Music and regaining calm when faced with academic stress

S. Faus¹, A. Matas¹* and E. Elósegui¹

Abstract: The objective of this study was to analyse the influence of listening to music to regain a sense of calm in a group of students after an exam. The sample was made up of 86 teacher-training students. A pre-test–post-test design was carried out with two experimental groups and one control group with repeated measurements in the post-test. Several tests were used, arranged in a data collection protocol that included scales of assessment of “positive” and “negative” emotional states. The results show that music makes easy to regain a state of calm and emotional well-being, although no differences have been found between music and a music composition imitating nature sounds. Lastly, some educational implications of the obtained results are discussed.

Subjects: Educational Research; Music & Education; Media Education

Keywords: music; examination; calm; mood; university

1. Introduction

This research study is focused on what extent listening to music helps to regain the affective state after a stressful stimulus as an exam. Exams of any kind are usually considered to be the most stressful academic activities in the formal academic system (Cassady & Johnson, 2002; Kurt, Bulci, & Kose, 2014; Putwain, 2007). The study carried out by (Hernández, 2005) on a sample of 28,559 students from 16 universities, concluded that 20.84% claimed to suffer anxiety when facing exams. These results have been supported by later studies (Álvarez, Aguilar, & Lorenzo, 2012). In general, stress is correlated with negative mood. Besides, stress has several effects on mood such as anxiety, lack of motivation,
overwhelm, irritability, sadness among other (McKinzie, Burgoon, Altamura, & Bishop, 2006; Starr, Dienes, Li, & Shaw, 2019) One of the main reasons why people listen to music is to regulate their emotions (Chamorro-Premuzic & Furnham, 2007), including the search for a state of relaxation (Goethem, 2011). Music also appears to act as a distractor, facilitating muscle relaxation, which helps to alleviate pain (Mitchell, Raymond, & Brodie, 2006).

These effects do not only focus on stress but, in general, existing literature on this subject tends to agree that listening to music leads to emotional changes, covering happiness, pleasure, sadness, love and pride, among others (Juslin, 2016). Nevertheless, Caballero, Pablo, Carrión, & Olivenza (2017) challenge that the mere fact of listening to music causes a change in emotions without taking into account interaction with the context in question. Then, further research needs to be carried out into whether the changes that are recorded when a person listens to music are the result of the subject’s emotional response or of the “perceived” emotion or that recognised in the piece of music, as some authors suggest (Ogg & Sears, 2017). In this regard, an assessment should be made of the theoretical proposals that suggest that the most intense emotional experiences could be linked to social experiences (concerts, gatherings, sporting events, etc.) and hence, to “collective emotions” (Scheve & Salmela, 2014). This study used songs and pieces of music categorised by participants as pleasant or favourite instead of pre-defined, because of evaluating an excerpt of music as relaxing or not is dependent on multiple factors and usually is a matter of debate. (Kreutz, Ott, Teichmann, Osawa, & Vaitl, 2008).

Affection (or affectivity) encompasses the emotions that people feel in the light of external or internal stimuli, such as ideas, thoughts or mental images (Casarrubios & García Gutiérrez, 2002). However, there is a lack of agreement as to what exactly is understood by emotion, and its differences from the affective state, which affects the way in which research studies into emotions are carried out (Mulligan & Scherer, 2012) and, consequently, the external validity of that research.

In this research study, the affective state has been taken as the participants’ emotional experience, assuming that it includes a subjective, as well as a cognitive and behavioural components (Scherer, 2004). On this basis, people may assess their mood and emotional state using bipolar value axes such as, for example, pleasant versus unpleasant, following the circumplex model of affect. The circumplex model of affect by Russell (1980) defends that all affective states derived from cognitive interpretations of the central neural sensations. Those states are the product of appraisal on two dimensions such as valance and activation. (Posner, Russell, & Peterson, 2005).

Scale instruments (Crawford & Henry, 2004; Sanz, 2001) are usually used for measuring, as well as what are considered to be more objective tests based on physiological records (Bradley & Lang, 2007; Jezova et al., 2013).

On the other hand, a study about driving concluded that music rhythm is another factor to take into account (Brodsky, 2001). One methodological conclusion from this study is that Control Group in research would not be a silence condition but that with neutral sound (about rhythm, volume, etc.). Other studies use white noise in Control Group (Rickard, Wong, & Velik, 2012).

The general framework that has previously been put forward can be summarised such that music is a reality in a person’s development, and that it has emotional implications, including stress regulation. In this sense, music and stress are bound to the essence of the education process, insofar as emotion is a basic element in a person’s integral development during their period of education (Caballero et al., 2017). Although there are well-known studies into the relationship between studying music and academic performance (Forés et al., 2015), there is a need for more studies into the effect of listening to music and its influence on students’ affective state when performing their academic tasks, especially handling academic stress.
The objective of this study is to examine whether listening to music helps teacher training students at the University of Malaga to regain a state of calm after the stressful experience of undergoing an examination. Secondly, we also aimed to analyse whether the effect of music is different from the effect of listening to a not selected background sound imitating forest nature musically. Then, the starting hypotheses were as follows:

- Listening to music after an exam facilitates the recovery of a state of calm, as opposed to listening to white noise, in a group of teacher training students.
- Listening to selected music is less effective than listening to music imitating nature to regain a state of calm in the situation mentioned in the previous hypothesis.

2. Method

2.1. Participants

The number of students in pre-school teacher degree was 135. 86 of them coursed the subject of Didactics of Musical Expression. In this sense, an incidental sample of 86 teacher-training students at the University of Malaga, specialising in pre-school education, which comprises a total of 135 students, took part in this study. 77.78% of the sample were women and the remainder (22%) were men. The average age was 20.56 years (SD = 3.21). Furthermore, none of the participants had any professional training in music or musical interpretation.

2.2. Instrument

To collect the necessary data, a protocol was drawn up, which included several phases (see design and procedure). An ad-hoc questionnaire was drawn up for data collection purposes, which included items on the variables of interest for this study. These items were arranged on the basis of two factors or dimensions: positive affect and negative affect.

- Positive affect: Two items were used that started the same but which differed in the last word: “At this moment I feel happy/excited”. They were answered with an appreciation scale: totally disagree (1), disagree (2), neutral (3), agree (4), totally agree (5).
- Negative affect: Three items were used: “At this moment I feel tense/angry/upset” applying the same scale.

Scores were summed for every affect. In this manner, data from items were reduced into a number, one for positive affect and another one for negative affect.

Previously, another questionnaire was passed in order to gather demographic information and about the participants’ musical tastes. For this last information, participants were requested to write down three songs, pieces or compositions at least. These selections were called pleasant music as is explained in the next epigraph.

2.3. Design and procedure

The study’s design is mixed quasi-experimental (AxB) with partially repeated measures (in B). Although the sample could not be selected randomly, a random assignment was carried out to the different experimental conditions. The procedure was organised in four phases as Figure 1 shows.
2.3.1. Moment P1

Approximately two weeks prior to the study, the participants filled out a questionnaire in which they were asked to specify the type of music they liked. This was considered as “favourite music”. They were also asked to provide general socio-demographic data (age, sex, and place of residence), e-mail address and musical training (years of formal musical education).

The music chosen by the participants in moments 1 were the following:

Pop, rock or similar:

- Adele: Someone like you
- Celine Dion: My heart will go on
- Manuel Carrasco: Ya
- Christina Perri: A thousand years
- Pablo Alborán: Quien
- John Legend: All of me
- India Martínez: Vencer al amor
- Travis Scott: A team

Classical, alternative and new-age:

- Mozart: The Marriage of Figaro
- Edward Cullen: Bella’s lullaby
- Nicola Piovani: Life is beautiful
- Ludovico Einaudi: Nuvole Bianche

Not selected background music composition imitating nature was from Heilung mit Naturmusik album by Urwald 432 Hz. To compile the list of pieces, all the choices were checked by researchers and only those one repeated at least three times were selected. This process was only applied for those students assigned to the experimental condition E1 (see below).
Each participant was identified by e-mail in order to make the assignments to the experimental conditions. The favourite music tunes for the students who were assigned to the experimental group were sought. The musical material and the assignment of tunes were carried out over two weeks, from the date on which the questionnaire was handed out, up to the date of the exam. During this time, the subjects were randomly assigned to different experimental conditions. The experimental conditions were as follows:

- E1. Experimental condition in which the students would listen to their favourite music.
- E2. Experimental condition in which the students would listen to music composition imitating nature.
- CG. Control Group condition in which the students would listen to white noise. It was following the interpretation from (Brodsky, 2001) who offers a critical analysis about different stimuli used in the researching designs where group comparisons are required.

2.3.2. Moment O1

The day on which the study data was recorded began in the students' usual classroom. Firstly, their informed consent was requested in order to participate in the study. Then they moved on to another classroom where they completed the positive and negative affect scales.

After this, they moved on to the Conference Hall, where the students took their place as spectators. The teacher called them in order, so that they could take the exam. The exam was carried out as it is in the subject syllabus. This exam entailed playing a piece of music chosen by the students themselves. They were also free to choose an instrument to play the piece. So the exam was the stressful stimulus.

2.3.3. Moment O2

As they gradually finished, the students were accompanied to an adjacent room by a researcher, who acted as a teaching assistant. In this adjacent room, the positive affect and negative affect were measured once again.

2.3.4. Moment O3

Next, the students underwent one of three experimental conditions according to the prior assignment. For 5 min, the students listened to the sound of the assigned experimental condition. After those 5 min, the positive affect and negative affect were measured once again.

2.3.5. Moment O4

Once the students entered the experiment room, where the O2 and O3 records were taken, each student sat at a “workstation” type of desk, in front of a 21-inch iMac computer. A collaborating researcher sat next to the participant the whole time. This researcher controlled the listening times and gave the student the relevant instructions.

In order to hear the music in question, individual headphones connected to the computer were used. The audio files were controlled via a VLC media player (Denis-Courmont et al., 2017). The students kept their headphones on at all times, sat straight and looking at the computer screen, where an image of the equalisation of what they were listening to was being displayed in order to avoid leadings associations between music and pictures emotional charge. This image is directly generated by the VLC software.

There were five computers available, that were gradually completed as the students finished their test-exam and were transferred to the room in question. The O2 and O3 records required between 12 and 15 min per student, and each student's test-exam took, on average, around 10 min. Those five computers enabled a continuous flow during the recording process, without there being any delay between each student finishing their test-exam and their subsequent participation in the study.
2.4. Analysis
The analysis began with a tentative descriptive study of the variables of interest. At the start (O1) hypothesis testing was carried out for independent groups, in order to ensure the O1 groups’ equality and homogeneity. A previous exploratory analysis concluded there were no differences by gender for any variable, then results by gender have been omitted.

With the purpose of analysing possible statistically significant differences in the variables of interest between the experimental conditions at different recording moments, a two-way ANOVA (AxB) was applied, with repeated measurements in B. This design is also known as Split-plot. The SPSS version 23 programme was used to analyse the data.

3. Results

3.1. Descriptive analysis
Table 1 shows the descriptive statistics for positive affect, negative affect and rumination. The first column on the table includes the total number of participants (n), the mean (M) and the standard deviation (SD) as well as the coefficient of variation expressed in percentages (CV%) for all participants. The following columns show the same statistics for each of the experimental conditions. In the same vein, the figure 2 shows the means by conditions and moments.

3.2. Testing for independent groups in O1
The testing was carried out using two approaches: t-test for independent groups, and a one-way ANOVA. The homogeneity of the variance was analysed for all tests. The results were no statistically significant differences between the variances of the experimental conditions groups. Then, groups are considered equal at start moment.

3.3. Anova with partially repeated measurements
The two-way analysis of variance (AxB) was then carried out with repeated measurements in B. A test was carried out for each dimension of interest.

3.3.1. Positive affect
With regard to the positive affect dimension, Mauchly’s sphericity test indicates that the null hypothesis of equality of variances-covariances of the repeated measurements cannot be rejected (W = 0.999; d.f. = 2; p = .735). Furthermore, on the basis of the significance level associated with the Box’s M statistic, the null hypothesis of equality of variances-covariances for the different experimental groups can also not be rejected (M = 20.760; d.f.1 = 12; d.f.2 = 32,779.957; p = .074). Following this, the assumptions of equal variances and sphericity are admitted.

With regard to Levene’s test on the equality of error variances in the intra-subject factor, the hypothesis of equality of error variances in the intra-subject factor at a significance level of 0.001 was not rejected. However, the difference in the O2 record is compromised at a significance level of 0.05 (Table 2 in annex).

Multivariate testing of the main effects of the intra-subject factor (O1 to O3 records) does allow to reject the null hypothesis of equality between the records (Pillai’s trace = 0.082; F = 3.659; d.f. error = 82; p = .030). Differences arise between the times of recording when faced with interaction with the groups (Pillai’s trace = 0.225; F = 5.261; d.f. error = 166; p = .001).

With regard to the inter-subject effects (experimental conditions E1, E2 and CG), the critical level associated with the statistic does not allow the null hypothesis of equality between groups at an alpha of 0.05 (F = 5.822; p = .227) to be rejected.

3.3.2. Negative affect
Mauchly’s test indicates that the data does not comply with the sphericity assumption (W = 0.928; d.f. = 2; p = .047). Box’s M and its transformation in F (M = 58.037; d.f.1 = 12; d.f.2 = 32,779.957; p < .0001)
Table 1. Descriptive statistics for the dependent variables

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Music condition (E1)</th>
<th>Nature sound condition (E2)</th>
<th>Control condition (CG)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M(SD)</td>
<td>CV%</td>
<td>n</td>
</tr>
<tr>
<td>Positive affect (1–10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O1</td>
<td>86</td>
<td>6.88(0.190)</td>
<td>4.76</td>
<td>27</td>
</tr>
<tr>
<td>O2</td>
<td>86</td>
<td>7.47(0.188)</td>
<td>6.00</td>
<td>27</td>
</tr>
<tr>
<td>O3</td>
<td>86</td>
<td>7.17(0.209)</td>
<td>3.97</td>
<td>27</td>
</tr>
<tr>
<td>Negative affect (1–15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O1</td>
<td>86</td>
<td>5.71(0.195)</td>
<td>6.20</td>
<td>27</td>
</tr>
<tr>
<td>O2</td>
<td>86</td>
<td>5.41(0.206)</td>
<td>7.62</td>
<td>27</td>
</tr>
<tr>
<td>O3</td>
<td>86</td>
<td>4.49(0.227)</td>
<td>5.23</td>
<td>27</td>
</tr>
</tbody>
</table>

Note: O1 = baseline; O2 = measurements after the test-exam; O3 = measurements after the experimental conditions.
suggest that the variances-covariances matrices of the factor between subjects are different. Both results indicate that the assumptions of equality of variance and sphericity are compromised. On the other hand, Levene's test shows homoscedasticity intra-subject except in O3 (Table 3).

According the multivariate testing (intra-subject effects) results (Table 4) the hypothesis of equality between the recording times is rejected, and it can be assumed that there are significant differences between the intra-subject factor levels.

With regard to the inter-subject effects, the critical level associated with the inter-subject factor statistic \( F = 0.405; p = .669 \) does not allow the null hypothesis of mean equality between groups to be rejected. This suggests that, after averaging the repeated means of each subject, there is not sufficient empirical support to be able to claim that the means of the three groups are different.

The table shows the pairwise comparisons of the intra-subject factor records with the Bonferroni correction.

The pair comparisons (Table 5) show that the levels of negative affect gradually drop between records, except in O1 and O2. In Table 6, the main effects in the interaction can be seen, and significant differences between times can be observed.

Figure 3 shows the evolution of the marginal means for each group at different recording times for the “negative affect” dimension.

4. Discussion
This paper has endeavoured to analyse the effect of listening to music after a stressful academic experience. This stressor and procedure have been used in this research study, as opposed to other

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**Table 2. Levene’s test of equality of error variance in the intra-subject factor**

<table>
<thead>
<tr>
<th></th>
<th>F</th>
<th>d.f.1</th>
<th>d.f.2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>O1</td>
<td>0.174</td>
<td>2</td>
<td>83</td>
<td>.840</td>
</tr>
<tr>
<td>O2</td>
<td>3.757</td>
<td>2</td>
<td>83</td>
<td>.027</td>
</tr>
<tr>
<td>O3</td>
<td>0.740</td>
<td>2</td>
<td>83</td>
<td>.480</td>
</tr>
</tbody>
</table>

**Table 3. Levene’s test of equality of error variance in the intra-subject factor**

<table>
<thead>
<tr>
<th></th>
<th>F</th>
<th>d.f.1</th>
<th>d.f.2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>O1</td>
<td>0.040</td>
<td>2</td>
<td>83</td>
<td>.960</td>
</tr>
<tr>
<td>O2</td>
<td>2.271</td>
<td>2</td>
<td>83</td>
<td>.110</td>
</tr>
<tr>
<td>O3</td>
<td>14.778</td>
<td>2</td>
<td>83</td>
<td>.000</td>
</tr>
</tbody>
</table>

**Table 4. Multivariate testing (intra-subject effects)**

<table>
<thead>
<tr>
<th>Effect</th>
<th>Value</th>
<th>F</th>
<th>Hypothesis df</th>
<th>Error df</th>
<th>Sig. lower than</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>.224</td>
<td>11.868</td>
<td>2.000</td>
<td>82.000</td>
<td>.0001</td>
</tr>
<tr>
<td>Wilks’ lambda</td>
<td>.776</td>
<td>11.868</td>
<td>2.000</td>
<td>82.000</td>
<td>.0001</td>
</tr>
<tr>
<td>Time * Group</td>
<td>.282</td>
<td>6.819</td>
<td>4.000</td>
<td>166.000</td>
<td>.0001</td>
</tr>
<tr>
<td>Wilks’ lambda</td>
<td>.724</td>
<td>7.172</td>
<td>4.000</td>
<td>164.000</td>
<td>.0001</td>
</tr>
</tbody>
</table>
options (Brouwer & Hogervorst, 2014) in the interest of greater ecological validity because was a real context of students examined.

As part of this study, a change was recorded in the students’ emotional state, which was attributable to the effect of a stressful stimulus (the exam) in interaction with the effect of the music they were listening to or ambient sound. The emotional changes when listening to music have been recorded in many research studies (Jezova et al., 2013; Juslin, 2016; Juslin & Daniel, 2008; Lamont, 2011). Nevertheless, the relationship does not appear to be direct. This has been revealed in this study, where recovery after the exam is affected by the interaction of the experimental conditions and the sequence of phases in the study. This effect of the interaction is consistent with those research studies that indicate that music by itself may not necessarily bring about an emotional change (Silvia, 2012) and those that highlight the cultural and social aspect of the musical experience (Lamont, 2011).

Table 5. Pairwise comparisons (intra-subject levels)

<table>
<thead>
<tr>
<th>(I) Time</th>
<th>(J) Time</th>
<th>Mean difference (I-J)</th>
<th>Standard error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>0.280</td>
<td>0.212</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1.224</td>
<td>0.264</td>
<td>.000</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>-0.280</td>
<td>0.212</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.945</td>
<td>0.226</td>
<td>.000</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>-1.224</td>
<td>0.264</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>-0.945</td>
<td>0.226</td>
<td>.000</td>
</tr>
</tbody>
</table>

Table 6. Comparisons simple effects intra-subject testing

<table>
<thead>
<tr>
<th>Origin</th>
<th>Records</th>
<th>Sum of squares</th>
<th>d.f.</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time * Group</td>
<td>O1-O2</td>
<td>48.498</td>
<td>2</td>
<td>4.055</td>
<td>.021</td>
</tr>
<tr>
<td></td>
<td>O2-O3</td>
<td>121.345</td>
<td>2</td>
<td>13.794</td>
<td>.000</td>
</tr>
</tbody>
</table>

Figure 3. Marginal means in negative affect.
The modifications in mood shown in this study coincide with the results given in the consulted literature (Labbé, Schmidt, Babin, & Pharr, 2007; Lai & Li, 2011; Radstaak, Geurts, Rosschot, & Kompier, 2014). To this effect, listening to music would be an effective emotional mediator, involving the working memory (Blais-Rochette & Miranda, 2016), the effect of which would depend on its interaction with the context in question.

Furthermore, this study has obtained some results that have not been mentioned in the consulted literature. So, the levels of homogeneity, measured by the coefficient of variation, show notable oscillations in the control group, whereas they remain relatively high for the negative emotional state. By contrast, the groups that listen to music or music composition imitating nature show considerably more moderate oscillations. Once again, the effect of the interaction would be evident. This may indicate a differential effect of noise in the participants. The results are consistent with classic studies (Furnham & Strbac, 2002; Loewen & Suedfeld, 1992).

With regard to the measurement of the negative affect, differences have been recorded between the recording times, although not between the experimental conditions. These differences consisted in a statistically significant reduction over time. Bearing in mind the effect of the experimental group in interaction with the recording time, the differences arise in all phases, except the last phase (before and after the period of silence). This result is consistent with the fact that, as the person moves further away from the disturbing situation, the negative affective state diminishes. However, in addition to this result, we must mention that the gradual reduction interacts with the fact of listening to music or noise, facilitating a smaller reduction in the case of noise.

Results from this study about mood are coherent with results from studies about anxiety and music. In fact, a recent meta-analysis study by Panteleeva, Ceschi, Glowinski, Courvoisier, & Grandjean, (2018) determines there is an overall decrease in self-reported anxiety when people listen to music, but it does not statistically significant for psychophysiological signals. They conclude that listening to music should be considered as part of a complex music-based psychological intervention for anxiety. They highlight the role of unconscious underlying processes (e.g. memory, mental imagery) must not be neglected. Then, generally speaking, both the results from this study and the results found in consulted literature highlight the use of music in the classroom must follow an Evidence-Based plan (Petty, 2014).

5. Conclusions
In short, the results obtained in this study, which are mostly consistent with the results found in the literature we consulted, indicate that listening to music imitating nature improves a person’s positive mood and reduces their negative mood after a stressful academic experience.

It seems to be clear that white noise is the most counterproductive: it reduces the positive mood, and increases the negative mood.

In an education context focused on a person’s integral development, emotions play a basic role. So it is important for the teacher to know and master the most efficient resources to manage those emotions.

This means that teachers need to be aware of music’s capacity to affect mood. They should also have a reliable knowledge that different moods will be generated in the students, depending on when, how and what kind of music they use.

Consequently, it is not enough to “use music for ...” knowing that some songs or pieces of music move, excite, calm or stimulate is one thing, but knowing why, when and how to use them is a different matter. So teachers must pay just as much attention to the use of music in the classroom as they do to education on health matters, social relations or maths.
About the research hypothesis, results can be interpreted as follows:

- Music considered pleasant by participants facilitates their recovery into a calm state after an exam in comparison with a noise condition.
- Music imitating nature background sound is as effective as pleasant music, even when no one selected this kind of music pieces neither similar plays.

Taken into account these results, students can listen to music that they like, or digital composition imitating nature sounds to restore an emotional state of calm after an exam, but any situations of noise should be avoided.

In any case, these results can only be taken as the beginning of further research that will assess the potential of listening to music in education. Among other aspects, an analysis should be carried out of the effect of the different components of music, the effect of the music chosen by the listener with regard to music that is not directly chosen by the listener, the effect of music considered not to be pleasant by the listener, etc. All this should follow the idea that the effect of music is mediated by its interaction with environmental factors as the Justin model suggests (Juslin, 2016; Juslin & Daniel, 2008).

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