

Singing in Early Childhood Related to Family Cultural Background and the Choice of School Curriculum

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Abstract Interest in the possible benefits that music can bring to intelligence development has considerably grown in the past two decades. Especially music seems to enhance academic achievement in other disciplines. However numerous studies made under different points of view have yielded discordant results due to two orders of problems: 1- difficulty of isolating variables that can co-affect the positive transfer between music and other learning processes (e.g. socioeconomic family status, motivations, the role of the teacher, type of music interventions). 2- Methodological inhomogeneity and the variety of different approaches (e.g. presence or absence of randomization, presence or absence of the control group, representativeness of the sample). This study takes into account the results of the OECD – PISA 2009 survey and merges them with the more detailed and comprehensive data collected in Italy and in the autonomous province of South Tyrol (Italy). In order to comply with the needs of the research only one kind of musical practice is taken into account, singing song in early childhood, using a randomized sample, isolating as related variables the parents' cultural, socio-economic and the immigration status. The results show how the practice of singing songs in early childhood influences the choice of curriculum after compulsory education and what types of families tend to encourage the practice of singing related to the cultural level of the parents.

Keywords: *academic achievement, choice of school curriculum, family cultural background, OECD – PISA Research, singing songs*

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1. Introduction

The impact of musical training on cognitive abilities and on academic achievement has aroused a considerable interest across the scientific community in the last decades producing a remarkable bibliography. The main purpose of the research concerns how to guide educational policies and school curricula in order to improve essential skills in children and eventually to support those at risk or with behavioral difficulties.

Quantitative recent surveys carried out by The American College Board [1] show that in 2015, students who took four years of arts and music classes while in high school scored an average of 93 points higher on their SATs than students who took only one-half year or less.

Likewise Thornton looking at the results of the school test scores of more than 7000 students, concludes that "Significantly higher scores were found for students involved in music compared with students not involved in music. It would seem music students did not have a disadvantage on the state test, despite the time they spent on musical activities" [2], Hille et al. tested 194 boys in Grade 3 by measuring reading and spelling performance,

non verbal intelligence and asked parents about musical activities since preschool. The result was that "Intelligence was higher for boys playing an instrument ($p < .001$). [...]. This effect was observed independently of IQ. Our findings suggest an association between music education and general cognitive ability as well as a specific language link" [3]. Even more recent studies, following 147 children in six Dutch schools over two and a half years by giving theoretical and practical lessons, showed "a positive influence of long-term music education on cognitive abilities such as inhibition and planning [...]. All results combined, this study supports a far transfer effect from music education to academic achievement mediated by executive sub-functions" [4].

Despite these results, other studies have produced discordant findings assuming that other factors would affect the students' school performances before or together with the music itself. Elpus for example, taking into consideration the demographic variable, the past academic achievements, the use of the time and the attitude towards school, has pointed out that "Results indicated that music students did not outperform non-music students on the SAT once these systematic differences had been statistically controlled. The obtained pattern of results remained consistent and robust through

internal replications with another standardized math test and when disaggregating music students by type of music studied" [5]. Rickard, Bambrick and Gill, after six months of musical enhancement in public school sample classes, claim that "In contrast to previous research on the effects of private music tuition, no convincing benefits of school music classes were apparent. Trends of interest were observed in non-verbal intelligence, aggression scores and verbal memory, which require further investigation" [6]. Kinney's purpose was to investigate the theoretical models of prediction to students' decisions to enroll and persist in urban middle school band programs using independent variables of academic achievement, socioeconomic status (SES), family structure, mobility, ethnicity, and gender. The researcher came to the conclusion that "Academic achievement and family structure emerged as the only significant predictors of initial enrollment decisions [...]. Comparisons between models suggest slight differences in the non music factors affecting initial enrollment and retention" [7]. Southgate and Roscigno have examined the association between music involvement and academic achievement in both childhood and adolescence using three measures of music participation: in school, outside of school, and parental involvement in the form of concert attendance. The results show that "the overall variance explained changes little across equations as music indicators are added. This suggests to us that music is meaningful not as a predictor of achievement in and of itself, but rather as a mediator, to some degree, of family background and student status, thus supporting arguments and theorizing pertaining to cultural capital. Music, for example, might influence disposition or habits of mind" [8].

Assessing the transferal between music practices and other cognitive skills seems to involve different types of problems: 1- The complexity of isolating the variables that can co-influence this transfer (e.g. socio-economic status of the family, motivations, family expectations, the role of the teacher, type of music interventions). 2- Methodological inhomogeneity and the variety of different approaches (e.g. presence or absence of randomization, presence or absence of the control group, representativeness of the sample).

Recently an attempt has been made to put order into this discrepant research by drafting critical reviews of studies in the field of neuroscience, selected in order to obtain more homogeneous partial results. We will consider three of them with particular reference to musical transfer to mathematical and linguistic fields.

Assuming that the cerebral cortex self organizes as we engage with different musical activities, it seems that skills in these areas may transfer to other activities if the processes involved are similar. Starting from this assumption, Hallam has taken into consideration the literature concerning the transfer of some musical skills in relation of perceptual, language and literacy skills, numeracy, intellectual development, general attainment and creativity, personal and social development, physical development, health and wellbeing. The analysis led Hallam to conclude that "Speech and music have a number of shared processing systems. Musical experiences which enhance processing can therefore impact on the perception of language which in turn impacts on learning to read.

Active engagement with music sharpens the brain's early encoding of linguistic sound" [9]. Regarding transferable musical skills in mathematics, Hallam concludes that the research has produced mixed results "in part, because not all mathematics' tasks share underlying processes with those involved in music. Transfer is dependent on the extent of the match, for instance, children receiving instruction on rhythm instruments scored higher on part-whole maths problems than those receiving piano and singing instruction".

A recent, important critical review on music interventions and child development has been realized by Dumont, Syurina, Feron and van Hooren analyzing the evidence of 46 studies, dealing with five developmental domains, including the motor, social, cognitive, language, and academic domain. Regarding the language domain, "Several studies have explored the association between a music intervention or music training and performance on (specific) language skills respectively, with contradictory findings" [10]. Four studies taken into consideration have explored the effects of music on mathematics. The four studies reviewed yielded mixed results. One reported positive results. The remaining three studies were (longitudinal) quasi-experimental without randomization and longitudinal developmental. Of these three studies, one found a positive association, one found partial positive results, and one found no relation. Only one of these three studies included an active control group. The authors affirm that "Regarding academic performance, research suggests some possible beneficial effects of music, although precise conclusions cannot be reached on the basis of reviewed studies. It cannot be concluded whether participation in a music program had a positive effect on promoting a positive approach due to the lack of randomization, the representativeness of the sample, the potential influence of parental and teacher expectations" [10].

A third critical review on Music education and its effect on intellectual abilities in children was carried out by Jaschke, Honing, Eggermont and Scherder in 2013. The purpose of the review was the need to standardize the survey methods in order to obtain more homogeneous results than of those achieved by research so far. Out of the 217 articles examined by the survey only 61 were considered relevant by the meta-analysis. The exclusion of the others was due to the lack of an adequate structured classification of music and musicality and a lack of understanding of the neuropsychological effects underlying far transfer. Studies were excluded when effects were measured on the basis of study sizes rather than sample sizes, when there was no control group, when they analyzed near transfer, when they were meta-analyses or longitudinal studies lasting less than 12 months. The results show that the majority of these analyzed articles obtained positive effects of music education on reading, while in others the results are inconsistent or inconclusive. These differences can be traced back to the analytical methods used, differences in the forms of music education studied and differences in neural activation during the processing of these tasks. Similar conflicting results were also recorded for the phonological awareness. Likewise, the analysis of the transfer from music to mathematical skills appears to be controversial. "The difficulty of

analyzing transfer from music to mathematics is similar to that where reading is involved, as both target domains have to be divided into sub-groupings" [11].

2. Singing Songs and the Research Purpose

Our research, of quantitative nature, seeks to confirm a possible cognitive transfer of music training on academic achievement taking into account the methodological criticalities outlined: a) isolating only one type of musical practice, singing song in early childhood, thus eliminating other possible practices that may interfere; b) by using a randomized sample, the one used by the OECD-PISA tests; c) isolating as related variables the parents' cultural, socio-economic and the immigration status. Other variables had already been taken into account in a previous contribution of Maule and Hilpold confirming that "The results would seem to indicate that the performances of the 15-year-olds in mathematics, science and reading comprehension are positively correlated to the frequency with which they were able to undergo musical-vocal experiences inside the family during their first years of life" [12].

As in the previous survey, we took into consideration data from the OECD - PISA 2009 research and, in particular, the replies given by the parents of 15-year-old school pupils. The question asked was formulated as follows: *When your son/daughter was attending the first year of primary school, how often did you (or someone else at home) involve him/her in the following activities?* The question involved the parents of 3,123,744 15-year-old school pupils (this is a weighted value). A valid answer was given by the parents of 2,247,100 students. The question was not included in the later OECD PISA tests, therefore we will still use the data provided in 2009, coming from the fifteen states in which the parents questionnaire was administered. This time we will answer the following questions:

Is the singing practice in early childhood meaningful as a predictor of academic achievement or is it a mediator of family cultural background?

Is the practice of singing a predictor to student's curricular choices independently of the socioeconomic and cultural status of the family?

The international data taken as a whole do not provide an answer to this last question; indeed, the OECD PISA research does not differentiate the types of schools attended by the questioned students. Schools beside differ from state to state and are not comparable with each other. To answer the question we therefore considered the data provided by the OECD research integrating them with those, more complete and detailed, relating to Italy and to the restricted area of South Tirol, an autonomous province in northern Italy with a majority of German-speaking inhabitants.

3. Methodology

The OECD – PISA survey benefits from the collaboration of a large number of prominent scientists

and researchers in the field of learning and education. PISA is characterized by the use and practical application of the IRT (Item response theory), a theory of probability testing based on the models of Rasch. To determine the estimates and standard errors a complex weighting procedure was applied to the sample that reproduces the sampling design, while for the actual calculation the bootstrap methods were used with the support of the relative software. The Jackknife or bootstrap methods do not take into account the form of distribution either for the sample or for the underlying statistical universe. A great number of methods based on classical test theory require the normality of the distribution in the sample to be established, whereas the methods used in PISA also work with other distributions.

The Rasch methods make it possible to represent the results of the single postulate (based on a series of plausible values) where the personal capacity in terms of probability and the difficulty of every single item are indicated on the same unidimensional scale. The mean of the results for the OECD is standardized at 500 points with a standard deviation of 100 points. The models used in PISA are suitable for carrying out research on a large or medium scale and do not lend themselves to making statements about individual postulates [13].

In the present study, which looks more deeply into certain aspects of the PISA survey, the same analysis methods were used. The dichotomization of the variable 'sing songs' was made on the valid answers, thus obtaining three categories: one for those who did not answer this item (who are nevertheless present in the database because they answered other items and are therefore not part of the missing data) and the two categories regarding the frequency of singing songs.

The internal validity of the PA03 factor was measured by applying simple estimates of correlation (rank, or more precisely Spearman, as we are dealing with ordinal scale variables) between the single variables, measuring the significance in accordance with the PISA methods.

To measure the relation between the results obtained for the 'sing songs' variable (ordinal scale in the dichotomized form) and the performances in PISA (continuous interval scale variables) we opted for the Kendall correlation, which does not require linearity or equidistance, nor a high level of scale.

4. The Variable Singing Songs in Early Childhood in the OECD- PISA Research

The variable is present only in the OECD-PISA 2009 study. The characteristic of singing in early childhood was revealed by means of the Parent Questionnaire in which it was included in question no. 3 composed of a group of 9 partial questions related to the parents' activity with their children when they attended the first class of primary school.

The question asked was formulated as follows:

When your son/daughter was attending the first year of primary school, how often did you (or someone else at home) involve him/her in the following activities?

The question (PA03) was a container for nine multiple-answer items (PA03Q01 to PA03Q09), namely: a) Read

books; b) Tell stories; c) Sing songs; d) Play with alphabet toys; e) Talk about things you had done; f) Talk about what you had read; g) Play with word games; h) Write letters or words; i) Read aloud signs. The possible answers were: 1) Never or hardly ever; 2) Once or twice a month; 3) Once or twice a week; 4) Every day or almost every day. Here we will focus on the third item, namely: c) Sing songs.

The questionnaire aimed at parents was administered in Chile, Denmark, Germany, Hungary, Italy, Korea, New Zealand, Poland, Portugal, Croatia, Hong Kong, Lithuania, Macao, Panama, Qatar. The question involved the parents of 3,123,744 15-year-old school pupils. A valid answer was given by the parents of 2,247,100 students. This question was left unanswered on 20% of questionnaires.

The nine activities considered by the variable PA03 in the Parent questionnaire are moderately correlated with a Pearson correlation coefficient from 0.30 to 0.50, always highly significant. It is possible to split the indicator into two distinct partial indicators: the factor analysis shows clearly the following two groups of variables: a first group consisting of read books, tell stories, sing songs, what you had read, things you had done and a second group composed of other variables. The first group could be characterized as more traditional activities, the second group as more "modern" practices.

Let's take a look at the frequencies within the variable "sing songs in the early childhood", referring to the sample of those who were given the parent questionnaire:

Table 1. We consider the answer: "every day or almost every day"

Activities	Every day or almost every day
Read books	37,2 %
Tell stories	32,2 %
Sing songs	30,6 %
Alphabet toys	26,4 %
Things you had done	54,5 %
What you had read	22,5 %
Play word games	22,9 %
Write letters or words	51,8 %
Read aloud signs	41,2 %

Table 2. If we put together the two statements "every day" and "once or twice a week" the frequency order does not change substantially

Activities	every day or almost every day & once or twice a week
Read books	71,5 %
Tell stories	71,5 %
Sing songs	61 %
Alphabet toys	63,5 %
Things you had done	79,1 %
What you had read	57,1 %
Play word games	61,3 %
Write letters or words	81,8 %
Read aloud signs	71,1 %

4.1. Kind of Users of Sing Songs

Among those who sing intensely, in **57%** of the cases there are parents of **females** versus **43%** of parents of **males**. The difference is significant. Consider that the parents of males and females are almost equally distributed in the sample.

4.2. The Activity "sing songs" and the Socioeconomic Status of Parents

Now we consider the correlation between ESCS variable divided into quartiles and the grouped answers "sing songs every day or almost every day" with "sing songs once or twice a week". The correlation of sing songs with the variable ESCS (economic, social and cultural status - indicator of the socio-economic and cultural status of the family) is weak with coefficient (Pearson) of 0.123 (SE 0.0059). ESCS is a composite indicator that integrates employment status with the family's cultural level. Dividing the ESCS variable into quartiles we can see the following situation:

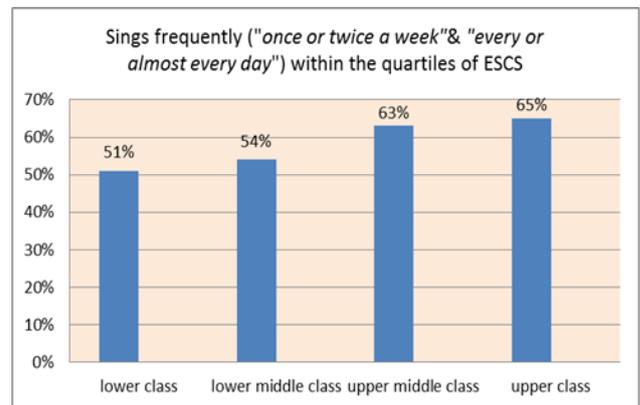


Figure 1.

The differences are not remarkable and even in the lower quartile split more than half of the parents answer that they sing at least once a week. Taking the frequent singers in full and looking at how the various socio-economic classes are present among them, we can observe an almost equal distribution.

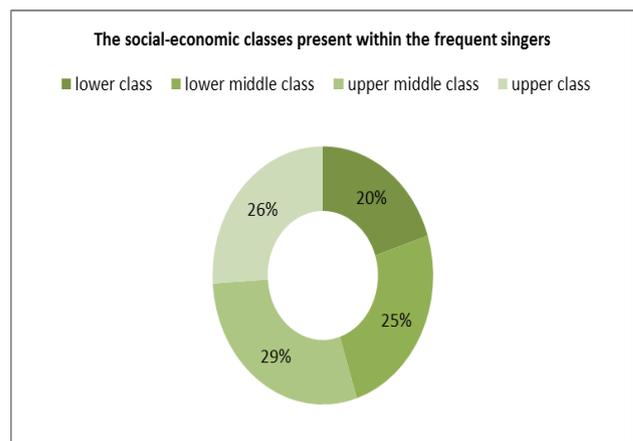


Figure 2.

The sing songs variable (PA03Q03 in the parents questionnaire) is split into:

1 rarely (singers) ← espl. 1 e 2 di PA03Q03

2 frequently (singers) ← espl. 3 e 4 di PA03Q03

as already practiced on other occasions.

While in the ESCS quartiles there are 25% of the population in each, the dichotomization of the sing songs variable has the following percentage distribution:

1 rarely s. 40,8 %

2 frequently s. 59,2 %.

If the socio-economic and cultural status does not affect the frequency of the singing, the expected presence of the frequently singers would be in each quartile more or less than 59.2% against the 40.8% of the rarely singers.

Let's look at the following chart:

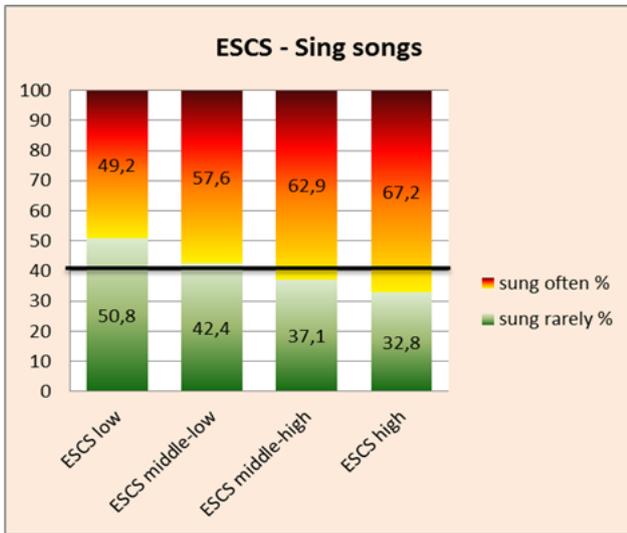


Figure 3.

It is worth looking at the individual components of socio-economic and cultural status

4.3. The Sub variable “sing songs in the early childhood” and the Parental Employment Status¹

Looking at the International student file we note that the correlation between the practice of the sing songs and the employment characteristics of the parents is very small, even if statistically significant. We considered the variables:

FSECATEG (Father White collar/Blue collar classification) -0,063**

MSECATEG (Mother White collar/Blue collar classification) -0,099**

HSECATEG (Highest parent White collar/Blue collar classification) -0,090**

HISEI (Highest parental occupational status) 0,090**

The figures to the side give the correlation according to Pearson. ** indicates a very high level of significance with a rejection error of less than 0.001. Negative values derive from the fact that the corresponding variable is indexed in descending order. This applies to White collar / Blue collar, where 1 stands for with collar high skilled and 4 for blue collar low skilled.

We can conclude that the employment level of parents does not affect the frequency of singing with children in their early childhood.

4.4. The Sub-variable “sing songs” and the Parents' Cultural Status

The situation is different for the educational characteristics of the family. Let's consider the variables

FISCED (Educational level of father) 0,109**

MISCED (Educational level of mother) 0,150**

HISCED (Highest educational level of parents) 0,135**

PARED (Highest parental education in years) 0,140**.

Here too the figures to the side give the correlation according to Pearson. ** indicates a very high level of significance with a rejection error of less than 0.001. We observe a certain relationship, albeit weak, but always highly significant, between the parents' level of education and the frequency of the practice of singing in early childhood. The father's studies have little influence, while the influence of the mother's educational level is not to be considered random.

4.5. The Sub-variable “sing songs” and the Migration Status of Parents

Non-immigrants - first-generation immigrants - second-generation immigrants.

Table 3.

Group percentages of frequencies of “sing songs in the early childhood” within immigration status		
	rarely ²	frequently ³
Native	38%	62%
Second generation	53%	47%
First generation	54%	46%

Although the percentage of parents with migratory background indicating that they rarely sang with their children is considerably higher than that of the natives, it should be noted that the group of people with migratory background who sang frequently is considerable. In part this may be attributed to the fact that these parents wished to continue their traditions also by singing with the children [14].

4.6. Influence of the Sing Songs in Early Childhood on PISA Reading Performance

The sing songs variable is very spurious as a predictor of the read performance (or even mathematics and science) and has communalities with other stronger influences on the results. It is a matter of checking if the singing songs are on the side of those determinants that act positively together on the PISA reading performance.

4.7. Resilience

Resilience refers to the capacity of individuals to prosper despite encountering adverse circumstances. In accordance with the OECD-PISA definition of resilience this paper defines academic resilience as the ability of 15-year-old students from disadvantaged backgrounds (bottom quarter of ESCS variable which indicates the socio-economic status) to perform at a certain level in the Programme for International Student Assessment (PISA) in reading (here: almost Level 3 of proficiency levels, which means more than 480,18 score points in reading).

¹ In the PISA study: Blue collar vs. White collar.

² Rarely = “never or hardly ever” & “once or twice a month”

³ Frequently = “once or twice a week” & “every or almost every day”

The percentage of students that achieved proficiency level 3 and whose parents were given the parents questionnaire containing the variable “activities in early childhood: sing songs” was 60.4%. The resilient students, i.e. those of the bottom quarter of ESCS that reach level 3, are 39% (In comparison, the students of the top quarter that reach level 3 are 79.5%. That is more than double the percentage of resilient students).

Comparing the frequency of early childhood singing of resilient and non-resilient students yields a distribution that is slightly in favor of those who sing frequently, but the difference is not significant. The conclusion therefore is, that the examined variable has no significant influence on resilience.

Table 4.

Bottom quarter of ESCS	resilient	non resilient
sang rarely	61%	39%
sang frequently	65%	35%

4.8. Distribution on the Type of School

One of the largest communities that administered the parents questionnaire was Italy, with considerable oversampling (which, however, has the right weight on the overall sample). This was due to the subdivision of the sample with respect to the regional differences and to the different types of schools.

In Italy, fifteen-year-olds attend the first or second class of upper secondary school. In this grade the schools differ by school type. In the sample there are also some pupils with a serious educational delay who are still in lower secondary school (middle school). The frequency of the various school types was described with the ‘program’ variable in the database of PISA 2009:

Lyceums ⁴	42%
Technical Institutes ⁵	30%
Professional Institutes ⁶	22%
Middle schools ⁷	1.5%
Vocational schools	3.4%

It is a characteristic of the Italian school that lyceum is preferred to other types of school. This tendency is reinforced by parents belonging to the same social stratum that, among other things, practices singing with their children in early childhood.

More than 50% of young people with parents who sang with them every or almost every day enrolled in lyceums and 28% in technical institutes. On the other hand, the lyceums are populated by 43% of these young people. Only 17% of lyceums students have parents who never sang with them in early childhood.

We can conclude that in lyceums, children whose parents have often sung with them in early childhood are largely over-represented. In fact, this type of school is much more likely to be chosen by students who had this opportunity rather than by students who rarely sang with their parents.

The sample of Italy gives the opportunity to observe if in the various regions there is a different distribution of the practice of singing songs in early childhood.

In the central regions and in the south the percentage of frequent singers is with 65% slightly higher than in the north with 60%. The difference is just significant.

If we consider only the frequency of those who indicate they have sung every or almost every day we have the following frequency map in the Italian regions:

4.9. Sang Every or Almost Every Day

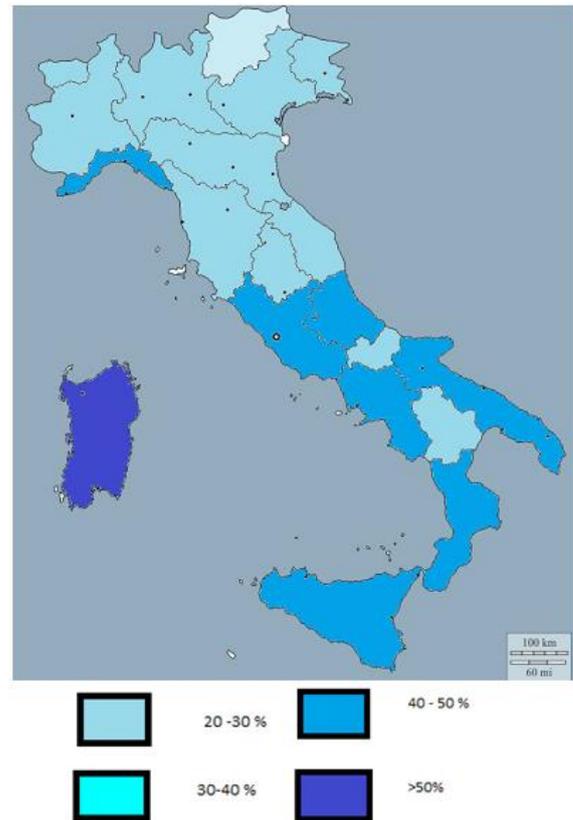


Figure 4.

5. Conclusion

In a 2013 study we showed that singing in early childhood has a positive influence on long term academic achievement. Pupils that had the opportunity to sing score better in mathematics, science and reading on standardized PISA tests.

Here, building upon our previous study, we investigated the family-related variables that affect singing and whether they influence long term curriculum choices.

The results show that within a family:

1. Girls are more involved in singing activities (57%) than boys (43%).
2. Socioeconomic factors have a small effect on the incidence of singing.
3. The parent’s occupation does not influence singing.
4. Singing is less common in first- and second-generation immigrant families compared to families with no immigration background, yet still higher than what is expected from other variables.

⁴ Classical, scientific or linguistic high school.

⁵ Industrial technical or commercial technical institute.

⁶ Educational institution for industrial or commercial professions

⁷ Lower secondary schools.

5. The family variable that has the greatest positive effect on the frequency of singing is the mother's cultural status, whereas the educational level of the father seems to have no effect.
6. It is safe to say that there exists no significant relation between singing in early childhood and resiliency.
7. The influence of singing in early childhood on school choices is statistically significant regardless of the parents' educational level and type. Pupils who sang tend to choose high schools over technical and vocational schools.

In conclusion, our study confirms the results of previous research on this topic, i.e. that musical activities -and more specifically singing- within the family have a positive effect on the cognitive and personal development of children.

List of Abbreviations

OECD Organisation for Economic Co-operation and Development.
 ESCS. (Index of) Economic, Social and Cultural Status
 PISA. Programme for International Student Assessment.
 PA. Parents
 PAQ. Parents Questionnaire
 MISCED. Mother's Index of school education.
 FISCED. Father's Index of School Education.
 HISCED. Highest Index of School Education.
 PARED. Parent's Index of School Education
 IRT. Item response theory

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