prior musical experience obtained higher descriptive scores in both recall tasks, the differences between participants with and without such experience were not statistically significant. The findings therefore provide no evidence of a reliable association between prior musical experience and recall performance in the present study.

This finding is consistent with previous research reporting no significant advantage for musically experienced participants in similar memory tasks (Terrell, 2019), although it differs from studies suggesting either cognitive advantages or greater interference among musically trained individuals. The absence of a statistically significant difference in the present study may partly reflect the small number of participants with prior musical experience, which limited the statistical power of the comparison. Consequently, although the descriptive pattern favored participants with musical experience, stronger conclusions cannot be drawn from the present data.

Concluding Remarks

Summary of Findings

The findings of the present study revealed several notable patterns. Participants in the silence condition obtained the highest mean scores in both immediate and delayed recall. However, the difference reached statistical significance only in the immediate posttest, specifically between the silence and instrumental music conditions. Although the instrumental condition produced the lowest descriptive mean in both assessments, the difference between the instrumental and vocal conditions was not statistically significant. No statistically significant differences were observed between the vocal and silence conditions. Finally, neither familiarity with the musical stimuli nor prior musical experience was significantly associated with recall performance.

Practical Applications

The findings suggest that quiet learning environments may be preferable when students are engaged in cognitively demanding vocabulary-learning tasks. In the present study, participants in the silence condition obtained the highest recall scores, and the significant difference between the silence and instrumental music conditions suggests that background music may interfere with initial word encoding under some circumstances. Educators should therefore exercise caution when introducing background music during tasks that require sustained attention to unfamiliar lexical material.

At the same time, the present findings do not support recommending a particular type of background music for all learners. Responses to music may vary according to individual preferences, familiarity, prior musical experience, and characteristics of the auditory stimulus itself. In addition, because the vocal and instrumental tracks used in this study differed in several musical characteristics, including tempo, the findings cannot establish that one type of music is inherently more suitable than another. Where background music is used, allowing learners some degree of choice or taking individual listening preferences into account may therefore be more appropriate than prescribing a single musical condition for an entire class.

Overall, the present findings suggest that silence may represent a more cautious default condition for tasks requiring concentrated vocabulary encoding. However, the possible benefits or costs of background music should be considered in relation to the characteristics of the task, the auditory stimulus, and the individual learner rather than assuming that a single musical condition will be optimal for all students.

Limitations and Further Research

Several limitations should be considered when interpreting the findings of the present study. First, the sample was characterized by an uneven gender distribution, with female participants comprising the majority of the sample, which may limit the generalizability of the findings. In addition, the relatively small number of participants in each experimental condition (n = 19) may have limited statistical power and the ability to detect smaller group differences. Future studies should therefore employ larger and more balanced samples.

A further limitation concerns prior musical experience. Only a small proportion of participants in the two background-music conditions met the criterion for prior musical experience, resulting in an unequal comparison between participants with and without such experience. This imbalance may have reduced the statistical power of the analysis. Future research including larger and more balanced groups of musically experienced and non-experienced participants would allow a more robust examination of the role of prior musical experience in recall performance.

The limited exposure to the target words should also be acknowledged. Each target word was presented only once during the encoding phase, which may have limited the strength of initial learning and contributed to the decline observed in delayed recall. Future research could incorporate multiple exposures to unfamiliar words and examine whether the effects of background music differ as lexical representations become more established.

Another important limitation concerns the musical stimuli. The vocal and instrumental tracks were not matched for tempo, with the vocal track having a substantially faster BPM than the instrumental track. Consequently, musical type and tempo were confounded, and the study cannot determine whether differences between the two music conditions were attributable to the presence of lyrics, tempo, or other stimulus-specific characteristics. Future studies should use vocal and instrumental stimuli matched on tempo, loudness, duration, genre, and other relevant acoustic properties, or manipulate these features independently.

Future research could also broaden the range of auditory conditions examined. In addition to instrumental and vocal music, different musical genres and non-musical auditory stimuli, such as white or brown noise, could be investigated. Extending this line of research to other language-related tasks, including reading comprehension and writing, may also provide a more comprehensive understanding of how different forms of auditory stimulation interact with varying cognitive demands.

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