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Academic Achievement and Emotional Education Using Music Learning in Spain

Oscar David Marcenaro-Gutierrez | Ana Colacio Moyano | Luis Alejandro Lopez-Agudo

Departamento de Economía Aplicada (Estadística y Econometría), Facultad de Ciencias Económicas y Empresariales, Universidad de Málaga, Málaga, Spain

Correspondence: Oscar David Marcenaro-Gutierrez (odmarcenaro@uma.es)

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ABSTRACT

In the current research work, we intend to analyse the effect of music on developing students' academic performance, self-concept and emotional development. We work with experimental data gathered from an application of special music lessons at schools aimed at developing students' learning and at educating their emotions in the academic year 2018–2019. These music lessons consisted of collective, cooperative, practical, and experiential musical activities. Our results show that this intervention had a positive influence on students' emotional development; nevertheless, it does not seem to influence students' academic achievement or their self-concept.

1 | Introduction

Most of the population can appreciate the taste of the kind of music that they enjoy, even when they have not received any kind of music training. Many research works have highlighted that, in fact, listening to music has many benefits for social cohesion, self-concept, performance and emotional well-being (Trusty and Oliva 1994; Lesiuk 2005; Krout 2007; Boer and Abubakar 2014; Randall et al. 2014, among many others). As indicated by Sausser and Waller (2006), 'Music is a non-invasive medium that enhances self-expression, self-esteem, motor skills, coordination, and socialization. It facilitates creativity, inventiveness, independence, and success' (p. 8). Music also involves physiological effects such as taking control of the breathing rhythm and heart rate (which changes depending on the kind of music), helping with muscle tension as well (Schwarz and Shweppe 2010) and improving verbal memory (Ho et al. 2003; Rickard, Vasquez, et al. 2010). Furthermore, it has been observed that when listening to the specific kind of music which is perceived by the listener as nice, some chemical substances are released, which stimulate neurotransmitters such as dopamine, endorphin and oxytocin, improving happiness and optimism, facilitating the expression of emotions and feelings (Betés de Toro 2000). In the same direction, music compositions have been found to stimulate brain regions and emotional state, helping to show and understand emotions and feelings (Díaz and Giráldez 2007).

In line with these relevant influences, some authors point out that the introduction of music in schools at an early age can also stimulate abilities, capacities, and mould the brain, increasing its plasticity since it is not completely formed yet—lasting this training for a complete life span (Münte et al. 2002; Gruhn 2005; Wan and Schlaug 2010; among others). Then, it seems clear that education does not end with compulsory subjects such as reading or mathematics, which are in every school curriculum, but also involves several cross-competences that can be improved through music as, e.g., self-concept (Rickard et al. 2013) or emotional

regulation (Saarikallio 2009; Miranda and Gaudreau 2011; Jucan and Simion 2015), which are crucial aspects that must be learned by students. Besides, music does not only help with cross-competences but can also help to improve students' academic performance in compulsory subjects (Fitzpatrick 2006; Kinney 2008; Southgate and Roscigno 2009). It is not surprising, then, that introducing music in the school curriculum may have as a result an objective increase in students' marks. Particularly, in this context, we intend to analyse the influence that special music lessons may have on students' academic performance, self-concept and emotional development.

Nevertheless, in spite of the relevance of music, the most recent Spanish education law[1] has turned the music subject in schools from compulsory to optative, called 'artistic education', whose offer as an optative subject depends on the regional government. This has been a widely criticised regulation (Angel-Alvarado 2019), which the Spanish ex-minister of education justified as a way to eliminate 'subjects which distract students' from those which are more relevant (to the extent that music is not assessed by international large-scale assessment tests as PISA[2]). In regard to this issue, other countries such as the United Kingdom still consider that teaching this subject is essential; in the words of the United Kingdom Music Education Council, 'All children should be able to experience music regardless of their parent's ability to pay for lessons'.[3]

In this context, the current research is focused on the Spanish region of Valencia. This is the fourth largest Spanish region in terms of population, presenting achievement scores which were very close to those of the Spanish average in PISA 2015, being higher than those of the OECD: 499 points in reading, 496 for Spain and 487 for the OECD; 485 in mathematics, 486 for Spain and 478 for the OECD; and 494 in science, 493 for Spain and 488 for the OECD (OECD 2016).

Specifically, in this study, we intend to answer three research questions, which are related to three different student outcomes (students' learning, self-concept and emotional development):

1. Does music help fourth-grade Valencian students to improve their academic achievement?
2. Does music help fourth-grade Valencian students to improve their self-concept?
3. Does music help fourth-grade Valencian students to improve their emotional development?

In order to do this, an experiment was conducted among Valencian students. Specifically, students in the treatment group received an intervention consisting of collective, cooperative, practical and experiential musical activities. Each one of these activities was performed, and then, students shared their experiences, reflected on them and discussed. These activities pursued to help students give a 'name' to their emotions and to regulate them, sharing these emotions with the teacher and trying to get students to associate the emotion with a lived situation, with the final objective of developing students' personality and improving their academic achievement. Students in the control group received standard music lessons (following the Spanish school curriculum).

This research presents two novel contributions: (a) This is the first time that the influence of music on so many student outcomes (academic achievement, self-concept and emotional development) has been analysed for the Spanish case. (b) To approach this issue, we are making use of experimental data, a rarity for Spain, as this allows us to approach the causal effect of the intervention on the three indicated student outcomes.

The current research is structured as follows: First, a literature review on the influence that music has on students' academic achievement, self-concept and emotional development is presented; then, the data and methodology employed for the current research are explained, followed by our main results, their discussion and conclusions.

2 | Literature Review

There is extensive evidence on the influence that music education has on many outputs. In the following, we focus on the literature for the three outputs, which are the main focus of the current research: students' academic achievement, self-concept and emotional development.

In the case of the relationship of music education with *academic achievement*, most of the evidence points towards a positive or null association. In the case of research works finding a positive association, Southgate and Roscigno (2009) followed United States children from kindergarten to beyond high school, finding a robust positive relationship between music participation and academic achievement. Similarly, Fitzpatrick (2006) established, for ninth-grade students, that instrumental music students in Ohio performed higher in all subjects than those who did not receive this training. Also analysing this issue, Kinney (2008) followed fourth- to eighth-grade Midwestern students and found that those participating in instrumental music programs performed higher in terms of academic achievement than those who did not receive this music training.

In the analysis of the influence of music education on students' academic achievement in particular subjects or cognitive areas, Hallan (2015) performed a review of music research and indicated that music helped students to develop their language and literacy skills and academic attainment. Similarly, Piro and Ortiz (2009) conducted an experiment among primary school students in New York to test the influence of music lessons (being only the treatment group exposed to piano lessons), finding that students in the treatment group presented better vocabulary and verbal sequencing skills. Focusing on mathematics, Vaughn (2000) performed a meta-analysis on 20 correlational studies and showed that there is a modest positive association between studying music and academic achievement in mathematics, whereas Gouzouasis et al. (2007) analysed British Columbia 11th- and 12th-grade students and found that participation and performance in music in 11th grade were positively associated with students' academic achievement in 12th grade, especially in mathematics and biology. In the same line, Wetter et al. (2009) carried out an intervention in Switzerland with children from grades 3 to 6, finding that children who practiced music obtained significantly better average marks in all the subjects, with the exception of sports.

In the case of research works that find low to null association, Cox and Stephens (2006) analysed high school students in Nebraska and found that those who received music lessons did not perform better in mathematics. Johnson and Memmott (2006) found for both primary and middle school that students who received higher quality music instruction performed higher than those who received lower quality music programs in both English and mathematics standardised tests, although with low effect sizes.

When analysing the relationship of music education with *self-concept*, there seems to be an almost wide consensus in the literature about the positive association between music and students' self-concept and self-esteem. In this sense, Rickard, Appelman, et al. (2013) analysed primary education Australian students and established that increasing the amount of music lessons was positive for these children's self-esteem. These results were also found by Baste and Gadkari (2014), who analysed medical students' stress in Mumbai and concluded that music reduced the stress they were exposed to because of their curriculum, a stress that was associated with these students' self-esteem. In line with these research works, Omizo et al. (1995) took a sample of children in Hawaii who were taking third, fourth and fifth grades and found that an intervention using art and music activities had a positive influence on various dimensions of students' self-esteem. Similarly, Degé et al. (2014) investigated a sample of German students in sixth and seventh grade, finding that music lessons significantly improved students' self-concept, whereas Degé and Schwarzer (2018) analysed if an extended music curriculum (EMC)[4] had influence on academic self-concept for a sample of students aged 9–11 in Germany, concluding that children attending EMC reported higher academic self-concept after a year of participation than students not attending it. Other authors, such as North et al. (2000), analysed ninth-grade students in England, asking about their preferences in terms of listening to music and playing instruments. They found that music helped adolescents to create a self-image to show to the outside world and to satisfy their emotional needs.

This positive influence of music education on students' self-esteem was also found to help social mobility; in this way, Shin (2011) analysed the effect of a music program based on workshops for middle-school students in low-income communities, finding that participating in this program positively influenced their self-esteem. Furthermore, Darrow et al. (2009) analysed the association of participation in a music mentorship program by at-risk students, concluding that this improved their self-esteem and attitudes.

Furthermore, the correlation found in the literature for music education and *emotional development* is mostly positive. For instance, Miranda and Gaudreau (2011) analysed Canadian students' emotional well-being (in secondary education) and found that music listening was positively related to it. Other authors, such as Saarikallio (2009), studied the role of music in 2.9- to 8.1-year-old children's emotional self-regulation, finding that music calmed down children, kept them concentrated and interested, helped them express and increase their happiness and developed their imagination. In the same vein, Jucan and Simion (2015) studied the influence of music background on preschool children in Romanian classrooms and found that it improved their social–emotional skills. In line with these investigations, Hallam et al. (2002) analysed sixth-grade students aged 10–11 in a junior school in London, concluding that music's influence on students is conditioned by their mood and by how music is perceived by them. On the basis of their research, the authors discussed that choosing an adequate music background (which evokes certain emotions and feelings) in schools and at home can have a beneficial influence on students.

In the case of using music education as some kind of emotional therapy, Baker and Jones (2006) conducted a music therapy research study on Queensland refugee grade 12 students and found that it reduced externalising behaviours such as hyperactivity and aggression. Other researchers, such as Porter et al. (2016), analysed the influence of music therapy on 8- to 16-year-old students with social, emotional, behavioural and developmental difficulties and found that, although this therapy did not seem to influence children, students aged 13 and above showed higher self-esteem and lower depression scores.

Among the research works which have *simultaneously analysed two or more of these student outcomes* are those as, e.g., Hallam (2010), who performed a comprehensive review of the literature on music education for all these outcomes, finding that music has a positive association with students' language development, literacy, numeracy, measures of intelligence, general attainment, creativity, motor co-ordination, concentration, self-confidence, emotional sensitivity, social skills, teamwork, self-discipline and relaxation but only when it is an enjoyable and rewarding experience. Others, such as Devroop (2012), took on research involving eighth-grade students in KwaZulu-Natal province in order to study the influence of music instruction on disadvantaged South African students. The results showed that, after applying a music program, students' levels of self-esteem, optimism and happiness had increased, as well as their attitude towards subjects.

In the case of research works that analyse students' academic performance and emotional development, Lim et al. (2014) analysed the influence that piano instruction and music therapy had on at-risk elementary school students. They found that they had a positive association with social and emotional outcomes, together with reading academic achievement. In a similar way, Schellenberg and Mankarious (2012) found that primary education students in Toronto who received music training not only scored higher on tests of intellectual ability, but also in social and emotional functioning. Other authors, such as Schellenberg et al. (2007), analysed the influence of exposure to music for Canadian undergraduates and Japanese 5-year-old students, finding that this exposure was positively associated with performance in cognitive tests and also with their emotional state. Moreover, Črnčec et al. (2006) performed a comprehensive review of literature and found that music instruction has benefits on spatio-temporal reasoning skills and that listening to music may calm and focus children with special needs. On the contrary, Rose et al. (2017) analysed 7- to 9-year-old students' musical instrument learning and found that it improved their intelligence, but it did not influence memory, visual motor integration or socio-emotional behaviour.

Focused on students' academic performance and self-concept, Costa-Giomi (2004) analysed fourth-grade Canadian students

who received 3-year piano instruction; they found that these students presented higher self-esteem and music scores than those who did not receive it, but they did not perform better in reading and mathematics standardised tests.

Hence, the current research intends to fill a gap in this literature by exploring the influence of music lessons on the three proposed student outcomes (academic achievement, self-concept and emotional development), focusing on a Spanish region. The use of experimental data lets us get as close as possible to a causal effect.

3 | Data

We report how we determined our sample size, all data exclusions (if any), all manipulations and all measures in the study. The data employed for this research are those from the Emotional Education Program through Music, funded by Fundación Bancaria la Caixa. The data were gathered for fourth-grade students (9- to 10-year-old students) in the academic year 2018/2019 from 15 schools, by the use of a clustered random sampling procedure (as our data has three levels: school, classroom and student). This number of schools was established using the non-parametric sample size formula proposed by Banerjee (2020) for experimental design.[5] Complete classes were randomly selected within each school; this presents the advantage that students are randomly assigned to classes according to their surnames, so there is not any kind of classroom grouping bias. In addition, the use of complete classes within each school for the control or treatment groups instead of dividing each class in either treatment or control group is also rooted in two main reasons: (a) First, parents did not agree with splitting the classroom so that their child cannot be benefited by the intervention (ethic conflict). (b) Students in the same classroom can talk to each other about the music lessons they are receiving and bias in a certain way the influence of the intervention.

Once the sample of 15 schools was selected, complete schools were randomly assigned to the control and treatment groups. Nevertheless, because of the relative size of classrooms (in terms of the number of students) and imbalances in student characteristics, three schools were reallocated from the control to the treatment group, reaching a total of 11 treated and 4 control schools in order to achieve a comparable sample between treatment and control groups. This supposes that a total of 512 students were sampled (153 in the control group and 359 in the treatment group), and all of them took music lessons.

Once schools were classified into the control or treatment groups, teachers in the treatment group received the music training to conduct the intervention in the academic year 2018–2019. The underlying idea was that if the intervention showed a benefit, teachers in the control group schools would receive it the next academic year.[6] Treatment group teachers received a 20-h training course in October 2018 in which they learned to understand the relevance that emotions have in daily life, to be aware of their own emotions, to regulate them, to establish better personal relationships and to interact with students in a more efficient way. These teachers also received training on how to perform the intervention, which consisted of collective, cooperative, practical, and experiential musical activities. Each one of these activities was performed, and then, students shared their experiences, reflected on them and discussed. The underlying idea of these activities was to help students give a 'name' to their emotions and to help to regulate them, sharing these emotions with the teacher and trying to get students to associate the emotion with a lived situation, having as a final objective to develop students' personality and to improve their academic achievement. These music lessons were conducted twice a week in 45-min lessons from October 2018 to March 2019, comprising singing, percussion, audition and relaxation techniques.

In the case of the schools in the control group, music lessons were conducted following the music subject curriculum of the school.

The intervention was performed in two steps: First, preliminary information about students was gathered at the start of the academic year (September), which contained:

- Student background questionnaire: this questionnaire was answered by students and provided relevant background information such as, e.g., students' sex, whether the student repeated a grade or not, immigrant status, whether the father and the mother have university studies or not, father's and mother's occupation (using the Nacional Classification of Occupations, CNO-2011[7]) and the number of books at home.
- The Piers-Harris 2 children's self-concept questionnaire (Piers and Herzberg 2002). This questionnaire was answered by students.
- Emotional development questionnaire CDE 9-13 (Pérez-Escoda 2016). This questionnaire was answered by students.
- Students' administrative academic scores in the academic year 2017/2018 in nine subjects (natural sciences, social sciences, Spanish language and literature, mathematics, first foreign language, Valencian language and literature, physical education, religion and artistic education) on a 1–10 scale.

Second, students' academic scores were gathered at the end of the first term (December) but not for the Piers-Harris 2 children's self-concept questionnaire and the Emotional Development Questionnaire. Then, students' academic scores, together with the Piers-Harris 2 children's self-concept questionnaire and the Emotional Development Questionnaire information, were gathered in (a) March (when the intervention was finished, at the end of the second term) in order to see the influence that the intervention had at the moment of finishing it and (b) also by the end of May (end of the third term) to check for long-lasting influence of the intervention.

3.1 | The Piers-Harris 2 Children's Self-Concept Questionnaire

This questionnaire was initially developed by Piers (1969). It consisted of 80 questions, but it was later revised and reduced to 60 questions, as the erased 20 questions did not satisfy the required psychometric properties (Piers and Herzberg 2002). When

computing the punctuations of this questionnaire, we get, for each student, a global self-concept score and a score for each one of the six self-concept subscales (Behavioural Adjustment, Intellectual and School Status, Physical Appearance and Attributes, Freedom from Anxiety, Popularity and Happiness and Satisfaction). These scores can be directly translated into a T-score, which lets us interpret the global and six subscale results, with an increasing self-concept of the student when increasing the T-score (the interpretation of T-scores can be found in Piers and Herzberg 2002).[8]

3.2 | Emotional Development Questionnaire (EDQ 9-13)

This questionnaire was developed by Grupo de Investigación en Orientación Psicopedagógica based on the works by Bisquerra and Pérez-Escoda (2007), who developed the 'Pentagonal Model of Emotional Competences'.[9] In this sense, they divided these emotional development competences into five blocks of competences (emotional consciousness, emotional regulation, emotional autonomy, social competence and competences for life and well-being), together with a global emotional development competence. The definitions of these competences are as follows[10]:

- Emotional consciousness: The capacity to recognise one's own emotions and those of others, having an emotional vocabulary and language; to understand the emotions of other people; and to take consciousness of the interaction between emotion, cognition and behaviour. This is the first competence to develop in order to develop the rest of the emotional competences.
- Emotional regulation: It is the capacity to manage and express emotions in a proper way to put into practice the skills to face issues by the use of self-regulatory strategies and the capacity to self-generate positive emotions towards life and its problems.
- -Emotional autonomy: It is a wide competence that includes self-esteem, self-motivation, self-emotional efficacy, responsibility, being critical towards social norms, resiliency and a positive attitude towards life.
- -Social competence: In this competence, social relationships are the central axis, together with having social abilities, effective and affective communication, assertiveness and the capacity to manage conflicts.
- -Competences for life and well-being: It is the capacity to adopt responsible and proper behaviours towards life. This supposes making decisions, setting objectives, searching for help and resources and taking an active citizenship.

The reliability of this questionnaire was checked by Pérez-Escoda (2016), finding a high level of internal consistency (0.85 in terms of Cronbach's alpha).

In Table A1, we present the descriptive statistics for the sample of students in the control and treatment groups before the treatment and also a test of mean differences between both groups, using the main dependent and independent variables of our analysis. We can appreciate that most of the variables for both the control and treatment groups are similar, which may assure that the results of our experimental design are reliable (i.e., students are randomly assigned to both control and treatment groups); however, some others (e.g., students' academic scores in first foreign language, religion or artistic education) present significant differences. Because of that, we check our results by the use of the difference-in-difference (DiD) and propensity score matching techniques, as we will explain in the following.

4 | Methodology

Three different methodologies have been applied in order to obtain the influence of the music treatment: ordinary least squares (OLS) with experimental data, DiD and propensity score matching.

4.1 | OLS With Experimental Data

This methodology intends to take advantage of the fact that our data have been obtained by the previously described experimental design, so we should be able to obtain the effect size of the treatment only by the estimation of OLS. In order to do this, we estimate the following model:

$$Y_{icjt} = \alpha + \beta T_{icjt} + \gamma \boldsymbol{X}_{icjt} + \vartheta \boldsymbol{CLSS}_{cjt} + \delta \boldsymbol{SCH}_{jt} + \varepsilon_{icjt} \quad (1)$$

where $i = student$, $c = classroom$, $j = school$ and $t = time\ of\ the\ survey$ ($t = 1$, for preliminary tests in October 2018, $t = 2$ for the first term in December 2018, $t = 3$ for the second term in March 2019 and $t = 4$ for the third term in May 2019). Y_{icjt} is the dependent variable, which is alternatively students' global mean standardised academic scores or in any of the nine subjects[11], students' global self-concept score or in any of the six self-concept subscales[12] or students' global emotional competence score or in any of the five blocks of emotional development competences[13]; T_{icjt} indicates whether the student received the treatment or not; X_{icjt} is a vector of student observable characteristics; $CLSS_{cjt}$ is a vector of classroom observable characteristics; SCH_{jt} is a vector of school observable characteristics; and α is the constant term and ε_{icjt} is the idiosyncratic error term.

This model is estimated for $t = 2$ (only for standardised academic scores) and $t = 3$, when the treatment was already performed. It was also estimated for $t = 4$, but as we will explain in the Results section, this last observation period presents some issues. By the estimation of this model, we can obtain the effect size of the treatment (β) in students' output $\left(Y_{icjt}\right)$.

4.2 | DiD

However, in spite of the experimental design of the present research work, in order to overcome potential variable omission and endogeneity issues, we go further beyond correlation by the use of the quasi-experimental methodology of DiD. In particular, the estimated model is the following:

$$Y_{icjt} = \alpha + \beta T_{icjt} + \rho \boldsymbol{TIME}_t + \varphi T_{icjt} * \boldsymbol{TIME}_t + \varepsilon_{icjt} \quad (2)$$

where TIME is a vector of binary variables that measure the time of intervention and $T_{icjt} * \boldsymbol{TIME}_t$ is an interaction of the treatment with the vector of time intervention, which gathers the influence of the intervention, hence making φ the coefficient of interest for the present study. As we are measuring each individual at different time moments, all observable and unobservable student, class and school characteristics (i.e., $\boldsymbol{X}_{icjt}$, $\boldsymbol{CLSS}_{cjt}$ and $\boldsymbol{SCH}_{jt}$) that are fixed between times are implicitly controlled. Therefore, we obtain the effect size of the treatment (φ) in students' output $\left(Y_{icjt}\right)$ in the present model.

Alternatively, the propensity score matching (PSM) methodology has been employed as a robustness check. Although DiD is focused on getting as close as possible to the causal influence of the treatment on the dependent variable for the sample under analysis, PSM intends to obtain a similar influence by creating balanced treatment and control groups from the sample. Therefore, the main analysis of the present study has been replicated using PSM; for reasons of space, it has been included in the Supporting Information.

5 | Results

In the following, we present our main results to answer the research questions that we posed in the Introduction section. For this purpose, we have estimated (a) using the OLS estimation technique for a model in which we included both treated and control groups, presenting the results in Table 1 for students' academic scores (in the first and second terms of the academic year), students' self-concept and students' emotional development (both in the second term of the academic year). Then, as we indicated in the Data section, some variables present statistically significant differences between treatment and control groups. Because of that, we applied (b) the DiD methodology, presenting the results in Table 2 for students' academic scores, students' self-concept and students' emotional development for the same periods of time as in Table 1. We have to highlight that, for second term academic scores, one of the control group schools did not provide information; because of that, we treat with caution the results based on second term academic scores.[14]

In the following, we comment on the main results for both Tables 1 and 2, answering each of the research questions that we posed in the Introduction.

5.1 | Does Music Help Fourth-Grade Valencian Students to Improve Their Academic Achievement?

In the view of Table 1, it can be appreciated that the treatment has improved students' first term global mean academic scores by 0.209 standard deviations (SDs), mathematics by 0.264 SD, first foreign language by 0.268 SD, religion by 0.316 SD, and artistic education by 0.585 SD; similar results are obtained for the second term. However, after applying DiD (Table 2), nonsignificant influences are found for all the variables. Then, these results contrast with the vast majority of previous research works, which pointed towards a positive influence of music lessons on students' academic performance.

5.2 | Does Music Help Fourth-Grade Valencian Students to Improve Their Self-Concept?

Both Tables 1 and 2 seem to indicate that the treatment did not have any influence on any of the student self-concept variables; then, it seems that music treatment has not influenced students' self-concept, which is an unusual result compared to the findings of previous literature. Thus, the proposed activities aimed at developing students' learning and at educating their emotions did not seem to influence their self-concept; then, after these results, we can only wonder what happens with the last of these outcomes: emotional development.

5.3 | Does Music Help Fourth-Grade Valencian Students to Improve Their Emotional Development?

Finally, the intervention seems to play a relevant role here. Table 1 seems to indicate that the treatment improves students' emotional development in 7.061 points for emotional consciousness (an improvement of 9%[15]), 3.477 in emotional regulation (7%), 7.754 in social competence (11%), 6.948 for competences for life and well-being (12%) and 33.647 for the global measurement (8%); although it did not influence emotional autonomy. Taking a look at Table 2, all these emotional development aspects seem to be positively influenced in similar amounts as in Table 1: 5.563 points in the case of emotional consciousness (7%), 2.802 for emotional regulation (6%), 6.972 for social competence (10%), 6.541 for competences for life and well-being (11%) and 27.796 in the case of the global measurement (7%); without influence on emotional autonomy. Thus, these results are in accordance with the findings of previously mentioned research works (e.g., Hallam et al. 2002; Saarikallio 2009; Miranda and Gaudreau 2011; Jucan and Simion 2015, among others). These were, in a certain way, expected results, as the intervention was focused on developing students' learning and educating their emotions. However, we do not find any kind of 'spill-over' influences of this intervention to other fields, such as students' academic performance or self-concept.

Finally, this analysis has been replicated using Propensity Score Matching, and results have been displayed in the Online Supplemental Material. As it can be seen, both methodologies provide similar results.

6 | Discussion and Conclusions

We have analysed in this research the influence that music may have on fourth-grade Valencian students' academic performance, self-concept and emotional development. This research presents the novelty that this is the first time in which the influence of music lessons—aimed at developing students' learning and at educating their emotions—on so many student outcomes has been analysed for the Spanish case, joined with the use of experimental data to get as close as possible to its causal effect. We have found that the music treatment improves all the emotional development factors under analysis with the exception of emotional autonomy; nevertheless, students' academic scores and self-concept do not seem to be influenced by this treatment.

TABLE 1 | Relationship of the music treatment with students' academic scores, self-concept and emotional development.

		Effect of treatment (ref.: nontreated)		Constant		
	Variables	**Coeff.**	**SE**	**Coeff.**	**SE**	**Observations**
Standardised students' academic scores (first term)	Mean scores	0.209**	0.106	−0.164*	0.090	464
	Natural sciences	0.161	0.106	−0.138	0.090	464
	Social sciences	0.016	0.105	−0.022	0.090	464
	Spanish language and literature	−0.008	0.106	−0.015	0.090	464
	Mathematics	0.264**	0.105	−0.210**	0.090	464
	First foreign language	0.268**	0.105	−0.197**	0.089	464
	Valencian language and literature	−0.013	0.106	−0.001	0.091	464
	Physical education	−0.056	0.107	0.045	0.091	464
	Religion	0.316***	0.104	−0.227**	0.089	464
	Artistic education	0.585***	0.102	−0.441***	0.087	464
Standardised students' academic scores (second term)	Mean scores	0.297***	0.108	−0.201**	0.093	445
	Natural sciences	0.170	0.109	−0.112	0.094	445
	Social sciences	0.162	0.109	−0.107	0.094	445
	Spanish language and literature	0.040	0.108	−0.008	0.093	445
	Mathematics	0.260**	0.109	−0.181*	0.094	445
	First foreign language	0.507***	0.107	−0.372***	0.092	445
	Valencian language and literature	0.051	0.109	−0.017	0.094	445
	Physical education	−0.144	0.109	0.125	0.094	445
	Religion	0.341***	0.108	−0.255***	0.093	445
	Artistic education	0.645***	0.105	−0.467***	0.090	445
Students' self-concept (second term)	Popularity	0.460	0.491	47.081***	0.417	356
	Happiness and satisfaction	−0.122	0.422	40.869***	0.358	356
	Intellectual and school status	0.239	0.305	39.333***	0.259	356
	Freedom from anxiety	0.057	0.459	42.141***	0.390	356
	Physical appearance and attributes	−0.244	0.622	50.485***	0.529	356
	Behavioural adjustment	−0.619*	0.375	39.848***	0.318	356
	Global	−0.215	0.301	40.667***	0.256	356
Students' emotional development (second term)	Emotional consciousness	7.061***	2.265	37.719***	1.920	455
	Emotional regulation	3.477***	1.137	23.227***	0.964	455
	Emotional autonomy	1.766	1.411	43.641***	1.196	455
	Social competence	7.754***	1.888	31.414***	1.600	455
	Competences for life and well-being	6.948***	1.829	27.492***	1.550	455
	Global	33.647***	9.004	190.469***	7.633	455

Note: 'Coeff.' stands for 'coefficient' and 'SE' stands for 'standard error'. Estimation method: ordinary least squares (OLS). Dependent variables: Standardised academic scores of each subject using the sample mean and standard deviation, students' self-concept and students' emotional development. Coefficient: ***significant at 1%, **significant at 5% and *significant at 10%.

Source: Authors' own calculations.

TABLE 2 | Relationship of the music treatment with students' academic scores, self-concept and emotional development and difference-in-difference.

		Effect of treatment (ref.: nontreated)*After the treatment (ref.: before the treatment)		Constant		
	Variables	**Coeff.**	**SE**	**Coeff.**	**SE**	**Observations**
Standardised students' academic scores	Mean scores	−0.120	(0.159)	−0.206**	(0.098)	420
	Natural sciences	−0.152	(0.160)	−0.142	(0.099)	420
	Social sciences	−0.097	(0.160)	−0.097	(0.099)	420
	Spanish language and literature	−0.203	(0.161)	−0.122	(0.099)	420
	Mathematics	0.072	(0.160)	−0.123	(0.099)	420
	First foreign language	−0.174	(0.160)	−0.303***	(0.099)	420
	Valencian language and literature	−0.254	(0.161)	−0.172*	(0.099)	420
	Physical education	−0.237	(0.163)	−0.141	(0.101)	420
	Religion	−0.086	(0.159)	−0.296***	(0.098)	420
	Artistic education	0.135	(0.158)	−0.381***	(0.097)	420
Students' self-concept	Popularity	0.048	(1.232)	55.333***	(0.756)	415
	Happiness and satisfaction	−1.696*	(0.915)	52.735***	(0.562)	415
	Intellectual and school status	0.795	(0.814)	48.716***	(0.500)	415
	Freedom from anxiety	−0.031	(0.867)	48.784***	(0.532)	415
	Physical appearance and attributes	−0.925	(1.206)	55.059***	(0.740)	415
	Behavioural adjustment	0.071	(0.745)	48.333***	(0.457)	415
	Global	−0.174	(0.981)	52.245***	(0.602)	415
Students' emotional development	Emotional consciousness	5.563**	(2.821)	20.847***	(1.708)	416
	Emotional regulation	2.802*	(1.578)	18.955***	(0.956)	416
	Emotional autonomy	0.728	(2.061)	38.703***	(1.248)	416
	Social competence	6.972***	(2.377)	20.279***	(1.439)	416
	Competences for life and well-being	6.541***	(2.272)	15.586***	(1.376)	416
	Global	27.796**	(11.193)	131.063***	(6.777)	416

Note: 'Coeff.' stands for 'coefficient' and 'SE' stands for 'standard error'. The variables 'Effect of treatment (ref.: nontreated)' and 'After the treatment (ref.: before the treatment)' have been controlled but not included for reasons of space in the table. Estimation method: Ordinary Least Squares (OLS). Dependent variable: Standardised academic scores of each subject using the sample mean and standard deviation; students' self-concept and students' emotional development. Coefficient: ***significant at 1%, **significant at 5% and *significant at 10%.

Source: Authors' own calculations.

The results of this research work are quite consistent with the conclusions reached by the literature on the relationship of music and emotions: music lessons seem to help students develop a stronger emotional base. Particularly, music positively influences the emotional aspects of emotional consciousness, emotional regulation, social competence, competences for life and well-being, and the global emotional development competence. These results were in part expected, as the intervention was basically aimed at developing students' learning and at educating their emotions; however, we also checked for potential spillover influences on other outcomes, such as students' academic performance or self-concept (which, unfortunately, do not seem to appear).

Thus, to the extent that emotional skills have been found by many research works to be useful to avoid, for instance, that students develop mental health problems (Aviles et al. 2006), perform disruptive behaviour (Esturgó-Deu and Sala-Roca 2010) and also to help students to face the many difficult situations and problems that they will may be confronted during their lives such as high-stakes tests, substance abuse, delinquency, interpersonal violence, dropouts, changes in families, among others (Zins and Elias 2007), the implementation of this intervention for music lessons in more Spanish regions is advisable. This could be approached in a similar way as it was done in the present intervention, teaching students in similar content lessons and providing teachers with a similar training to that delivered to participating teachers. Furthermore, this result shows that the music subject is an essential one for students' emotional development and not a 'subject which distracts students'.

This research presents some limitations: first, our treatment and control groups are not perfectly balanced (although they are very close to it). This has been partly solved by the use of propensity score matching methodologies. In addition, the obtained results are only applicable for the Spanish region and the grade under analysis (Valencian students in fourth grade), so further research should be performed for other regions. Third, although we found a positive influence of the treatment on students' artistic education scores, we are cautious and do not interpret this as a result of the treatment, to the extent that teachers are responsible for scoring students, and they may, unconsciously, positively affect the academic scores of those students who received the treatment. This is a common issue when using administrative scores, as students are scored by their teachers; however, as complete schools belong to either the treatment or control groups and a DiD methodology is being used, this potential bias may not be a serious issue, to the extent that it may be 'fixed' between terms.

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Data Availability Statement

Data were confidentially gathered by the authors for their exclusive use in the context of the project EMOCIONA of the Fundación Bancaria La Caixa (under the research programme EduCaixa).

Endnotes

[1] Organic Law 8/2013, 9th December (Ley Orgánica 8/2013, de 9 de diciembre, para la mejora de la calidad educativa, LOMCE; BOE 2013).

[2] This means that subjects such as reading, mathematics and science are considered as "relevant subjects", while others like music, arts or philosophy are not. More information can be found in the Spanish newspaper *El País*: https://elpais.com/sociedad/2013/11/26/actualidad/1385491452_200770.html.

[3] More information on this Council can be found at http://mec.org.uk.

[4] This EMC consisted of two additional music lessons per week in which students played an instrument in group and participated in the school choir and/or in the school orchestra

[5] Particularly, the parameters employed to calculate this sample size have been $\alpha = 0.05$ and $\beta = 0.20$.

[6] All teachers in the treatment group received support during the whole process in order to conduct the intervention in a successful way.

[7] Following INEI (2016), the occupation codes (using the National Classification of Occupations 2011, CNO-2011, with a four-digit scale) were classified into competence levels: the highest level of competence, 4, which gathered Groups 1 and 2; Level 3, which gathered Group 3; Level 2 included Groups 4, 5, 6, 7 and 8, and Level 1 was composed by Group 9. Level 0 represented those parents who did not work.

[8] Furthermore, Piers and Herzberg (2002) calculate an inconsistent responding index (to detect response patterns) and a response bias index (to detect a tendency to agree and disagree with test items, irrespective of their content), which have been employed in the current research to avoid biased responses.

[9] The content of the 41 questions which compose this questionnaire is available upon request to their creators: Grupo de Investigación en Orientación Psicopedagógica.

[10] Authors' own translation of the definitions provided in Pérez-Escoda (2016, 560–561).

[11] These scores have been standardised using the mean and standard deviation of each subject to have a mean of 0 and a standard deviation of 1.

[12] These Piers-Harris 2 self-concept variables have already standardised scales: Popularity (Scale 24–68), Happiness and Satisfaction (Scale 22–59), Intellectual and School Status (Scale 20–65), Freedom from Anxiety (Scale 22–65), Physical Appearance and Attributes (Scale 23–65), Behavioural Adjustment (Scale 22–62) and Global Self-Concept (Scale 26–78).

[13] These emotional development variables have already standardised scales: Emotional Consciousness (Scale 0–8), Emotional Regulation (Scale 0–5), Emotional Autonomy (Scale 0–9), Social Competence (Scale 0–7), Competences for Life and Well-Being (Scale 0–6) and Global Emotional Competence (Scale 0–41).

[14] In addition, we have performed a similar analysis to check whether the influence of the treatment is kept 2 months after the treatment (after the third term), obtaining similar results for self-concept and emotional development. Nevertheless, four treated schools and one control school failed to provide third term academic scores and three treated schools failed to provide third term Piers-Harris 2 and the Emotional Development Questionnaire information for this follow-up. Because of that, because of potential bias of our results, we do not report these results in the paper but provide them upon request to the authors.

[15] In order to calculate these percentages to facilitate the interpretation of the results, we have employed the scale of these variables, which we report in the following: Emotional Consciousness ranges from 0 to 80; Emotional Regulation, from 0 to 50; Emotional Autonomy, from 0 to 90; Social Competence, from 0 to 70; Competences for Life and Well-Being, from 0 to 60; and Global Measurement, from 0 to 410. For instance, to calculate this 9%, we have performed (7.061/80)*100.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Table S1:** Relationship of the music treatment with students' academic scores, self-concept and emotional development using propensity score matching. **Table S2:** Covariate imbalance testing of propensity score matching for students' academic scores, self-concept and emotional development. **Figure S1:** Treated and untreated student distribution with propensity score matching for standardised students' academic scores (first term). **Figure S2:** Treated and untreated student distribution with propensity score matching for standardised students' academic scores (second term). **Figure S3:** Treated and untreated student distribution with propensity score matching for students' self-concept (second term). **Figure S4:** Treated and untreated student distribution with propensity score matching for students' emotional development (second term).

Appendix

TABLE A1 | Descriptive statistics for the control and treatment groups and test of mean differences (before the treatment).

Variable		Control group			Treatment group			
		Obs.	Mean	SD	Obs.	Mean	SD	Difference
Students' academic scores	Mean scores	141	6.90***	1.30	323	7.34***	1.43	0.44***
	Natural sciences	141	6.68	1.42	324	6.86	1.81	0.18
	Social sciences	141	6.71	1.50	324	6.92	1.83	0.21
	Spanish language and literature	126	7.06	1.50	324	7.20	1.69	0.14
	Mathematics	141	6.67	1.66	324	6.90	1.93	0.23
	First foreign language	126	6.43***	2.00	324	7.26***	1.98	0.83***
	Valencian language and literature	126	6.82	1.40	323	7.05	1.77	0.23
	Physical education	125	7.70	1.19	325	7.90	1.30	0.2
	Religion	124	7.79***	1.19	323	8.26***	1.25	0.47***
	Artistic education	125	7.09***	1.66	324	7.59***	1.42	0.5***
Sex of the student	Boys	132	0.49	0.50	335	0.50	0.50	0.01
	Girls	132	0.51	0.50	335	0.50	0.50	−0.01
Immigrant status	Native	133	0.94	0.24	335	0.92	0.28	−0.02
	Immigrant	133	0.06	0.24	335	0.08	0.28	0.02
Repeater student	No	133	0.84	0.37	337	0.89	0.32	0.05
	Yes	133	0.16	0.37	337	0.11	0.32	−0.05
Immigrant status of the mother	Native	133	0.70	0.46	335	0.69	0.46	−0.01
	Immigrant	133	0.30	0.46	335	0.31	0.46	0.01
Immigrant status of the father	Native	131	0.73	0.45	327	0.70	0.46	−0.03
	Immigrant	131	0.27	0.45	327	0.30	0.46	0.03
Mother with university studies	No	122	0.45	0.50	312	0.38	0.49	−0.07
	Yes	122	0.55	0.50	312	0.62	0.49	0.07
Father with university studies	No	118	0.47	0.50	298	0.46	0.50	−0.01
	Yes	118	0.53	0.50	298	0.54	0.50	0.01
Number of books at home	Between 0 and 10	133	0.22	0.42	331	0.18	0.39	−0.04
	Between 11 and 25	133	0.21	0.41	331	0.21	0.40	0
	Between 26 and 100	133	0.29	0.46	331	0.27	0.45	−0.02
	Between 101 and 200	133	0.11	0.31	331	0.16	0.37	0.05
	More than 200	133	0.17	0.37	331	0.18	0.38	0.01
Level of competence of the mother	4 (highest)	126	0.1*	0.29	305	0.16*	0.37	0.06*
	3	126	0.05	0.21	305	0.03	0.18	−0.02
	2	126	0.33	0.47	305	0.40	0.49	0.07
	1 (lowest)	126	0.39	0.49	305	0.32	0.47	−0.07
	0 (does not work)	126	0.13	0.33	305	0.09	0.28	−0.04
Level of competence of the father	4 (highest)	121	0.08	0.28	306	0.13	0.35	0.05
	3	121	0.05	0.20	306	0.06	0.23	0.01
	2	121	0.69	0.46	306	0.63	0.48	−0.06
	1 (lowest)	121	0.15	0.36	306	0.14	0.35	−0.01
	0 (does not work)	121	0.03	0.18	306	0.04	0.19	0.01

(Continues)

TABLE A1 | (Continued)

Variable		Control group			Treatment group			Difference
		Obs.	Mean	SD	Obs.	Mean	SD	
Popularity	Above average range	116	0.53	0.50	318	0.51	0.50	−0.02
	Average range	116	0.30	0.46	318	0.35	0.48	0.05
	Low average range	116	0.13	0.34	318	0.08	0.28	−0.05
	Low range	116	0.03	0.16	318	0.06	0.23	0.03
	Very low range	116	0.01	0.09	318	0.00	0.00	−0.01
Happiness and satisfaction	Above average range	116	0.5**	0.50	318	0.62**	0.49	0.12**
	Average range	116	0.36	0.48	318	0.28	0.45	−0.08
	Low average range	116	0.09	0.29	318	0.07	0.25	−0.02
	Low range	116	0.05	0.22	318	0.03	0.17	−0.02
	Very low range	116	0.00	0.00	318	0.00	0.00	0
Intellectual and school status	Above average range	116	0.14	0.35	318	0.12	0.32	−0.02
	Average range	116	0.65	0.48	318	0.60	0.49	−0.05
	Low average range	116	0.18	0.39	318	0.19	0.39	0.01
	Low range	116	0.03*	0.18	318	0.08*	0.27	0.05*
	Very low range	116	0.00	0.00	318	0.01	0.08	0.01
Freedom from anxiety	Above average range	116	0.14	0.35	318	0.14	0.35	0
	Average range	116	0.63	0.49	318	0.64	0.48	0.01
	Low average range	116	0.16	0.37	318	0.13	0.34	−0.03
	Low range	116	0.07	0.25	318	0.09	0.29	0.02
	Very low range	116	0.00	0.00	318	0.00	0.00	0
Physical appearance and attributes	Above average range	116	0.60	0.49	318	0.57	0.50	−0.03
	Average range	116	0.33	0.47	318	0.32	0.47	−0.01
	Low average range	116	0.04	0.20	318	0.07	0.26	0.03
	Low range	116	0.03	0.16	318	0.04	0.19	0.01
	Very low range	116	0.00	0.00	318	0.00	0.00	0
Behavioural adjustment	Above average range	116	0.01	0.09	318	0.01	0.06	0
	Average range	116	0.80	0.40	318	0.80	0.40	0
	Low average range	116	0.12	0.33	318	0.14	0.35	0.02
	Low range	116	0.07	0.25	318	0.05	0.23	−0.02
	Very low range	116	0.00	0.00	318	0.00	0.00	0
Global self-concept	Very high range	116	0.00	0.00	318	0.00	0.06	0
	High range	116	0.25	0.43	318	0.23	0.41	−0.02
	High average range	116	0.17	0.38	318	0.16	0.36	−0.01
	Average range	116	0.43	0.50	318	0.49	0.50	0.06
	Low average range	116	0.12	0.33	318	0.08	0.28	−0.04
	Low range	116	0.02	0.13	318	0.04	0.20	0.02
	Very low range	116	0.01	0.09	318	0.00	0.06	−0.01

(Continues)

TABLE A1 | (Continued)

Variable		Control group			Treatment group			Difference
		Obs.	Mean	SD	Obs.	Mean	SD	
Emotional consciousness	Very high quintile	128	0.18	0.39	328	0.20	0.40	0.02
	High quintile	128	0.19	0.39	328	0.20	0.40	0.01
	Average quintile	128	0.16	0.37	328	0.20	0.40	0.04
	Low quintile	128	0.22	0.42	328	0.20	0.40	−0.02
	Very low quintile	128	0.25	0.43	328	0.19	0.39	−0.06
Emotional regulation	Very high quintile	128	0.20	0.40	328	0.18	0.38	−0.02
	High quintile	128	0.14*	0.35	328	0.22*	0.41	0.08*
	Average quintile	128	0.20	0.40	328	0.21	0.41	0.01
	Low quintile	128	0.26	0.44	328	0.20	0.40	−0.06
	Very low quintile	128	0.21	0.41	328	0.20	0.40	−0.01
Emotional autonomy	Very high quintile	128	0.18	0.39	328	0.20	0.40	0.02
	High quintile	128	0.15*	0.36	328	0.23*	0.42	0.08*
	Average quintile	128	0.20	0.40	328	0.19	0.39	−0.01
	Low quintile	128	0.23	0.43	328	0.19	0.39	−0.04
	Very low quintile	128	0.24	0.43	328	0.19	0.39	−0.05
Social competence	Very high quintile	128	0.20	0.40	328	0.19	0.39	−0.01
	High quintile	128	0.17	0.38	328	0.20	0.40	0.03
	Average quintile	128	0.16	0.37	328	0.19	0.39	0.03
	Low quintile	128	0.20	0.40	328	0.22	0.42	0.02
	Very low quintile	128	0.27*	0.44	328	0.19*	0.39	−0.08*
Competences for life and well-being	Very high quintile	128	0.19	0.39	328	0.20	0.40	0.01
	High quintile	128	0.21	0.41	328	0.15	0.36	−0.06
	Average quintile	128	0.17*	0.38	328	0.26*	0.44	0.09*
	Low quintile	128	0.16	0.36	328	0.20	0.40	0.04
	Very low quintile	128	0.27*	0.45	328	0.19*	0.39	−0.08*
Global emotional competence	Very high quintile	128	0.20	0.40	328	0.20	0.40	0
	High quintile	128	0.15*	0.36	328	0.22*	0.41	0.07*
	Average quintile	128	0.20	0.40	328	0.20	0.40	0
	Low quintile	128	0.20	0.40	328	0.21	0.41	0.01
	Very low quintile	128	0.26*	0.44	328	0.18*	0.38	−0.08*

Note: 'Obs.' stands for 'Observations' and 'SD' stands for 'standard deviation'. The column 'Difference' is calculated as the difference between the mean of the treatment and control groups. Test of mean differences: *** indicates that the difference between treatment and control group is significant at 1%; **, at 5%; and *, at 10%.
Source: Author's own calculations.