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The Effect of Listening Enjoyable Music Before Study on Learning

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ABSTRACT

Research studies have suggested that increasing dopamine in a natural way by listening to a short piece of enjoyable music has the potential to improve human performance. However, there is not enough empirical evidence on whether listening to music before studying instructional material enhances learning. Considering this need, the goal of this study is to investigate the effect of listening to enjoyable music before study on learning outcomes. A total of 80 students participated in this experimental study having a between-subjects design. Half of the participants were randomly assigned to the experimental group in which they listened to enjoyable music, whereas the other half were assigned to the control group in which they listened to no music. Afterwards, all the participants studied the instructional materials. The results demonstrate that learning gains were higher in the experimental group than in the control group. Particularly, the results of the current study suggest that when people listen to enjoyable music before they study the instructional materials, they learn better.

Keywords: Music, Learning, Dopamine, Education, Emotion

Çalışmadan Önce Dinlenilen Eğlenceli Müziğin Öğrenmeye Etkisi

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ÖZET

Araştırma çalışmaları, eğlenceli kısa bir müzik parçasını dinleyerek doğal yolla dopamini artırmanın insan performansını geliştirme potansiyeline sahip olduğunu iddia etmektedir. Buna rağmen, öğretimsel materyalleri çalışmadan önce dinlenilen müziğin öğrenmeyi iyileştirip iyileştirmediği gösteren yeterince deneysel kanıt yoktur. Bu ihtiyaç dikkate alındığında, bu çalışmanın amacı çalışmadan önce dinlenilen eğlenceli müziğin öğrenme çıktılarına olan etkisini araştırmaktır. Denekler-arası desene sahip olan bu deneysel çalışmaya toplam 80 öğrenci katılmıştır. Katılımcıların yarısı seçkisiz olarak eğlenceli müziğin dinlenildiği deneysel gruba atanırken diğer yarısı herhangi bir müziğin dinlenilmediği kontrol grubuna atanmışlardır. Daha sonra tüm denekler öğretimsel materyalleri çalışmışlardır. Sonuçlar, deneysel gruptaki öğrenme kazanımlarının kontrol grubundan yüksek olduğunu göstermektedir. Özellikle, bu mevcut çalışmanın sonuçları insanların öğretimsel materyalleri çalışmadan önce eğlenceli müzik dinlediklerinde daha iyi öğrendiklerini ortaya koymaktadır.

Anahtar Sözcükler: Müzik, Öğrenme, Dopamin, Eğitim, Duygu

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1. INTRODUCTION

Learning is a cognitive process that may be influenced by environmental factors, such as music. As the well-known statement suggests, music heals the 'soul' and has positive influences. Music elicits different kinds of emotions like from aliveness to relaxation, happiness to sadness, and horror to comfort (North & Hargreaves, 1996; Sloboda & O'Neill, 2001; Sloboda, 2001). Neurosurgeons listen to music to focus better (Firlik, 2006). Armies use music to enhance cooperation (McNeil, 1995). Workers use it to enhance focus and wakefulness (Soto et al., 2009). Athletes use music to increase motivation (Terry, Karageorghis, Saha & D'Auria, 2012). The positive effect of music is came to be known for so long. Recently, neuroimaging studies have shown that specific areas in the brain, including the insular, cingulate cortex, hippocampus, hypothalamus, prefrontal cortex, and amygdala are activated by music (Boso, Politi, Barale, & Emanuele, 2006). Moreover, in the light of neurochemical studies, it is additionally suggested that the musical experience leads to several biochemical mediators, including dopamine, endorphins, and endocannabinoids (Boso et al., 2006).

Biochemical hormone dopamine, which is central to the learning mechanism, is released in response to rewarding human activity like music (Bressan & Crippa, 2005). Research studies in which the participants' brains are imaged by positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) have shown that music is inextricably linked with our deepest reward systems and listening to music induces higher level of dopamine transmission (Ford, Wammes, Neufeld, Mitchell, Théberge, Williamson, & Osuch, 2014). Consistently, dopamine hormone, which may affect learning processes, is released by rewarding stimuli. Enjoyable music is a way to reward human activity (Menon & Levitin, 2005). In sum, research studies have suggested that increasing dopamine in a natural way by listening to a short piece of enjoyable music has the potential to improve human performance. However, there is not enough empirical evidence on whether listening to music before studying instructional materials enhances learning. Considering this need, the goal of the current experiment is to examine whether listening to enjoyable rewarding music, which is expected to increase dopamine hormone transmission enhances learning outcomes.

The arousal and mood hypothesis suggests that the effects of listening to music on cognitive processes are due to arousal or mood (Thompson, Schellenberg, & Husain, 2001). While musical tempo (fast vs. tempo) has an effect on arousal, musical mode (major vs. minor) affects mood (Husain, Thompson, & Schellenberg, 2002). Music also has the potential to motivate learners to show positive attitudes toward the instructional contents (Lehmann, Hamm, & Seufert, 2019). Pleasant music compared to unpleasant music increases heart rate and frontal theta power, which is an indicator of higher sustained attention and mental effort (Sammler, Grigutsch, Fritz, & Koelsch, 2007). Proverbio, De Benedetto, Ferrari, and Ferrarini (2018) suggest that the beneficial effects of music are due to enhanced alertness. Hallam, Price, and Katsarou (2002) suggest that performance is enhanced in simple tasks because stimulating music increases arousal levels of learners, but for complex tasks performance can be easily impaired.

It is fascinating that people look for pleasurable experiences like listening to music, even though music provides no survival advantage for human beings (Ferreri et al., 2019). Music increases activation in mesolimbic structures in the brain, which are related to reward mechanisms

(Koelsch, Skouras, & Lohmann, 2018). It has been demonstrated that dopamine modulates the reward processes evoked by music (Ferreri et al., 2019).

Prior research studies mostly have focused on the long-term effects of music on clinical settings (Gold et al., 2005) and comparing musicians with non-musicians in terms of their cognitive abilities (Schlaug, Jancke, Huang, & Steinmetz, 1995; Zatorre et al., 1998; Hutchinson et al., 2003). Jausovec and Habe (2003) found positive effects of music on epilepsy. Except for clinical settings, Rauscher, Shaw, and Ky (1995) explained the positive effect of music on performance on different accounts. They found an association between spatio-temporal reasoning and listening to music. Jausovec and Habe (2003) also suggested that when participants listed Mozart's music, they better learned spatio-temporal rotation tasks. The Mozart effect is known as the finding of superior performance in spatial tasks as a result of listening to Mozart's music (Hetland, 2000; Rauscher, Shaw & Ky, 1993). However, several researchers could not replicate the Mozart effect (Simons & Chabris, 1999; Steele, Bass, & Crook, 1999; Steele et al., 1999; Boso et al., 2006). This effect has been associated with arousal and mood differences required by the experimental conditions (Husain, Thompson, & Schellenberg, 2002; Nantais & Schellenberg, 1999; Thompson, Schellenberg, & Husain, 2001).

Although several studies, as indicated in the introduction, have shown that music enhances human performance, few research studies have examined the causal relationship between music and learning. It has been found that background music enhances second language learning (de Groot, 2006). Presenting arousing music after learning improved retention of word lists (Judde & Rickard, 2010). However, to our best knowledge, no study has investigated the effect of music that is presented before instructional materials on learning. Thus, it is not clear whether music will have beneficial effects on learning or not. Considering this need, the effect of listening to enjoyable music on learning is examined in the current study, which might be caused by probable dopamine release in our reward system as a result of listening to enjoyable music. The current study has the potential to reveal the causal relationship between music and learning outcomes in a controlled experiment.

2. METHOD

The current experimental study has a pretest-posttest control group design. Participants were randomly assigned either to the intervention (experimental) group or to the non-intervention (control) group. Performances of both groups were measured before and after the intervention with pretests and posttests, respectively.

2.1. Participants

The sample consisted of 80 students from Çankaya University, Hacettepe University, Gazi University, Ankara University, and Middle East Technical University (see Table 1). In the current study, there were two groups of participants as the control group (n = 40) and the experimental group (n = 40).

Table1. *Demographics of the Control and Experimental Groups*

Variable	Control Group (n=40)	Experimental Group (n=40)
University		
Cankaya University	32	29
Hacettepe University	2	4
Gazi University	3	4
Ankara University	1	3
Middle East Technical University	2	0
Gender		
Female	28	23
Male	12	17

For the sample of the control group, the age interval of the students was between 19 and 29, with a mean age of 22.28 (SD = 2.35). Given the percentage, 70% of the subjects were female (n = 28) and 30% of them were male (n = 12). Given the educational level, 87.2% of the participants in the control group were undergraduate students (n = 34), and 12.8% of them were graduate students (n = 5). For the sample of the experimental group, the age interval was between 20 and 26 years with a mean age of 22.58 years (SD = 1.88). For percentages, 57.5% of this group were female (n = 23) and 42.5% off them were male (n = 17). All of the participants in this group were undergraduate students (n = 40). All participants were volunteer to participate in the study and gave informed consent form before their enrollment.

2.2. Materials

Socio-demographic Information Form.

The demographic characteristics of the participants, including gender, age, GPA, education status, and history of psychiatric and organic disorders were obtained by this form (see Appendix A).

Achievement Focused Motivation Scale

A 7-point Likert scale was used to identify the general achievement-focused motivation of participants created by Semerci (2010). The scale included 4-factors (i.e., internal effects, external effects, self-conscious, and growth of aim) with 35 questions in which participants rate from 1 (absolutely disagree) to 7 (absolutely agree). Item-total correlations were between 0.36 and 0.58. Cronbach's alpha coefficient of the scale was 0.896. The correlation coefficient between the two halves points was 0.895. The test-retest correlation was 0.977.

Pretest and Posttest

To assess the learning of the concept of the information processing model, the pretest and the posttest questions were prepared. The pretest and posttest consisted of 10 multiple-choice questions with three options. The posttest was an equivalent form of the pretest.

2.3. Design of the study

The study had a between-subject design with two groups of participants: the control group and the experimental group. The experimental group was exposed to the music intervention consisting of listening to a 3.24-minute song, named Kaoma’s Lambada. No intervention was

applied to the control group. The dependent variable in the experiment was the learning gain of each individual, calculated by subtracting the pretest score from the posttest score for each participant.

2.4. Procedure

Participants were assigned to the experimental group or control group randomly. Numbers from 1 to 80 were written on a little piece of paper and collected in a bag. After that, each participant took a number from the bag. Participants with odd numbers were assigned to the control group, and the rest were assigned to the experimental group. Next, the participants were requested to complete the socio-demographic information form, achievement-focused motivation scale, and finally the pretest. The participants in the experimental group listened to the 'Lambada' song of Kaoma's which is 3.24-minute long, whereas the participants in the control group waited during a 3.24-minute period in silence without doing anything. Participants in the experimental group were asked to rate whether the music they listened was enjoyable or not on a forced-choice yes-no scale. Later, participants in both groups watched the 6-minute video related to the topic named information processing model. After watching the video, all the participants were given the posttest. The experiment took approximately 15 minutes.

3. RESULTS

A one-way analysis of variance (ANOVA) was run in order to examine whether there was a significant difference between the experimental and control group on pretest scores. The results of the ANOVA test suggest that there existed no statistically significant difference between these two groups, F (1, 77) = 3.18, p = .08, partial eta squared = .04. This result indicates that the groups were comparable in terms of their prior knowledge of the subject matter. All the subjects in the experimental group rated that the played song was enjoyable, indicating that the music was enjoyable. Gain scores were calculated for each participant by subtracting the pretest score from the posttest score. The effect of group was significant on gain scores, F(1, 77) = 10.63, p = .002, partial eta squared = .12 (see Table 2). Accordingly, learning gains were higher in the experimental group than in the control group. Although these two groups did not statistically differ on pretest scores, pretest scores may be a confounding factor. In order to control for the influence of the pretest, an analysis of covariance (ANCOVA) was performed with the group as the between-subjects variable, pretest scores as the covariate variable, and gain scores as the dependent variable. The results indicated that the effect of group remained significant even the influence of pretest was controlled for, F (1, 76) = 7.12, p = .009, partial eta squared = .09. No significant difference was detected between the groups in motivation, F(1, 77) = 0.03, p = .86, partial eta squared = 0.

Table 3. *Mean and (standard deviation) for Control and Experimental Groups on Pretest, Posttest, Gain and Motivation*

Variable	Control Group	Experimental Group
Pretest	36.25 (16.59)	29.74 (15.81)
Posttest	60.75 (16.39)	67.18 (18.20)
Gain	24.50 (18.53)	37.44 (16.66)
Motivation	134.25 (15.79)	134.87 (15.26)

4. DISCUSSION AND LIMITATIONS

The aim of this study was to investigate the effect of enjoyable music on learning. Results of the subjective ratings of the played music showed that the song was enjoyable. No significant differences were found between the pretest scores of the groups, indicating that the groups were comparable in terms of their prior knowledge on the subject matter. The results also suggested that the enjoyable music had a significant effect on learning gains. Several mechanisms can be proposed for the beneficial effect of music on learning. For instance, music may enhance the motivation of the participants, and higher motivation in the experimental condition may be responsible for the observed learning gains. However, the results of the current study suggest that music had no significant effect on the motivation of participants (Lehmann, Hamm, & Seufert, 2019). Another possibility is that participants in the music condition compared to the ones in the no-music condition may have higher arousal levels and consequently perform better in the posttest (Thompson, Schellenberg & Husain, 2001). Unfortunately, this possibility was not tested in the current study. The underlying mechanism and neural basis of this enhancement and their associations need to be identified.

The effect of enjoyable music on learning may be due to increased dopamine hormone. Neuroimaging studies have suggested that music has similar effects like other rewarding stimuli such as food, drink and sex and affects the same neural structures in the brain (Blood & Zatorre, 2001; Brown, Martinez & Parsons, 2004; Jeffries, Fritz & Braun, 2003; Menon & Levitin, 2005). The findings from prior research indicated that pleasure associated with music could cause dopamine release in the striatal system that is considered a primary part of the reward system (Menon & Levitin, 2005; Craig, 2002). Moreover, Zatorre, and Salimpoor (2013) have proposed that the rewarding effect of music is coded by activity levels in the nucleus accumbens. The functional link of the nucleus accumbens with auditory and frontal areas increases as a result of increasing musical reward (Zatorre & Salimpoor, 2013). Perham and Whithey (2012) presented liked and disliked music in fast and slow tempo before spatial rotation tasks and found that regardless of tempo, liked music enhanced spatial rotation performance. However, some researches are conflicting with the study by Perham and Whithey (2012).

The findings from some previous studies focused on the long-term effects of music (Gold et al., 2005), the effects of music in clinical settings like autism (Rimland & Edelson, 1995) and the cognitive processes of musicians in comparison with non-musicians brain (Schlaug et al., 1995; Zatorre et al., 1998; Hutchinson et al., 2003). In another research, Rodrigues, Loureiro, and Caramelli (2013) illustrated that long term musical training improved different forms of visual attention ability as a cognitive benefit. However, in this study, the short-term effect of music on learning scores has been studied. Similar to our study, Cole and Maeda (2015) also demonstrated short term benefits of music on human performance. Their results suggested that when participants listened to music, they ran further. It can be proposed that even with a small piece of enjoyable music, we may increase our learning gains, which may be attributed to dopamine, arousal, or mood which help us do better in performing our current tasks.

There are also several limitations to the current study. The first limitation of this study is that all of the participants included in this study were university students, with the mean age of 22.28 years for the control group and 22.58 years for the experimental group. Therefore, all age groups were not represented in the current study. Therefore, in further studies, other age

groups may be included in the study. The second limitation of the current study is that the pretest may affect the performance of the participants on the posttest. Thus, the Solomon group design may be used to investigate the effect of the pretest on the scores of the participants on the posttest in future studies. The third limitation of the study was the music chosen, since music may affect the individuals differently in accordance with the personal preferences of different kinds. Therefore, for further research, individual preferences of the different types of music may be taken into consideration before conducting the experiment.

In conclusion, based on the findings, there is an impact of enjoyable music on learning outcomes. Thus, music provides a beneficial effect on learning in an easy and natural way. The findings of this research can contribute to education. Students may listen to enjoyable or emotionally arousing music before they study instructional materials in order to enhance their learning (Ozcelik, 2015). During breaks, instead of silence, enjoyable music can be played.

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6. EXTENDED ABSTRACT

Araştırma çalışmaları, eğlenceli kısa bir müzik parçasını dinleyerek doğal yolla dopamini artırmanın insan performansını geliştirme potansiyeline sahip olduğunu iddia etmektedir (Boso, Emanuele, Politi, & Barele, 2006). Buna rağmen, öğretimsel materyalleri çalışmadan önce dinlenilen müziğin öğrenmeyi etkileyip etkilemediğini gösteren yeterince deneysel kanıt yoktur. Bu ihtiyaç dikkate alındığında, bu çalışmanın amacı çalışmadan önce dinlenilen eğlenceli müziğin öğrenme çıktılarına olan etkisini araştırmaktır.

Denekler-arası desene sahip olan bu deneysel çalışmaya toplam 80 öğrenci katılmıştır. Deneklere sırasıyla sosyo-demografik bilgi formu, başarı odaklı motivasyon anketi (Semerci, 2010) ve ön-test uygulanmıştır. Katılımcıların yarısı seçkisiz olarak eğlenceli müziğin dinlenildiği deneysel gruba atanırken diğer yarısı herhangi bir müziğin dinlenilmediği kontrol grubuna atanmışlardır. Katılımcıların dinledikleri şarkıyı ne kadar eğlenceli bulduklarını değerlendirmeleri istenmiştir. Daha sonra tüm denekler öğretimsel materyalleri çalışmışlardır. Çalışma sonrasında tüm katılımcılara son-test uygulanmıştır.

Öznel değerlendirme sonuçları katılımcıların dinledikleri şarkıyı eğlenceli bulduklarına işaret etmektedir. ANOVA analiz sonuçları deneysel ve kontrol gruplarının ön-test sonuçlarında bir fark olmadığını göstermektedir. Bu bulgu çalışılan materyal konusunda grupların ön bilgileri açısından bir fark olmadığını ortaya koymaktadır. İki grubun motivasyonları karşılaştırıldığında gruplar arasında anlamlı bir fark bulunmamıştır. Son-test sonuçlarından ön-test sonuçlarının çıkarıldığı öğrenme kazanımları karşılaştırıldığında, deneysel gruptaki öğrenme kazanımlarının kontrol grubundan yüksek olduğunu görülmuştur. Mevcut çalışmanın sonuçları insanların

öğretimsel materyalleri çalışmadan önce eğlenceli müzik dinlediklerinde daha iyi öğrendiklerini ortaya koymaktadır.

Bulgular eğlenceli müzik dinlenmenin öğrenme kazanımlarını artırdığını göstermektedir. Bu kazanımları açıklayan birçok neden olabilir. Dinlenilen eğlenceli müzik öğrencilerin motivasyonunu ve sonrasında öğrenme kazanımlarını artırıyor olabilir (Lehmann, Hamm, & Seufert, 2019). Ancak, elde edilen bulgular grupların motivasyonları arasında anlamlı bir fark olmadığını göstermektedir. Diğer bir ihtimal ise müzik dinlemenin deneklerin heyecanlarını artırıp daha iyi öğrenmelerini sağlamasıdır (Thompson, Schellenberg, & Husain, 2001). Ne yazık ki, mevcut çalışmada bu ihtimal test edilmemiştir. Bir başka ihtimal ise eğlenceli müziğin dopamin hormonlarının salınımını artırmasıdır. Beyin görüntüleme çalışmaları müziğin ödül içeren yiyecek ve seks gibi uyarıcılar gibi beynin benzer sinirsel yapılarına etkisi olduğunu göstermektedir (Menon & Levitin, 2005; Craig, 2002). Sonuç olarak, bu çalışmanın bulguları müzik dinleme gibi kolay ve doğal bir yol ile öğrenmenin artırılabileceğine işaret etmektedir. Eğitimcilere şu gibi uygulama önerileri sunulabilir. Öğrencilere çalışmaya başlamadan önce müzik dinlemeleri sağlanabilir. Ayrıca, tenefüs aralarında öğrencilere eğlenceli güncel müzikler dinletilebilir. Bu sayede öğrencilerin daha iyi öğrenmeleri sağlanabilir.

Appendix A
Demografik Bilgi Formu

DEMOGRAFİK BİLGİLER

Yaş :
Cinsiyet : ☐ Kadın ☐ Erkek
Eğitim durumu: ☐ İlkokul ☐ Ortaokul ☐ Lise ☐ Üniversite
☐ Yüksek lisans/Doktora
Çalışıyor musunuz? ☐ Evet ☐ Hayır
Meslek:
Gelir Düzeyi: ☐ Düşük ☐ Orta ☐ Yüksek
Medeni durum: ☐ Evli ☐ Bekar ☐ Boşanmış ☐ Dul
Çocuğunuz var mı? ☐ Evet ☐ Hayır
Evet ise kaç tane?
Çocuklarınız dışında evde bakmakla yükümlü olduğunuz başka biri var mı?

GENEL BİLGİLER

Herhangi kronik bir rahatsızlığınız var mı? ☐ Evet (Belirtiniz:……..)
☐ Hayır
Herhangi bir ilaç kullanıyor musunuz? ☐ Evet (Belirtiniz:……..)
☐ Hayır
Herhangi bir psikolojik rahatsızlığınız var mı? ☐ Evet (Belirtiniz: ……..)
☐ Hayır