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ARTÍCULOS

Exploring Self-Perceived Musical Capacities in Education and Social Science University Students

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ENG **Abstract:** This study aims to explore the varying musical self-perceived capacities of university students, including their emotional sensitivity to music, music memory and imagery, listening skills, personal involvement with music, and how these capacities vary by factors such as sex, field of study, employment, and prior experience with music. The study employs the MUSEBAQ questionnaire, a self-report survey, to collect data from 1489 university students from the Autonomous Community of Madrid (Spain) studying social sciences. The collected data was analyzed using descriptive and differential analysis to identify the nuances of perceived musical capacities among different demographics. The findings of the study suggest that students generally view their musical capacities as medium to high, with a significant emotional connection to music. Emotional sensitivity, personal commitment, and the role of music in evoking memories and imagery are highlighted as crucial aspects of students' musical experiences. No significant differences in the perception of musical capacities were found based on educational background or employment status. Based on sex-based analysis, the study finds that women tend to exhibit a higher level of emotional sensitivity towards music, but no significant differences were found in appreciation or listening sophistication. Moreover, students with higher levels of self-perceived musical capacities were more likely to engage in informal music practice and interact with music in various ways, which further enhanced their capacities. The study identified four distinct student categories based on their musical capacities, ranging from exceptional to very low levels of musical capacity, offering insights into the diverse ways students engage with and perceive music.
Keywords.: self-perceived music capacities, MUSEBAQ questionnaire, emotional sensitivity to music, personal commitment to music, music memory, music imagery.

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1. Introduction

Humans possess a set of traits known as music capacities, music abilities or musicality, which enable them to perceive, produce and enjoy music in its various forms. These traits are deeply ingrained in human biology and are shared by all members of every culture (Honing, 2021). Music is a result of these musical abilities and is exceptionally diverse, encompassing cultural-specific products and a variety of musical systems (Savage *et al.*, 2020). However, when reviewing literature, it is important to distinguish between the terms music capacities and music abilities, which are often used interchangeably but carry slightly different meanings. Music capacities refer to an individual's inherent potential in various aspects of music, such as perceiving, remembering, discriminating, and understanding musical elements like pitch, rhythm, and melody. These capacities typically develop through natural exposure to music during the first decade of life and are influenced by both genetic and environmental factors (Swaminathan & Schellenberg, 2018). In contrast, music abilities focus on the skills and proficiencies that an individual has acquired through learning and practice. These abilities can be categorized into technical skills (such as playing an instrument) and expressive skills (such as musical interpretation) (Hallam & Prince, 2003; Sloboda, 2007).

Various studies compile findings associated with different factors linked to musical capacities. Among these, research stands out on emotional sensitivity to music, highlighting characteristics related to the satisfaction experienced while listening to music and establishing psychosocial foundations for emotional development (Fuentes-Sánchez *et al.*, 2021). Additionally, understanding the induction of musical emotions allows for personalized musical listening based on individuals' characteristics (Gerstgrasser *et al.*, 2023) addressing their auditory discrimination (MacGregor & Müllensiefen, 2019), decoding emotional content through musical training (MacGregor *et al.*, 2023), and how music-induced emotions are internalized and experienced by listeners, known as emotional contagion (Akkermans *et al.*, 2019).

Another study emphasizes the importance of mental imagery in various life contexts, identifying musical experience associated with self-reported auditory mental imagery in relation to everyday sounds (Talamini *et al.*, 2022). Furthermore, Hashim *et al.* (2023) suggest that music can induce a wide range of visual imagery, identifying three main themes due to their capacity to generate information: storytelling (magical worlds, characters, etc.), associations (memories, emotional experiences, etc.), and references (movies, television, etc.). Additionally, incorporating elements from familiar songs in new compositions allows listeners to influence their musical experiences (Dahl *et al.*, 2022).

From a musical practice perspective, engagement with music has been highlighted as pivotal by Müllensiefen *et al.* (2014) in relation to musical behaviors, while Wallentin *et al.* (2010) emphasized people's melodic and rhythmic capacities in musical activities. These studies connect us with musical sophistication and its relationship with musical capacity, considering various forms of musical experience alongside cognitive and musical skills, both through engagement and musical practice (Correia *et al.*, 2023; Jimenez & Elliott, 2023).

Researchers have been studying ways to measure music capacities for more than a century. Different approaches are used depending on the examined aspects (Ullén *et al.*, 2014). Typically, assessments involve auditory discrimination tasks related to rhythm, melody, and harmony (Law & Zentner, 2012; Peretz *et al.*, 2003; Ullén *et al.*, 2014; Wallentin *et al.*, 2010), as well as self-reports that assess the physical, emotional, and social responses to music (Kreutz *et al.*, 2008). Other self-report measures of musicality include music engagement, skilled musical behaviors (Müllensiefen *et al.*, 2014), implications for motivation toward music practice (Morin *et al.*, 2016), and the capacity for music listening, emotional sensitivity, and personal commitment (Chin *et al.*, 2018).

Self-perceived music capacities refer to an individual's subjective assessment and belief in their own musical abilities, skills, and potential. This complex and multifaceted concept encompasses various aspects of music self-concept, including perceptions of one's proficiency in specific areas such as instrument playing, reading music, listening, composing, singing, and moving/dancing to music (Vispoel & Lee, 2024). It involves an individual's judgment of capability, persistence in the face of difficulties, and ability to hear music features metaphorically and as actions, as well as their capacity to perceive the relational properties of music (Barret, 2023).

Research has found positive associations between self-perceived music capacities and several important outcomes. These include a greater motivation to practice music (Schmidt, 2005; West, 2013), increased interest in music as a school subject (Fiedler & Spychiger, 2017), and the development of positive attributions for success and failure in music, alongside other motivational beliefs (Sichivitsa, 2004). Furthermore, self-perceived music capacities are linked to higher self-reported and actual school grades in music (Morin *et al.*, 2016) enhanced practical music competencies (Albert, 2017), and increased participation in music-related activities both within and outside of school (McClellan, 2011). These perceptions also influence career aspirations in the field of music (Sichivitsa, 2007) and contribute to overall self-esteem (Scalas *et al.*, 2016; Sun, 2022). These aspects highlight the importance of self-perception in developing musical talent and underscore the need for further research in this area.

Regarding the perception of commitment to music, Qarri (2023) highlighted the importance of motivational factors in learning achievements, such as self-concept, personal dedication, attitude, and the relationship of music with other activities. Similarly, Veloso and Mota (2020) identified increased commitment to musical creation through the application of collaborative tasks that fostered their relationship with music and personal and social development.

Sex-based differences also influence these perceptions, such as emotional attention, age, and music knowledge (Botella-Nicolás & Retamero-García, 2024). Additionally, it is relevant to consider potential differences in the use and perception of music in personal and professional situations (Cabedo-Más *et al.*, 2021; Rodríguez-Rey *et al.*, 2020). Furthermore, other studies explore different profiles associated with musical abilities, whether from musical experience and rhythmic skills, distinguishing between musicians and non-musicians (Bella *et al.*, 2024), or based on divided rhythmic interpretation into weak or strong performance (Fiveash *et al.*, 2022).

Even though there is a growing number of studies on music capacities and its influence in the cognitive, emotional and social development, there is a limited understanding of autopercieved music capacities outside the musical academic population. Understanding self-perceived musical capacities in university students is essential, as it plays a fundamental role in the development of musical skills, influencing motivation and engagement as well as broader psychological constructs such as self-esteem and identity (Morin *et al.*, 2016; Scalas *et al.*, 2016).

Additionally, growing literature shows that music plays a significant role in emotional regulation, memory, imagination, and social interaction (Akkermans *et al.*, 2019; Talamini *et al.*, 2022). Thus, mapping the self-perceived musical capacities of university students allows for a deeper understanding of how music

contributes to their personal, emotional, and cognitive development. This research can also identify different student profiles based on musical self-concept, thereby supporting targeted interventions to enhance musical engagement and well-being.

Also, examining how variables such as sex, field of study, employment status, and prior musical experience impact musical self-perception provides valuable insights into the many ways individuals relate to music (Botella-Nicolás & Retamero-García, 2024; Rodríguez-Rey *et al.*, 2020). These findings may provide educational strategies that foster inclusive and personalized approaches to musical learning across academic disciplines, including those traditionally considered unrelated to music.

In this context, the research question guiding this study is: How do university students in Spain perceive their own musical abilities, and to what extent do these self-perceptions vary according to sex, field of study, employment status, and prior musical education? Thus, the objective of this study is to analyze the self-perceived musical abilities of university students in Spain and explore potential variations based on several key factors, such as sex, field of study, employment status, and prior musical education. Additionally, the study aims to identify student profiles based on their perception of their musical abilities.

2. Method

2.1. Participants

The sample was made up of university students from various universities located in the region of the Community of Madrid, Spain. The type of sampling used was incidental, with a sample of 1489 students. The socio-demographic data comprised 80.8% women and 19.2% men, of whom 42.6% worked. Respondents studied the following bachelor degrees: 38% Primary Education, 38.9% Early Childhood Education, 3.8% Pedagogy, 6.4% Social Education, 4.6% Social Work, and 8.2% followed other social science studies.

Regarding the musicianship of the sample (see Table 1), 22.4% had completed formal training in music theory and 9% had received practical lessons in music centers. 24.3% of respondents stated that they knew something about musical theory and structure. Also, 23% indicated that they had studied some instrument self-taught, while around 80% had never been part of musical projects nor had played or sung in amateur projects. This percentage decreased to 70% when asked if they practiced at home with their instruments or voice (also in a self-taught way).

The sample of students in this study reflects the current trend in social sciences and education, which tends to attract more female students (Barone & Assirelli, 2020). Therefore, a predominantly female sample accurately represents the demographic distribution in this field. Additionally, most of the students in the sample lack training in musical studies, which is a significant characteristic of this study population, as noted by Rosenbloom (2004).

Tabla 1. Musical Knowledge, Training, and Experience of the Participants

VARIABLE	**YES (N, %)**		**NO (N, %)**		
Formal training in music theory	333 (22.4%)		1156 (77.6%)		
Practical classes in music centers	134 (9.0%)		1355 (91.0%)		
Self-taught instrument study	343 (23.0%)		1146 (77.0%)		
VARIABLE	NONE	LITTLE	SOME	QUITE A BIT	A LOT
Knowledge of theory and structure	36.0%	38.3%	24.3%	1.4%	–
VARIABLE	NEVER	RARELY	SOMETIMES	OFTEN	ALWAYS
Participation in professional projects	81.1%	5.9%	7.0%	3.2%	2.8%
Instrumental or vocal practice	71.4%	4.2%	9.1%	8.9%	6.5%
Amateur musical projects	83.1%	6.1%	6.6%	2.5%	1.7%

Table created by the authors.

2.2. Instrument

For the study, we used the MUSEBAQ questionnaire (Chin *et al.*, 2018) focusing on module 1, musicianship, and module 2, music capacities, as the different modules of the instrument can be used independently. Module 1 provides an overview of the musical background of the individuals, taking into account formal and informal practice and knowledge. Module 2 is made up of 27 items that are divided into four dimensions (emotional sensitivity to music, personal commitment to music, music memory and imagery, and listening sophistication) with Likert Scale-type responses, being 1, totally disagree, and 5, totally agree. The study of reliability showed excellent results with a global Cronbach's Alpha of .976, above .9, as suggested by George and Mallery (2018). Regarding the specific dimensions, the values obtained were the following: .960 in Emotional sensitivity to music; .907 in Personal commitment to music; .924 in Music memory and imagery; and .826 in Listening sophistication.

2.3. Design and procedure

The design of this study was quantitative, non-experimental and of an exploratory nature. For data collection, contact was made by email with different heads of universities in the area of social sciences in the Community of Madrid. In the email, the study's objective was explained and the anonymity and confidentiality of the data was guaranteed. The universities willing to participate were granted access to the survey through Google Forms, and the invitation was sent to their students. This study received ethical clearance from the CES Don Bosco University Ethics Committee.

2.4. Data analysis

Data analysis was conducted using SPSS 26. Descriptive statistics were performed first, followed by differential analyses in relation to the variables collected in the study (sex, degree program, employment, and those variables focused on musical knowledge). Student's t-distribution was applied to test dichotomous variables, and one-way analysis of variance (ANOVA) with the Scheffé procedure was used for continuous variables between groups. In both tests, a significance level of .05 was established. Additionally, effect size was calculated using Cohen's *d* statistic (Cohen, 1992) for comparisons between two groups (small effect: .2; medium: .5; large: .8) and the ETA squared (η^2) test (Pardo & Ruiz, 2005) for variables with more than two categories (small effect: .01; medium: .06; large: .14). Finally, a cluster analysis was carried out to identify different profiles of students' musical capacities.

3. Results

3.1. Descriptive analysis

In this study, specific dimensions of musical capacity were analyzed. Emotional sensitivity to music, personal commitment to music, music memory and imagery, and listening sophistication were all examined, revealing a mean value of 3.83 on a scale of 1 to 5 and a standard deviation of .961. However, to gain more specific information about musical capacities in students, it's necessary to pay attention to the individual dimensions and items of the instrument (see Table 2).

Upon analyzing the Emotional Sensitivity to Music dimension, we found that the students had an overall mean of 3.95 and a heterogeneous standard deviation of 1.025. The students had high ratings for feeling intense emotions while listening to certain types of music (item 2), shivering (item 9), tearing up when listening to certain music (item 10), and moving to the rhythm of specific songs (item 15). Appreciation for beautiful and sublime music, producing feelings of fascination and awe, connecting with the emotions expressed by the performers, being moved by the music, and flowering of feelings (items 6, 13, 18, 23, and 24) had medium-high level ratings, while grasping the emotions that other listeners experience when listening to music had medium level ratings (item 19).

In the dimension of Personal Commitment to Music, the overall mean obtained was 3.70, indicating a range of responses with a standard deviation of .995. Respondents rated very highly that they could not live without music (item 8). Medium-high values were placed on the dedication of time to search for music online and in stores, the specific choice of each song, and music seen as addictive (items 4, 12, and 21). Also, medium values were obtained for the importance of devoting full attention to the music listened to and losing track of time when listening to music (items 16 and 22).

Regarding the Music Memory and Imagery dimension, there was a high overall mean of 4 points with a standard deviation of 1.088. Respondents rated high levels in the tendency to relive the past when listening to certain music and evoking memories from the past (items 3 and 14). Similarly, we obtained high scores, but with more significant variability, in the medium and high responses in relation to images that appear in the head when listening to music or some specific type of music (items 7 and 17).

Finally, in the Listening Sophistication dimension, students obtained a high mean score at a global level (3.57) with a standard deviation of .949. Respondents scored high in repetition or humming a song after listening (item 1) but only medium in the items' ability to describe a song heard from others (item 5), searching for unfamiliar music (item 11), and having a good ear for music (item 20).

Table 2. Descriptive analysis of the dimensions

ITEMS	M	SD
Emotional sensitivity to music	3.95	1.025
2. I experience strong emotions when I listen to particular types of music	4.19	1.163
6. I tend to appreciate music for its beauty or sublimity	3.89	1.192
9. I get chills or 'gooseflesh' when listening to moving music	4.15	1.209
10. Tears come to my eyes when listening to some pieces of music	3.90	1.290
13. Music can produce feelings of wonder and fascination in me	4.02	1.181
15. I can't help swaying my body or tapping my foot when listening to some music	4.14	1.222

ITEMS	M	SD
18. When I listen to live music, I tend to experience the emotions expressed by the performers.	3.80	1.196
19. I sometimes seem to 'catch' the emotions that other listeners experience while listening to music	3.35	1.096
23. I can be greatly moved by music	4.04	1.213
24. Listening to music fills me with emotion	3.99	1.186
Personal commitment to music	3.70	.995
4. I often spend time online or in shops looking for music	3.60	1.249
8. I couldn't live without music	4.28	1.228
12. It's important for me to choose each piece of music I listen to	3.72	1.183
16. It's important that I give my full attention to music when listening	3.41	1.097
21. Music is like an addiction for me	3.72	1.248
22. I become so involved in music I'm listening to that I lose track of time or where I am	3.48	1.208
Music memory and imagery	4.00	1.088
3. I find it difficult to stop reliving my past when I listen to some music	4.09	1.200
7. I often see detailed pictures or movies in my head when I listen to some music	3.85	1.228
14. Music often evokes vivid memories from my past	4.15	1.189
17. Images appear without any effort when I hear some music	3.92	1.202
Listening sophistication	3.57	.949
1. After hearing a new song a few times, I can usually sing or hum it by myself.	4.12	1.192
5. I am able to describe a piece of music I've heard to someone else	3.37	1.149
11. I'm intrigued by music I'm not familiar with and want to find out more	3.39	1.148
20. I have a good ear for music	3.39	1.193
Music Capacities	3.83	.961

Table created by the authors.

3.2. Differential studies

In this section, we analyze respondents' musical capacities and identify differences in sex, degree, job, and music knowledge.

Regarding sex, women scored higher than men in the dimensions of emotional sensitivity to music, personal commitment to music, and music memory and imagery (with a small effect size). However, no significant differences were found in items related to the perception of musical beauty (item 6; $p = .52$), visual imagery while listening to music (item 7; $p = .24$), and song choice (item 12; $p = .58$), nor in the listening sophistication dimension (Table 3).

Tabla 3. Differential studies by gender

DIMENSION	SEX	M	SD	t	*p*	COHEN'S d
Emotional sensitivity to music	Female	4.00	1.009	4.083	.000**	.26
	Male	3.73	1.061			
Personal commitment to music	Female	3.75	.973	3.599	.000**	.24
	Male	3.51	1,062			
Music memory and imagery	Female	4.05	1.071	3.537	.000**	.23
	Male	3.80	1.136			
Listening sophistication	Female	3.58	.931	1.278	.202	-
	Male	3.50	1.020			

** $p < .01$

Table created by the authors.

Significantly higher levels were found in emotional sensitivity to music, personal commitment to music, and listening sophistication among students who had received formal training in music theory (Table 4), with a small effect size. However, no significant differences were observed in item 12 (p = .20) and item 15 (p = .06), which focus on music selection and movement, respectively, nor in the dimension of music memory and imagery.

There were also significant differences among students who had received practical classes in music schools, specifically in the listening sophistication dimension (p < .05; t = 2.047; p = .041; Cohen's d = .19), again with a small effect size. However, only item 5 (describing a song heard by someone else) and 20 (having a good ear for music) showed significant differences in the variable knowledge about musical theory and structure, with lower scores in the students who responded *A little* in relation to the rest of the groups (see table 5).

Table 4. Differential studies based on music training

DIMENSION	MUSIC TRAINING	M	SD	t	*p*	COHEN'S D
Emotional sensitivity to music	Si	4.10	.990	3.038	.002**	.2
	No	3.90	.031			
Personal commitment to music	Si	3.86	.980	3.275	.001**	.2
	No	3.66	.995			
Music memory and imagery	Si	4.10	.040	1.874	.061	-
	No	3.98	1.100			
Listening sophistication	Si	3.80	.941	5.145	.000**	.32
	No	3.50	.941			

** p < .01

Table created by the authors.

Table 5. Differential studies based on knowledge of musical theory and structure

DIMENSION	KNOWLEDGE OF MUSIC THEORY AND STRUCTURE	M	SD	t	*p*	COHEN'S D
Item 5	A Little	3.25	1.089	3.888	.009**	.20
	A fair amount	3.47	1.218			
Item 20	None	3.50	1.245	10.247	.000**	.08
	A Little	3.20	1.120			
	A moderate amount	3.50	1.184			
	A great deal	4.14	1.108			

** p < .01

Table created by the authors.

In the variable of self-taught instrument study, results show significant differences across all dimensions, with those who are self-taught achieving higher scores in all items (Table 6), with an effect size ranging from small to moderate. Similarly, for the variable practice with an instrument or voice, we found significant group differences in the dimensions emotional sensitivity to music, personal commitment to music, and listening sophistication, with students who reported *Never* practicing showing the lowest scores (with a small effect size) (Table 7). The variable frequency of playing or singing in amateur projects also shows differences in items related to the beauty of music (Item 6), dedication and attention to music listening (Item 16), the ability to capture emotions in people when listening to music (Item 19), and in the dimension listening sophistication, with those who responded *Never* having the lowest scores (Table 8) (small effect size). Additionally, those who have never participated in professional musical projects have lower scores in the listening sophistication dimension (p < .01; F value = 7.013; Sig. = .000; η^2 = .01). It is worth noting that no significant differences were found in relation to education and employment variables.

Table 6. Differential studies based on self-taught instrument study

DIMENSION	SELF-TAUGHT STUDY	M	SD	t	*p*	COHEN'S D
Emotional sensitivity to music	Yes	4.18	.953	4.754	.000**	.30
	No	3.88	1.036			
Personal commitment to music	Yes	3.94	.971	5.019	.000**	.32
	No	3.63	.991			
Music memory and imagery	Yes	4.20	1.015	3.715	.000**	.24
	No	3.95	1.102			
Listening sophistication	Yes	3.91	.944	7.692	.000**	.47
	No	3.47	.927			

** p < .01

Table created by the authors.

Table 7. Differential studies based on instrumental or vocal practice

DIMENSION	INSTRUMENTAL OR VOCAL PRACTICE	M	SD	t	*P*	η^2
Emotional sensitivity to music	Never	3.88	1.029	4.593	.001**	.01
	Often	4.19	.868			
Personal commitment to music	Never	3.63	.995	6.620	.000**	.01
	Often	3.96	.865			
	Siempre	4.01	1.061			
Listening sophistication	Never	3.47	.926	12.043	.000**	.03
	Often	3.89	.829			
	Siempre	3.96	1.079			

** p < .01

Table created by the authors.

Table 8. Differential studies based on frequency of performing in amateur projects

DIMENSION	AMATEUR PROJECTS	M	SD	t	*P*	η^2
6	Never	3.84	1.184	5.889	.000**	.01
	Sometimes	4.24	1.094			
	Always	4.68	.900			
16	Never	3.36	1.079	4.743	.001**	.01
	Sometimes	3.72	1.053			
19	Never	3.30	1.086	6.186	.000**	.01
	Sometimes	3.77	1.098			
Listening sophistication	Never	3.51	.919	9.057	.000**	.02
	Sometimes	3.86	.962			
	Always	4.32	.852			

** p < .01

Table created by the authors.

3.3. Cluster analysis

This form of analysis facilitates the delineation of distinct student profiles in relation to their music capacities. The process commences with an initially unclassified dataset, wherein the measurement distances between elements is undertaken through an iterative procedure, culminating in the allocation of each element to a specific cluster. Within the framework of this cluster analysis, the K-means method was employed, taking into

account the predetermined number of clusters. The selection of an appropriate cluster count is crucial, as an excessive number might find challenges in interpretation, while a low number could result from an insufficient representation of the study sample within the clusters. To achieve this, we used the established categorical ratings spanning from 1 to 5 (1 being Strongly Disagree and 5 Strongly Agree) as criteria for forming the study clusters.

The initial cluster analysis, configured with 5 clusters, yielded the subsequent outcomes: Notably, minimal distinctions emerged between clusters 2 and 4. In view of these findings, an adjustment was made to the number of clusters, refining it to 4. The conclusive outcomes of the cluster centers, depicted in Table 9, serve as the foundation for examining potential profiles linked to musical ability, as perceived by university students.

The outcomes stemming from the employment of four clusters proved satisfactory, facilitating a more precise delineation of each cluster: cluster 1 (Excellent musical ability), cluster 2 (Good musical ability), cluster 4 (Medium musical ability) and cluster 3 (Low musical ability).

Table 9. Centers of the final clusters. K-Means Method. Solution 4 conglomerates

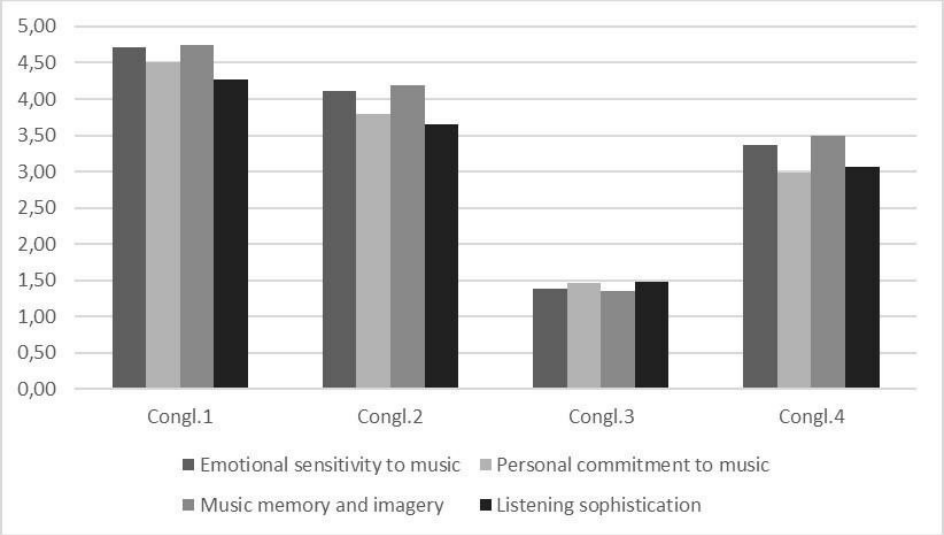
DIM.	ITEMS	CONGLOMERATE			
		1	2	3	4
Emotional sensitivity to music	2	4.88	4.45	1.34	3.77
	6	4.67	3.99	1.31	3.43
	9	4.87	4.43	1.33	3.61
	10	4.74	4.06	1.41	3.08
	13	4.82	4.15	1.33	3.50
	15	4.82	4.37	1.33	3.78
	18	4.56	3.94	1.52	3.09
	19	4.07	3.34	1.56	2.78
	23	4.88	4.23	1.33	3.29
	24	4.81	4.16	1.33	3.32
Personal commitment to music	4	4.41	3.67	1.51	2.83
	8	4.93	4.67	1.31	3.65
	12	4.42	3.82	1.37	3.33
	16	4.19	3.43	1.53	2.71
	21	4.65	3.81	1.47	2.74
	22.	4.41	3.39	1.63	2.62
Music memory and imagery	3	4.76	4.32	1.32	3.73
	7	4.62	4.01	1.45	3.19
	14	4.87	4.38	1.33	3.71
	17	4.75	4.03	1.33	3.34
Listening sophistication	1	4.68	4.40	1.38	3.90
	5	4.12	3.35	1.49	2.83
	11	4.09	3.45	1.50	2.77
	20	4.17	3.37	1.54	2.77

Table created by the authors.

In order to describe the profiles, we will be following the guidelines set by Hair *et al.* (2014), which suggest assigning a label to each cluster in order to specify its nature. In addition, we will analyze the means obtained by the elements within the clusters via analysis of variance. Prior to this, we conducted a preliminary study to determine homogeneity of variances using the Levene test. We will be using the Game-Howell statistic in case of non-homogeneity, and the Scheffé statistic for other cases.

Upon analyzing the results, it was observed that all dimensions showed significant differences among all groups, meeting the following criteria: Cluster 1 displayed higher means compared to the other groups, with a more moderate stance in Cluster 2. In turn, Cluster 2 exhibited higher means compared to Cluster 3 and more moderate means compared to Cluster 4. Lastly, Cluster 3 showed lower means compared to the rest of the groups (See Figure 1). Next, we present the results and highlight the variables that exhibit the most significant differences within each of the clusters.

Figure 1. Averages in each of the dimensions by clusters. Source: Own elaboration.



Cluster 1 (Excellent Musical Capacities) consists of 37.6% of the student sample. It is characterized by displaying a very high level in all characteristics measuring musical ability, with almost all students expressing that they cannot live without music (Item 12). However, we can observe lower scores when it comes to understanding the emotions experienced by other listeners when listening to music (Item 8), devoting full attention to the music they are listening to (Item 14), and in most items within the Listening Sophistication dimension (Items 22, 23, and 24).

Cluster 2 (Good Musical Capacities), comprising 14.4% of the student sample, is characterized by having high levels in the Emotional Sensitivity to Music and Music Memory and Imagery dimensions, with item 8 standing out with a lower mean when connecting with the emotions of other listeners when they listen to music and item 12 (not being able to live without music), while maintaining higher results compared to other scores. On the other hand, we observe moderately high levels in the Personal Commitment to Music and Listening Sophistication dimensions, with the lowest results focused on losing track of time (Item 16), describing a song to another person (Item 22), and having a good ear (Item 24).

The 37.9% of the student sample belongs to Cluster 3 (Medium Musical Capacities). This cluster is characterized by students who maintain a moderate level in dimensions measuring musical capacities. However, we observe several high scores among its characteristics, with a particular emphasis on experiencing intense emotions (Item 1), the tendency to move to the rhythm of music (Item 6), and humming or singing a song when hearing it multiple times (Item 21). Conversely, we find lower levels concerning the importance of listening attentively, considering music as an addiction, and losing track of time (Items 13, 14, and 15, respectively).

Finally, Cluster 4 (Low Musical Capacities) is made up of 10.1% of the student sample. It is characterized by having a very low level in all characteristics measuring musical ability. This group of students stands out with lower ratings in the Emotional Sensitivity to Music and Music Memory and Imagery dimensions compared to the Personal Commitment to Music and Listening Sophistication dimensions.

4. Discussion and conclusions

Based on the results of the study, it can be concluded that the students in the sample generally regarded their music capacities as medium-high. The results also indicate a limited engagement with formal music education and a preference for self-taught learning. Upon closer analysis of the dimensions evaluated, the following conclusions have been drawn.

Students have a strong emotional connection to music and are open to experiencing intense emotional responses when listening to certain songs. They are able to feel deep emotions, experience chills and tears, and move to the rhythm of music. This emotional sensitivity indicates a strong connection to music in terms of its most powerful emotional effects (joy, love, loneliness, nostalgia...) (Juslin *et al.*, 2008). However, they may struggle to understand the emotional reactions of others when listening to music, highlighting the need for greater empathy and understanding. These findings suggest opportunities for growth and reflection in students' relationship with music use (De Boise, 2015).

Respondents place a great deal of importance on personal engagement with music. They express a strong emotional attachment to music, to the point where they cannot imagine life without it. Many students actively dedicate time and effort to searching for music and paying attention to specific details of each song. This demonstrates the active role that music plays in their daily lives. Some students even consider music to be an addiction, indicating a deep and meaningful connection to this art form. However, there are varying results when it comes to losing track of time and attention while listening to music. This suggests that while music is felt as important, the specific functions of music listening are determined by various individual and situational

factors. According to Greb *et al.* (2018), the main activity during music listening has the greatest impact on situational factors, while the intensity of music preference is the most influential factor on the individual level.

In general, there is a positive view of the effect that music has on memory, and its ability to bring up images and memories in their minds. Specifically, respondents find that certain songs can transport them back in time and help them relive certain memories. Respondents also report that music can sometimes trigger visual images in their minds, although this varies from person to person. These findings support the importance and prevalence of visual imagery while listening to music, which is consistent with previous research (Byron & Fowles, 2013; Taruffi & Küssner, 2019; Taruffi *et al.*, 2017; Vuoskoski & Eerola, 2013).

Usually, students show an active and engaged relationship with music, willing to delve deeper into the musical experience and become familiar in detail with the songs they listen to. Nevertheless, students manifest less ability when it comes to describing a song to another person, possessing a good ear for music, and actively pursuing unfamiliar music to expand their knowledge. This suggests that, although students appreciate music highly, their level of technical knowledge or their technical knowledge and ability to communicate their musical experiences effectively may be lacking (Franco *et al.*, 2017).

Outlined below are the main findings derived from the analyses of sociodemographic variables.

In line with previous research, results show that women declare displaying a higher level of emotional sensitivity towards music (Hunter *et al.*, 2011), possess a stronger personal attachment to music, and have a better ability to retain and visualize various musical elements when compared to men (Beaman & Williams, 2010; Hyman *et al.*, 2013; Liikkanen, 2012; 2020; Campbell *et al.*, 2015). However, there were no significant differences observed between sexes in terms of appreciation of musical beauty, song preferences, or listening sophistication (Ferwerda & Tkalčič, 2019). It is essential to approach these results with caution, as studies do not reach unanimous results on sex differences (De Boise, 2015; Moeck, 2018).

Regarding variables on music knowledge and practice, it stands out that students who have received formal education in this field exhibit a greater emotional sensitivity to music, a deeper personal commitment to music, a sharper ability to generate mental images when listening to music, a greater familiarity with recent musical compositions, and a better development of their auditory perception. In this context, when the variable of knowledge about music theory and structure is analyzed, significant differences are revealed in only two particular aspects: the ability to describe a song heard by another person and the aptitude to possess a fine-tuned musical ear. Also, students who engage in self-taught practices exhibit a notable development of their musical capacities. In contrast, those who have had no experience playing an instrument or singing obtain lower scores on a number of dimensions, such as appreciation of the beauty and sublimity of music, the ability to capture emotions when listening to music, attention paid during music listening, the ability to describe a song to another person, the ability to discover new music, and auditory acuity. These results align with the research conducted by Correia *et al.* (2023) which suggests that there are inherent musical and non-musical differences between trained and untrained individuals that cannot be solely attributed to formal music lessons. This is a significant discovery as ongoing debates about music training (Bigand & Tillmann, 2022) emphasize the importance of measuring both musical abilities and music training to differentiate between training-specific and more general associations. Moreover, the results indicate that individuals with higher levels of musical aptitude are more likely to engage in informal music practice and interact with music in various ways, which further enhances their abilities. These findings also align with genetic studies on musical aptitude (Hambrick & Tucker-Drob, 2015; Wesseldijk *et al.*, 2019).

No significant differences in the perception of musical abilities were found based on educational background or employment status. This indicates that music is a universal experience that is appreciated similarly across all levels of education and occupations. Furthermore, this musical competence is linked to factors such as music training, socioeconomic status, short-term memory, general cognitive ability, and personality traits (Swaminathan & Schellenberg, 2018).

This study has identified four distinct categories of students based on their perception of their musical abilities:

1. The first category includes students who exhibit exceptional overall musical talent. Nearly all of these students express a deep passion for music and claim they couldn't imagine their lives without it. However, despite their remarkable musical aptitude, this group scored lower in specific areas related to musical perception. This was evident in their ability to comprehend the emotions conveyed through music, as well as their attention to detail while listening to music.
2. The second group of individuals can be distinguished based on their good musical abilities. They excel, particularly in the areas that involve emotional sensitivity to music and musical memory and imagination. However, the scores of this group tend to be lower when it comes to their ability to comprehend the emotions felt by other listeners while listening to music. They show moderate to high levels of personal engagement with music and are good at picking up details while listening to music. Conversely, they score lower in aspects such as losing track of time, describing a song to another person, and possessing an extraordinary musical ear.
3. Respondents in the third category demonstrate a moderate musical ability and have particular preferences and tendencies when it comes to their relationship with music. They obtain average levels in the dimensions that assess music capacities. They are more likely to respond emotionally and physically to music, but pay less attention to musical details. They also do not perceive music as an addiction.
4. The fourth group of students exhibit very low levels of musical ability across all characteristics.

In view of the above conclusions, this study provides valuable insights into the musical capacities of university students. However, it's important to acknowledge some limitations. The use of self-report measures, like the MUSEBAQ questionnaire employed in this research, could potentially introduce a response bias. Specifically, the study relies on students' self-assessments of their musical abilities, which may not accurately reflect their actual level of musical competence. Self-perception is frequently shaped by factors such as confidence, prior experiences, and the nature of their training, and may differ considerably from objective measures of performance (Gill *et al.*, 2022; Herb, 2021). To complement self-perception data, future research could incorporate objective assessments of musical abilities, such as music performance assessments or music listening tasks. It is important to note that this study only focused on university students in the social sciences field with an emphasis on the socio-educational domain, specifically in the Community of Madrid. This geographical and disciplinary limitation constrains the generalizability of the findings to other educational contexts or regions. Moreover, the sample size and the imbalance in the gender variable, as well as the exclusion of other key variables (e.g., age), may have affected the representativeness of the data. These aspects should be addressed in future research to ensure more robust conclusions. While this allows us to explore possibilities in music education, such as improving musical skills through curricular and extracurricular activities, as well as incorporating music as an additional strategy in future professions, it would be beneficial to broaden the research to a more diverse and representative sample, including individuals of different ages and educational levels. This would enhance our understanding of musical abilities in a broader context.

This study lays the groundwork for subsequent research that aims to expand our understanding of the multifaceted and universal nature of musical engagement among diverse populations. In this regard, it is essential to delve deeper into various aspects that could enhance the understanding of musical abilities. For instance, it would be relevant to investigate the discrepancy between self-perception and actual musical competence through more objective methods, such as musical performance assessments. Furthermore, longitudinal studies could provide a more comprehensive view of how these abilities develop over time and how they relate to the educational environment. It is also important to consider the influence of sociocultural factors—such as family background—which may significantly impact students' self-perception. Finally, future research could focus on the design and implementation of educational programs aimed at improving musical competencies in specific contexts, evaluating their long-term effectiveness.

In light of the findings of this study, it is essential to highlight its educational implications. Although students in social sciences and education perceive their musical abilities in diverse ways, these results underscore the need to incorporate more inclusive approaches to music education. The development of musical competencies can not only enrich students' academic profiles but also serve as a cross-disciplinary tool to enhance cognitive and socio-emotional skills. In this regard, educational institutions might consider including both curricular and extracurricular musical activities that foster the development of these skills, contributing to a more holistic education. Furthermore, the study suggests that self-perception of musical competence should be taken into account when designing educational programs, as students with low musical self-esteem could benefit from interventions that strengthen their confidence in this area. Thus, the findings provide a basis for the design of educational policies that promote access to music education and its integration across various disciplines, particularly in fields such as social education and psychopedagogy.

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