

Choice of Musical Instruments: Gender Differences

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Abstract

Current research has focused on gender as a conditioning factor in students' study choices, highlighting the existence of gender stereotypes associated with these choice. The general objective of this article is to analyse if there are differences based on sex in the choice of musical instruments in music conservatories. The methodology used is quantitative. We have analysed the data on enrolment in the different instrumental specialities of two public music conservatories in Seville (Spain) at the three levels of music education: Basic, Professional and Higher Music Education. This article contrasts if there are instrumental specialities that are mostly chosen by one or the other sex, and to check if this sexual segregation has been produced by chance or can be explained by other causes. This investigation was carried out for a total of 4120 students from two different conservatories. The main conclusions of the study were the existence of feminized and masculinized instrumental families, and the relationship between the variables "students' sex" and "instrumental families and musical specialities" was significant with a medium effect size. This research confirms that men and women choose the instruments that have traditionally been associated with their male or female roles respectively.

Keywords: musical instrument; sex; music education; gender studies; stereotypes

INTRODUCTION & BACKGROUND

The scientific literature points to the existence of gender differences in the choice of musical instruments by students who begin their musical studies, both in private and public schools (Abeles & Porter, 1978; Cramer et al., 2002; Delzell & Leppla, 1992; Graham, 2005; Griswold & Chrobak, 1981; Martínez-Cantero, 2017; Martínez-Trujillo & Colarte-Torres, 2013; Payne, 2009; Sansaloni, 2014).

There is concern that these differences in choices are based on sexist stereotypes, on preconceived ideas about what a musician should be like depending on whether they are female or male. This fact also suggests that they choose to play musical instruments that do not fit social prescriptions related to gender. In this regard, Sargent (2009) points out that masculinities vary by organizational context, demonstrating that organizational culture shapes the gendering of work even within the same occupation.

In this article we begin by presenting the theoretical framework of the subject, the analysis of the data and the methodology implemented to achieve the proposed objectives. Subsequently, we detail the results and dedicate a final section to the discussion and conclusions.

Gender has always been an object of special interest. Specifically, the influence of gender stereotypes on the choice of musical instruments, and also of musical specialities, such as composition, conducting, musicology and music pedagogy, has been widely studied in the Anglo-Saxon world (for a review of the literature, see Wych, 2012).

The reasons that motivate female and male music students to choose different musical and instrumental specialities have always been a subject of interest for music education professionals in conservatories. In fact, experts agree in highlighting the importance of the consequences that a student's choice of musical instrument may have, as such a decision will affect their musical experience in many ways, among which are the following aspects: a) Their performance in music education, motivation and professional success (Beauvillard, 2006); b) Their possible abandonment of music education (Valencia et al., 2003); c) Their chances of becoming a member of a band or an orchestra (Wych, 2012). It is very difficult to see women playing in jazz bands (McKeage, 2014), as they are formed by instruments mostly played by men, such as the saxophone, trumpet, trombone and percussion.

In addition, the aim of those involved in music teaching has always been that their students are satisfied with the instruments they have chosen (Wych, 2012). Certainly, there are many reasons why students choose to study one instrument or another, among which are the intrinsic characteristics, which are those that are born of the individual, and the extrinsic ones, the most important being the influence of the family and the peer group (Martínez-Cantero & Jauset-Berrocal, 2017).

The first study in this area was conducted in 1978 by Abeles and Porter, in which they

examined the gender typing of musical instruments by showing university students, with and without musical knowledge, eight instruments – the drum, clarinet, flute, saxophone, trombone, trumpet, violin and cello – paired in all possible ways, and asking them to identify which of the two instruments was the most masculine. The results indicated that the instruments considered most feminine were, in order, the flute, violin and clarinet, while those considered most masculine were the drum, trombone and trumpet, and that the cello and the saxophone were in the middle of the rankings. Furthermore, they found no significant differences according to the gender of the respondent (Abeles & Porter, 1978).

Subsequently, the scientific community began to carry out research, also with university students with and without musical knowledge, which replicated and completed Abeles and Porter's study.

On the one hand, Griswold and Chrobak (1981) expanded the number of instruments to be included, in addition to adding the categories "instrumental conductor" and "choral conductor", and the results indicated that the instruments considered most feminine, in order, were the harp, flute, piccolo, glockenspiel, cello, choral conductor, clarinet, piano, French horn and oboe, while the most masculine instruments, in order of precedence, were the tuba, double bass, trumpet, bass drum, saxophone, instrumental conductor, cymbal and guitar.

On the other hand, Delzell and Leppla (1992) replicated, fourteen years later, the study of Abeles and Porter, and their results were almost identical, being the only difference that the clarinet was considered the second most feminine instrument, and the violin remained the third.

Graham (2005) investigated the reasons for musicians' choice of instruments and, in addition to reasons derived from the physical properties of the instrument or the influence of teachers, family and friends, found reasons related to gender stereotypes. The results of the

associations between instruments and gender indicated that the tuba was considered the most masculine instrument and the flute the most feminine one.

In the same vein, Payne (2009) in his research on the instrumental choice of band students in Oklahoma schools (United States) concludes that gender stereotypes influenced both the selection of musical instruments and timbral preference, also related to personality traits. For example, extroversion was related to the timbres of the flute, clarinet, saxophone, horn, trumpet, trombone and tuba.

Abeles (2009) examines gender associations over three decades to determine if there have been changes in gender stereotypes of musical instruments. His results show that there have been few changes in the sex distribution of the instruments. The girls predominantly played flutes, violins, and clarinets, and most of the boys played drums, trumpets, and trombones.

Furthermore, it is very common for teachers to tend to perceive girls as more suited to singing and playing instruments and to associate boys with creative facets such as composition (Soler, 2018, 96-97), so they may encourage girls and boys to study particular musical and instrumental specialities based mostly on gender stereotypes.

Recent studies have focused on the relationship between pitch and timbre and the gender rating of musical instruments (Allen & Oxenham, 2014; Caruso & Balaban, 2014; Stronsick et al., 2018).

The results supported the idea that gender associations derived from both timbre and pitch level influence gender assessments: instruments typically considered feminine (e.g., the flute) were rated feminine, while instruments typically considered masculine (e.g., the tuba) were rated masculine (Stronsick et al., 2018).

Fund (2020) analysed if there were significant differences in boys' and girls' instrument choice when using Gordon's Instrument Timbre Preference Test (ITPT) method versus the traditional method of instrument selection and if students' choices corresponded to their timbral

preferences as measured by the ITPT. It also examined if this differed for boys and girls and as a whole. The results of this study determined that Gordon's ITPT would not influence gender imbalance across the family of instruments, but it might influence the students' decision of which instrument to play. Therefore, ways to reduce external factors to help students choose the instrument should continue to be sought.

Cooper and Burns (2021) studied the reasons why gender stereotypes determine students' choice of musical instruments. They found two mechanisms of social role theory, prescription and essentialism, as underlying mechanisms for how gender stereotypes influence students' choice of instruments.

Among the Spanish research framed in this field of study is the study conducted by Martínez-Cantero (2017) during the academic years 2003-2004, 2004-2005, 2012-2013 and 2014-2015 in conservatories, band schools, municipal music schools and private academies in the regions of Murcia and Alicante with the purpose of observing to what extent gender influences instrumental preferences. It concludes that string and percussion instruments are associated with girls and woodwind and brass instruments with boys, and that girls are more influenced by their social, educational, family and peer group environment in the beginning of their musical studies than boys. In her study there were only two girls studying percussion, so she concludes that "the scarcity of the sample does not allow us to deduce significant results" with respect to this instrumental speciality (Martínez-Cantero, 2017, 52).

Sansaloni (2014) conducted an investigation to find out if gender stereotypes influence the choice of musical speciality in the student body of the Conservatory of Higher Music Education of Valencia, from the academic year 2001-2002 to 2011-2012. It found that the number of men enrolled per year is much higher than that of women, and that there are "male" and "female" musical specialities, since of the 27 musical specialities offered by the conservatory, 17 have

a majority male presence, 4 have parity between women and men, and only 6 have a majority female presence. The musical and instrumental specialities in which there is a male presence were: the clarinet, harpsichord, composition, double bass, choral conducting, orchestra conducting, bassoon, guitar, jazz, organ, percussion, piano, saxophone, trombone, horn, trumpet and tuba, with an almost absolute male predominance in the last four. The specialities in which there is almost parity are musicology, oboe, language pedagogy and music education, and singing and instrument pedagogy. And the specialities of harp, singing, transverse flute, viola, violin and cello have a majority of female presence, concluding that strings are the most feminized of the instrumental families, with the exception of double bass, which continues to have a male majority. Sansaloni concludes, after examining the data from the entrance exams and observing the few applications from girls to study certain masculinized instruments such as the horn, that the cause of the appearance of gender stereotypes in the students' choice of musical speciality must be sought in stages prior to their arrival at the conservatory.

Martínez-Trujillo and Colarte-Torres (2013) studied the reaction of girls and boys between the ages of 9 and 12 in a primary school in Havana (Cuba) in order to identify the relationship they established between the sound, appearance and timbre of the instrument they played and gender; they found that the participants in the study associated wood, high-pitched sounds and weak timbre with the female gender, and steel, low-pitched sounds and strong timbre with the male gender. They considered that the clarinet, flute, guitar and violin could be played by both girls and boys, and that the role of orchestral conductor could be assumed by either a man or a woman. However, they observed that when the role was assumed by a boy, he built the orchestra mostly with brass and percussion instruments, while when it was assumed by a girl, she built the orchestra mostly with woodwind and rubbed string instruments. Therefore,

they concluded the existence of gender roles and stereotypes in the behaviour of children with respect to musical instruments.

Moro and Solís (2021) point out how gender stereotypes influence the choice of certain musical instruments; the violin, the piano or the flute, on the one hand (“associated with the feminine stereotype of delicacy and naturalness”); and, on the other, the electric guitar, drums, bass, brass or percussion (“instruments with which greater energy is released and the expression of force is greater”).

Along the same lines, the Report on the application of the Law on Equality of the Ministry of Culture and Sport (2020) shows the female association with string instruments (37 percentage) and keyboard (22 percentage) as opposed to wind (8 percentage) or percussion (0 percentage). Or, also, how vocal interpretation is the most favoured by the presence of women (47 percentage).

PURPOSE OF THE STUDY AND RESEARCH QUESTIONS

The general objective of this research is to analyse if there is gender segregation in the different instrumental and musical specialities taught in Spanish schools, specifically in two public music schools in the city of Seville (Spain). We try to contrast if there are instrumental specialities that are mostly chosen by one or the other sex, and to check if this sexual segregation has been produced by chance or can be explained by other causes.

Through the study we aimed to answer the following research questions:

- PI1: Which instruments do female students prefer to study?
- PI2: What instruments do students choose to study?
- PI3: Which are the most masculinized instrumental specialities?
- PI4: Which are the most feminized instrumental specialities?

PI5: Are there relationships between the sex of students and the musical specialities and instrumental families in which they are enrolled?

In this investigation we analyse the data on enrolments at three educational levels in order to contrast whether this phenomenon occurs at all levels of musical education or only at some of them.

The Chi-square test is carried out for each educational level and for each academic year in order to find out if there is a relationship between the variables “students’ sex” and “instrumental families and musical specialities” studied in these conservatories.

METHOD

Sample

This investigation was carried out for a total of 4,120 students from two different conservatories with the following distribution:

- Student body enrolled in the different musical and instrumental specialities, both in

Basic Music Education and Professional Music Education, in the public educational centre Cristóbal de Morales Professional Conservatory of Music of Seville during the 2012-2013, 2015-2016 and 2018-2019 academic years. They are comprised by a total of 624 female and 513 male and female students in the Basic Music Education and a total of 1,187 female and 1,268 male and 1,268 male students in the Professional Music Education.

- Students enrolled in the different musical and instrumental specialities in Higher Music Education in the public educational centre Manuel Castillo Conservatory of Higher Music Education of Seville during the 2018-2019 academic year.

They are comprised by a total of 219 female and 309 male students. The data of enrolled students who left their studies in the middle of the academic year due to the cancellation of enrolment or who voluntarily stopped attending class are not included. Table 1 shows the number of persons enrolled and percentages by academic year and centres analysed.

TABLE 1: Sampling

Academic year	Sex	Cristóbal de Morales Conservatory of Seville				Manuel Castillo Conservatory of Seville	
		Basic Music Education		Professional Music Education		Higher Music Education	
		Number	%	Number	%	Number	%
2012-2013	Women	194	48,50	348	46,77		
	Men	206	51,50	396	53,23		
2015-2016	Women	211	57,81	394	47,19		
	Men	154	42,19	441	52,81		
2018-2019	Women	219	58,87	445	50,80	219	41,48
	Men	153	41,13	431	49,20	309	58,52
Total		1.137		2.455		528	4.120

Source: Prepared by the authors on the basis of the classification indicated in the second volume of Dionisio de Pedro's Complete Theory of Music (De Pedro, 2014, 105–106).

Procedure

The enrolment data were provided by the secretariats of the two public schools: in the Cristóbal de Morales Professional Conservatory of Music of Seville, the data corresponding to the Basic Music Education and Professional Music Education levels of the academic years 2012-2013, 2015-2016 and 2018-2019 were provided; and in the Manuel Castillo Conservatory of Higher Music Education of Seville, the Higher Music Education data of the academic year 2018-2019 were provided.

Both descriptive and inferential statistics were used for data analysis. An instrumental or musical speciality was considered to be feminized if it had less than 30 percentage of students; likewise, an instrumental or musical speciality was considered to be masculinized if it had less than 30 percentage of female students. Finally, as established in Organic Law BOE 3/2007, 22nd March, for the effective equality of women and

men (art. 78 and First Additional Provision), parity was considered to exist if the percentages of women and men in the different instrumental and musical specialities were between 40 percentage and 60 percentage. In the inferential study, the relationship between the independent variable (VI) “instrumental families and musical specialities”, and the dependent variable (VD) “students’ sex” (that is, the number of girls and boys who study musical instruments from the aforementioned instrumental families or who study the said musical specialities) has been analysed; as both variables are qualitative, the Chi-square technique has been used to study and compare frequencies.

To facilitate the analysis, the different instrumental specialities offered in the Cristóbal de Morales and the Manuel de Castillo Conservatories were grouped into instrumental families (Table 2).

The division between idiophone and membranophone percussion instruments is not

TABLE 2: Classification of instrumental specialties into families

	Instrumental families	Instrumental specialties
String (Chordophones)	Rubbed String Family	the double bass, the viola, the viola da gamba, the violin and the violoncello
	Plucked String Family	the classical guitar, the flamenco guitar, the harp, the harpsichord, the lute and the theorbo
	Struck String Family	the piano
Wind (Aerophones)	Woodwind Family	the bassoon, the clarinet, the oboe, the peak flute, the saxophone and the transverse flute
	Brass Family	the horn, the trombone, the trumpet and the tuba
	Mechanical Wind Family	the organ
Percussion	Hard materials (idiophones)	the bells, the castanets, the cymbals, the glockenspiel, the tamtam, the triangle and the xylophone
	Tensioned membranes (membranophone)	the bass drum, the drum, the drum kit, the kettledrums and the tambourine
Electrophones	Mechanical-electrical	the electric guitar
	Purely electric	the electric organ and the synthesizer
	Radio-electric	the theremin

made in the descriptive and inferential statistical analysis, because in the two conservatories analysed in this study, students who wish to learn to play these instruments cannot enrol in specific instrumental specialities. They have to enrol in the instrumental speciality “percussion”, in which they learn to play the whole variety of percussion instruments mentioned in Table 2, with the exception of the speciality of “jazz drum kit” in which they can be enrolled independently, but this is only present in the Higher Music Education. Likewise, the musical speciality of orchestra conducting is not taught in the two conservatories under study, so they will not be included in the instrumental classification for the descriptive and inferential statistical analysis.

Descriptive Statistical Analysis and Chi-square Tests

A polytomous scale was used for the instrumental family (VI) as it contains more than two values (plucked string family, rubbed string family, struck string family, brass family, woodwind family, mechanical wind family, percussion, classical and flamenco singing, musicology, composition and choral conducting), and a dichotomous scale was used for the VD (sex). The relationship between the independent and dependent variables in each of the educational stages and for the academic years analysed was studied through Chi-square tests (one for each educational level and academic year), using $\alpha = .05$ as the level of significance. We calculated φ (contingency coefficient) as a measure of effect size, using small (.10), medium (.30) and large (.50) levels.

In all the Chi-square tests that were carried out with the data of the student body in number of students enrolled in the different musical specialities and instrumental families of the two conservatories studied, cells appeared with expected frequencies lower than 5, which, as they did not exceed 20 percentage of the total number of cells in any case, it was not essential to group

them and they were eliminated as they were not comparable to the rest of the categories; thus, the musical speciality of vocal education and the mechanical wind family were eliminated.

In order to know which musical specialities or instrumental families had the greatest significance obtained in each of the Chi-square tests carried out, the typed or standardized residuals were reviewed. For this purpose, the *z-value* was calculated, a quantity from which statistically significant typified or standardized values are found, that is, the values that really mark the differences between the variables analysed. All the cells that presented a standardized residual higher than the *z-value*, whether positive or negative, were statistically significant in the relationship between the variables studied. The *z-value* was calculated for the adjusted alpha values with a Bonferroni adjustment.

In the Chi-square tests performed in the Basic Music Education in the 2012-2013, 2015-2016 and 2018-2019 academic years, twelve cells were inspected: two rows corresponding to women and men and six columns corresponding to six instrumental families (plucked string family, rubbed string family, struck string family, brass family, woodwind family and percussion, not including vocal education because it was eliminated for possessing an expected frequency lower than 5).

So, the alpha value was divided by twelve ($.05/12 = .0042$) and the *z-value* = 2.87 was calculated.

For its part, in the Chi-square tests carried out in the Professional Music Education in the 2012-2013, 2015-2016 and 2018-2019 academic years, fourteen cells were inspected: two rows corresponding to women and men and seven columns corresponding to seven musical and instrumental specialities (plucked string family, rubbed string family, struck string family, brass family, woodwind family, percussion and “classical singing and flamenco singing”, without including the mechanical wind family because it was eliminated for having an expected frequency

of less than 5). Therefore, the alpha value was divided by fourteen ($.05/14 = .0036$) and the *z-value* = 2.91 was calculated.

Finally, in the Chi-square tests carried out in the Higher Music Education in the 2018-2019 academic year, twenty were inspected: two rows corresponding to women and men, and ten columns corresponding to ten musical and instrumental specialities (plucked string family, rubbed string family, struck string family, brass family, woodwind family, percussion, classical singing, musicology, composition and choral conducting, not including the mechanical wind family because it was eliminated for possessing an expected frequency of less than 5). Therefore, the alpha value was divided by twenty ($.05/20 = .0025$) and the *z-value* = 3.02 was calculated.

ANALYSIS AND RESULTS

In this investigation a truly equal instrumental family was not found, with a percentage of women or men no higher than 60 percentage and no lower than 40 percentage, the one that turned out to be closer to parity was included.

In some academic years and educational stages, due to the lack of a truly feminized instrumental speciality (with more than 70 percentage of female students), the instrumental speciality with more female participation was included, although this did not exceed 70 percentage.

It was observed that in the Basic Music Education, the most feminized musical specialities were vocal education and violin, in the Professional Music Education they were harp and transverse flute, and in the Higher Music Education it was again found that the most feminized speciality was the transverse flute. While the most masculinized instrumental speciality in the Basic Music Education was percussion, in the Professional Music Education it was “Renaissance and Baroque plucked string instruments” (the lute and the theorbo), trombone, organ and tuba, and in the Higher Music

Education there were numerous instrumental specialities with no female students enrolled.

In the Basic Music Education it was found that the most feminized musical specialities were vocal education, rubbed string and woodwind, in the Professional Music Education they were classical singing and flamenco singing, as well as woodwind, and in the Higher Music Education they were classical singing and musicology.

But there are small differences when comparing the most feminized and masculinized instrumental and musical specialities with the most feminized and masculinized instrumental families.

The most masculinized instrumental specialities in all educational stages were percussion and brass, in addition to the mechanical wind family, which includes the instrumental speciality of organ. More randomness was observed in the equal instrumental specialities than in the equal instrumental families, since depending on the educational stage and course the most equal instruments were the classical guitar, double bass, oboe, viola, bassoon, peak flute and saxophone, while the most equal instrumental families were repeatedly woodwind, plucked string and struck string. However, it was noted that the most evenly matched instrumental specialities belonged to the evenly matched instrumental families.

Table 3 summarizes the main results of this study, considering both the instrumental or musical speciality and the instrumental family:

- More masculinized instrumental specialities appeared than feminized ones.
- The most feminized instrumental specialities were vocal education, harp, violin and transverse flute.
- No instrumental family was found to be feminized (that is, with more than 70 percentage of female students) other than vocal specialities (vocal education and “classical and flamenco singing”). And in certain academic years of the Professional Music Education and in the Higher Music

TABLE 3: Summary of results

Descriptive statistical techniques			Inferential statistical technique (Chi-square test)		
Educational Level	School year	More feminized instrumental or musical specialty	More masculinized instrumental or musical specialty	Was the relationship between the variables sex of the students and instrumental family statistically significant?	The instrumental family that caused the significant differences in women's and men's instrument choices
Basic Music Education	2012-13	Vocal Education	Percussion	$\chi^2 (5, N = 399) = 34.73$ Yes, $p = .001$ But $r\phi = .28$	Women on Brass $z = -2.7$ It is $\leq z = 2.87$
	2015-16	Vocal Education	Percussion	$\chi^2 (5, N = 359) = 30.35$ Yes, $p = .001$ But $r\phi = .28$	Men on Percussion $z = 3.2$ It is $\geq z = 2.87$
In the Conservatory from Seville	2018-19	The violin	Percussion	$\chi^2 (5, N = 363) = 36.49$ Yes, $p = .001$ And $r\phi = .30$	Women on Percussion $z = -3.0$ Men on Percussion $z = 3.6$ Both are $\geq z = 2.87$
	2012-13	The harp	The lute and the theorbo	$\chi^2 (6, N = 738) = 74.87$ Yes, $p = .001$ And $r\phi = .30$	Women on Brass $z = -5.0$ Men on Brass $z = 4.7$ Both are $\geq z = 2.91$
In the Conservatory from Seville	2015-16	The harp	The trombone	$\chi^2 (6, N = 825) = 80.41$ Yes, $p = .001$ And $r\phi = .30$	Women on Brass $z = -4.3$ Men on Brass $z = 4.1$ Both are $\geq z = 2.91$
	2018-19	The transverse flute	The organ	$\chi^2 (6, N = 866) = 89.32$ Yes, $p = .001$ And $r\phi = .31$	Women on Brass $z = -4.6$ Men on Brass $z = 4.7$ Both are $\geq z = 2.91$
Higher Music Education	2018-19	Lyrical and flamenco singing	Percussion	$\chi^2 (9, N = 524) = 72.85$ Yes, $p = .001$ And $r\phi = .35$	Women on Brass $z = -3.3$ It is $\geq z = 3.02$
In the Conservatory from Seville		Jazz drum kit	Jazz guitar		
		Jazz piano	The lute and the theorbo		
In the Conservatory from Seville		The peak flute	The trombone		
		The viola <i>da gamba</i>	Percussion		

- Education, no instrumental family, not even vocal, was found to be feminized.
- In the Higher Music Education, no instrumental speciality, and therefore no instrumental family, was found to have more than 70 percentage female students. On the contrary, there were numerous instrumental specialities in which no female students were enrolled.
 - The most masculinized instrumental specialities were percussion, “Renaissance and Baroque plucked string instruments” (the lute and the theorbo), trombone, organ, tuba, jazz drum kit, jazz guitar, jazz piano, peak flute, trombone and viola *da gamba*.
 - The most masculinized instrumental families were percussion, brass and mechanical wind (organ). In fact, percussion was the most masculinized instrumental family in all educational levels and academic years, except in the Professional Music Education in the 2012-2013 academic year, in which was brass wind, and in the 2015-2016 and 2018-2019 academic years, in which it appears besides mechanical wind family.
 - In each course and educational stage, the instrumental speciality that was the most feminized or masculinized did not necessarily belong to the instrumental family that was the most feminized or masculinized, respectively. For example, in the 2012-2013 Professional Music Education course, the most masculinized instrumental speciality was “Renaissance and Baroque plucked string instruments” (the lute and the theorbo), while the most masculinized instrumental family was brass.
 - In those educational stages and courses in which the instrumental speciality of organ and the instrumental family of mechanical wind were the most masculinized (specifically in the Professional Music Education in the 2015-2016 and 2018-2019 academic years), one more instrumental speciality or family was included in Table 3 due to the low number of students enrolled in that speciality.
 - The instrumental speciality that turned out to be the most feminized in the descriptive analysis of the data in all the academic years of the Basic Music Education, which was vocal education, coincided with the cells that had to be eliminated from the inferential analysis (Chi-square tests) in these courses and in this educational stage because they were not comparable to the rest of the categories due to the fact that they presented expected frequencies of less than 5.
 - The instrumental family that turned out to be the most masculinized in the descriptive analysis of the data in the 2015-2016 and 2018-2019 academic years of the Professional Music Education, which was mechanical wind family (organ), coincided with the cells that had to be eliminated from the inferential analysis (Chi-square tests) in those academic years and in that educational stage because they were not comparable to the rest of the categories due to the fact that they presented expected frequencies lower than 5.

The most notable results of the study, corresponding to the shaded cells in Table 3, are:

- The relationship between the variables “students’s sex” and “instrumental families and musical specialities” was significant with a medium effect size in five of the seven Chi-square tests performed, indicating that there were differences in the instrumental choices of female and male students.
- Differences in the instrumental choices of female and male students were determined by female and male brass players, and by female and male percussion players. This indicated that the instrumental families of brass and percussion made the greatest differences in the instrumental choices of female and male students. In addition, among the main results of the study, it was found that both boys and girls preferred in the first and second place to study specialities of the rubbed string and woodwind families, with

the exception that boys, in some courses and educational levels, preferred to study in first or second place, in addition to these options, instruments of the brass family. Likewise, in the third and fourth place, girls preferred to study struck string family, while this family was not among the four most favourites families of the boys. On the other hand, in the third and fourth place, boys chose to study instruments of the plucked string family, a family not found among the four most favourites families of the girls. Musicology and classical and flamenco singing were also found as the fourth most preferred specialities of the girls, specialities not present among the four most preferred by the boys.

After studying the students' preferences for the instrumental specialities in a disaggregated way, that is, not grouped into instrumental families, it was observed that the instrumental specialities most chosen by the female students in almost all the courses and educational levels studied were, in the first place, piano, in the second place, transverse flute, and in the third place, violin. In fact, the instrumental speciality of piano was the most preferred by girls in all the courses and educational levels studied. However, greater dispersion was found in the instruments most chosen by the boys. In some courses and educational levels, the instrumental speciality most preferred by the boys was piano. But on other occasions it was percussion, classical guitar or trumpet. While in some courses and educational levels, piano, classical guitar, flamenco guitar, trumpet, clarinet and percussion competed for the second and third place in the boys' preferences.

DISCUSSION AND CONCLUSIONS

The results of this investigation coincide, for the most part, with the results obtained in studies on the subject. Thus, as in Abeles and Porter (1978), a high feminization has been found in the instrumental specialities of flute and violin,

and a high masculinization of percussion, trombone and trumpet. Also, as in that study, the results point to the saxophone and the cello as more equal instrumental specialities, not appearing in any academic year of those analysed a number of female or male students less than 30 percentage, and being the saxophone the most equal instrumental speciality during the course 2018-2019 in the Higher Music Education in the Manuel Castillo Conservatory of Higher Music Education of Seville.

However, unlike previous research (Abeles & Porter 1978; Delzell & Leppla 1992) our results do not indicate the clarinet as a feminized instrumental speciality. In our investigation this instrument has being an equal instrumental speciality in most grades and educational levels, except for Basic Music Education during the 2018-2019 academic year in which the number of girls studying that instrumental speciality did not exceed 20 percentage. The results of our study are also aligned with those of Graham (2005), finding the tuba to be a male instrument and the flute to be a female instrument.

On the other hand, McKeage (2014) points out how difficult it is to find girls playing in jazz bands. In this sense, the results of our research prove that jazz specialities (jazz drum kit, jazz double bass, jazz guitar, jazz piano and jazz saxophone), which are only offered in Higher Music Education, are highly masculinized.

Regarding Spanish studies, our results coincide, in part, with those obtained by Martínez-Cantero (2017). In this study it is indicated that the instrumental families of woodwind, brass and percussion were related to boys and that string was related to girls. In our study it was indeed found that the instrumental families of brass and percussion are highly masculinized. However, the woodwind speciality was not found to be masculinized. On the contrary, we have found that, in many academic years, it is the most equal instrumental family, and on other occasions, the most feminized instrumental family, always behind the vocal instrumental families and not exceeding 70 percentage of

female participation. Martínez-Cantero (2017) concluded that the string instrumental family was related to girls. But in our study, in many educational levels and academic courses, the struck string family has been the most parity, and only in the 2015-2016 Basic Music Education course the rubbed string instrumental family appeared as the second with the highest number of female students, always behind the vocal instrumental specialities and not exceeding 70 percentage female participation. However, when it was equal, it had slightly more female students than male students.

With regard to the results corresponding to students of Higher Music Education in the 2018-2019 academic year, it should be noted that they are in the same line as those obtained by Sansaloni (2014) for the same educational level in the academic years from 2001-2002 to 2011-2012, as a much greater number of masculinized instrumental specialities than feminized ones were observed, and both studies have coincided in determining that among these masculinized specialities are composition, guitar, horn, organ, percussion, trombone, trumpet, tuba and instrumental specialities related to jazz. However, while Sansaloni (2014) determined that choral conducting, piano and saxophone were masculinized specialities, in our investigation it was observed that these instrumental specialities were the only ones that turned out to be in parity in this course and academic level, along with cello.

In the three academic years studied in the Professional Music Education, the masculinized instrumental specialities coincided to be the same: flamenco guitar, organ, percussion, trombone, trumpet, tuba and "Renaissance and Baroque plucked string instruments" (the lute and the theorbo). Likewise, in the three academic years studied in the Basic Music Education, percussion, trombone, trumpet and tuba were found to be masculinized instruments. These results are similar to those obtained in other studies (Abeles & Porter, 1978; Martínez-Cantero, 2017; Sansaloni, 2014).

In all courses and educational levels, the harp appeared as a feminized instrumental speciality, except for Higher Music Education in the 2018-2019 academic year where the transverse flute was also identified as a feminized instrumental speciality in most courses and educational levels, coinciding with the findings of Griswold and Chrobak (1981) and Sansaloni (2014).

The instrumental families that turned out to be feminized were the vocal ones (vocal education, classical singing and flamenco singing). These results coincide with Sansaloni (2014), Soler (2018) and Green (2001).

It is noteworthy that in the Higher Music Education during the 2018-2019 academic year, the third favourite speciality of female students was musicology, a career focused on the historical analysis of scores and whose main professional opportunity is teaching, whereas for male students was composition, a career focused on musical creation. This result is in the line of the theories of Aller (2009), Soler (2018) and Díaz-Mohedo (2005), who denounce the lack of female referents in composition and the low visibility that female composers still have in academic education.

The fact that the results of our investigation coincide, for the most part, with those obtained in studies of previous periods, seems to indicate the existence of a differentiation by gender both in certain instrumental specialities and in instrumental families as a whole, a differentiation that has remained constant over time. There are significant differences in the instrumental choices of women and men, marking these differences certain instrumental families: brass and percussion. At higher educational levels, the masculinisation of instrumental specialities is accentuated, to the extent that there are instrumental specialities in which no women are enrolled.

Among other reasons, the instrumental preferences of the students are conditioned by the number of places available in the different specialities. In this sense, one of the possible reasons why the rubbed string and woodwind

instrumental families are among the most chosen by both boys and girls is the large number of instruments that make up these families. Along the same lines, a possible explanation for the fact that the piano is the instrument preferred by girls and one of the boys' favourites can be found, simply, in the large number of places offered within this speciality. The fact that there are more boys studying in the brass and percussion instrumental families also increases the employment opportunities for male musicians, as most municipal bands are made up mostly of instruments from these families.

A novelty that was not expected to be found in this study is that some specialities have turned out to be feminized or masculinized depending on the course and the educational stage. For example, double bass was a masculinized speciality in the Basic Music Education during the 2012-2013 academic year and a feminized speciality in the Basic Music Education during the 2018-2019 academic year, and viola *da gamba* was a feminized speciality in the Professional Music Education during the 2012-2013 and 2015-2016 academic years and a masculinized speciality in the Higher Music Education in the 2018-2019 academic year. This could be the result of chance. We expected to find some masculinization in the instrumental families of brass and percussion, due to the results obtained in the studies reviewed, but we did not expect to obtain as a result that the organ was the most masculinized instrumental speciality in various courses and educational levels. Likewise, it was a surprise to find that the "Renaissance and Baroque plucked strings" (the lute and the theorbo) appeared as the most

masculinized in a specific course and educational level.

It is noteworthy that the two conservatories in Seville offer a wide variety of instrumental specialities in their curricula, as not all conservatories have the resources to teach organ or "Renaissance and Baroque plucked string instruments", specialities from which, as mentioned above, have been possible to extract very interesting results. This fact enriches other researches carried out. Most of them do not include an analysis of these instruments, except for the study by Sansaloni (2014), which includes the organ.

This investigation is important because, if the systems of choosing instruments are improved, we could eliminate the effects that influence and determine the future of professional musicians. The association of gender with certain instruments can significantly influence the students' choice of instruments and has shown negative implications and results (Adekogbe, 2013). In that way, future consequences in the profession should be eluded, as it has reached the extreme of not admitting women in certain musical ensembles (Vernia-Carrasco 2019). Therefore, we must keep on searching ways to reduce external factors in order to help students choose their instruments (Fund, 2020).

NOTES

1. Throughout this study, the terms gender and sex are used interchangeably and in the same sense; that is, biological difference, because the students were not asked about their gender, but the data used were provided administratively disaggregated by sex.

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