Supplementary Materials

A Longitudinal Study on Children's Music Training Experience and Academic Development

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Methods:

Participants

The participants were students at Chengdu Normal University Elementary School, which is jointly sponsored by Sichuan Observatory of Music. All the children were provided the opportunity to receive formal music training since the beginning of semester 3. Children and their parents made their own decisions to receive the music training or not. Among the 77 musician children, 57 children played instruments, and 10 children practiced vocal and another 10 practiced both. When children entered the school in September 2006, they were randomly assigned to one of the five cohorts, each containing approximately 50 children. The musician/non-musician ratio was similar across cohorts (15/35; 16/33; 17/34; 13/37; 16/34).

Out-of-school academic engagement

It is common for a school-aged child in China to receive extra instruction out of school. At semester 11, children were asked to report whether they were receiving extra instruction of L1, L2, and mathematics out of school; if so, how much instruction (in minutes) they were receiving every week on each subjects. Out of the 173 non-musician children, 99 children were receiving instruction of L1 (M = 68.18min, SD = 57.14), while 86 children were receiving instruction of L2 (M = 66.22min, SD = 57.74), and 133 children were receiving instruction of mathematics (M = 81.26min, SD = 73.45). Out of the 77 musician children, 54 children were receiving instruction of L1 (M = 59.76min, SD = 48.87), while 42 children were receiving instruction of L2 (M = 68.44min, SD = 60.78), and 59 children were receiving instruction of mathematics (M = 80.72min, SD = 74.31). Separate independent samples t tests showed that musician and non-musician children did not differ in the amount of extra instruction they received for each subject (p's > .36). Then, bivariate correlational analysis examined whether the weekly amount of extra instruction children received for each subject was related to their music training experience (WA), their academic performance, and IQ at semester 11. Non-musician children were included in the analysis with each of their music experience indicators equal to zero. Results showed that the weekly amount of music training (WA) was not associated with the weekly amount of extra instruction children received for L1 (p = .45), L2 (p = .75), or mathematics (p = .64). Additionally, children's IQ was not associated with the weekly amount of extra instruction they received for L1 (p = .46), L2 (p = .93), or mathematics (p = .79). Furthermore, the weekly amount of extra instruction children received for L1, L2, and mathematics was not associated with their performance on L1 (p = .53), L2 (p = .22), or mathematics (p = .91) respectively at semester 11. Thus, out-of-school academic engagement was not included in the data analysis.

Results:

Did music training independently contribute to children's final musical development?

Bivariate correlational analysis showed that children's final musical aptitude (i.e., semester 11) was correlated with *weekly amount of musical practice* (WA) (r = .34, p < .001), parents' education (r = .24, p < .001), and pre-training musical aptitude (r = .32, p < .001). Did music training independently contribute to children's final musical aptitude? A direct entry regression model analyzed the unique contribution of WA, parents' education, and pre-training musical aptitude to children's final musical aptitude. Results showed that WA and pre-training musical aptitude independently accounted for 7.3% and 11.1% of the variance of children's final musical aptitude based on the squared semi-partial coefficients (sr^2 in Table S1). Thus, it demonstrated

that music training did enhance children's musical development. Effect sizes were estimated for the predictors using Cohen's (1988) f^2, $f^2 = \frac{sr_i^2}{1 - R_{full}^2}$, where the numerator is the squared semi-partial correlation coefficient for the predictor of interest and the denominator is 1 minus the squared multiple correlation coefficient for the full model. Cohen considered an f^2 of .02 to be a small effect, .15 a medium effect, and .35 a large effect. Therefore, results revealed that WA had a small-to-medium effect size and pre-training musical aptitude has a close to medium effect size.

Table S1. *Regression Analysis for Variables Predicting Children's Final Musical Aptitude*

Variable	β	sr^2	f^2
Music training (WA)	.271***	.073	.093
Pre-training musical aptitude	.335***	.111	.142
Parents' education	.129 (ns)		

*** < .001; ns: not significant
$R_{full}^2 = .213$
Note: β = standardized regression coefficient, sr^2 = squared semi-partial coefficient, f^2 = Cohen's (1988) effect size statistic for multiple regression analyses.

Did music training independently contribute to children's final performance on L1? Bivariate correlational analysis showed that children's final performance on L1 (i.e., semester 11) was correlated with *weekly amount of musical practice* (WA) ($r = .20, p < .001$), parents' education ($r = .17, p < .01$), IQ ($r = .13, p < .05$), and pre-training performance on L1 ($r = .20, p < .01$). Did music training independently contribute to children's final L1 performance? A direct entry regression model analyzed the unique contribution of WA, parents' education, and IQ to children's final performance on L1. Results showed that pre-training performance on L1 independently accounted for 2.6% of the variance of children's final performance on L1 with a small effect size (Table S2).

Table S2. *Regression Analysis for Variables Predicting Children's Final Performance on L1*

Variable	β	sr^2	f^2
Music training (WA)	.100 (ns)		
Pre-training L1 performance	.167*	.026	.092
IQ	.088(ns)		

Parents' education	.106 (ns)

* < .05; ns: not significant
R_{full}^2 = .072

Did music training independently contribute to children's final performance on L2? Bivariate correlational analysis showed that children's final performance on L2 (i.e., semester 11) was correlated with *weekly amount of musical practice* (WA) (r = .19, p < .01), parents' education (r = .23, p < .001) and IQ (r = .20, p < .05). Did music training independently contribute to children's final L2 performance? A direct entry regression model analyzed the unique contribution of WA, parents' education, and IQ to children's final performance on L2. Results showed that WA, parents' education, and IQ accounted for 2.0%, 5.6%, and 4.7% of the variance of children's final performance on L1 with a small effect size (Table S3).

Table S3. *Regression Analysis for Variables Predicting Children's Final Performance on L2*

Variable	β	sr^2	f^2
Music training (WA)	.141*	.020	.022
Parents' education	.237***	.056	.064
IQ	.220**	.047	.054

* < .05, **< .01, ***<.001
R_{full}^2 = .128

Did music training independently contribute to children's final performance on mathematics? Bivariate correlational analysis showed that children's final performance on mathematics (i.e., semester 11) was correlated with *weekly amount of musical practice* (WA) (r = .14, p < .01), parents' education (r = .15, p < .05), IQ (r = .37, p < .001), and pre-training performance on mathematics (r = .24, p < .01). Did music training independently contribute to children's final mathematical development? A regression model analyzed the unique contribution of WA, parents' education, IQ, and pre-training performance to children's final performance on mathematics. Result showed that parents' education, IQ, and pre-training performance independently accounted for 1.9%, 9.2%, and 3.3% of the variance of children's final performance on mathematics with a small or small-to-medium effect size (Table S4).

Table S4. *Regression Analysis for Variables Predicting Children's Final Performance on Mathematics*

Variable	β	sr^2	f^2
Music training (WA)	.104(ns)		
Parents' education	.139*	.019	.023
IQ	.311***	.092	. 112
Pre-training mathematics performance	.186**	.033	.040

* < .05, **< .01, ***<.001
R_{full}^2 = .181

Did music training independently contribute to children's IQ? Bivariate correlational analysis showed that children's IQ was marginally correlated with *weekly amount of musical practice* (WA) ($r = .11, p = .079$), and significantly associated with children's performance on L1 ($r = .13, p < .05$), L2 ($r = .20, p < .01$), and mathematics ($r = .37, p < .001$) at semester 11. Did music training independently contribute to children's IQ? A regression model analyzed the unique contribution of WA and children's final performance on L1, L2, and mathematics to IQ. Results showed that only children's final performance on mathematics independently contributed to IQ by accounting for 10.0% of the variance of IQ with a small-to-medium effect size (Table S5).

Table S5. *Regression Analysis for Variables Predicting Children's IQ*

Variable	β	sr^2	f^2
Music training (WA)	.058(ns)		
Final performance on L1	.082		
Final performance on mathematics	.372***	.100	. 117
Pre-training mathematics performance	.065(ns)		

***<.001
R_{full}^2 = .146