

School-Level Factors Impacting Arts Achievement for Fourth Graders: A Longitudinal Analysis


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Introduction

- The movement from STEM education to STEAM education in recent years has increased interest in the value of arts in education.
- Decades of research supports the notions of STEAM reformers.
- Many studies have reported that students' arts achievements can be influenced by individual factors such as gender, SES, and ethnicity (Imms, 1997; Janson, Janson, & Marmor, 1986; Dwyer, 2011).



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Introduction (con't)

- However, school-level factors such as “school climate”, “school type”, “school SES”, “school location”, “school size” may also explain variations in students’ arts achievement.
- This study uses a longitudinal method to investigate how school factors (school poverty, location, size, annual school report card rating, gender, and race/ethnicity) influence students’ music and visual arts scores over time.



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Research Questions

1. Are the means of school music and visual arts 25th percentile (low achievers), 50th percentile (middle achievers), and 75th percentile (high achievers) scores consistent across years from 2011 to 2017?
2. Are there any school factors that impact the means of school music and visual arts 25th percentile (low achievers), 50th percentile (middle achievers), and 75th percentile (high achievers) scores across the years from 2011 to 2017?



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Research Questions (con't)

3. Do the school factors affect low (25th percentile scores), middle (50th percentile scores), and high (75th percentile scores) achieving students differently for both music and visual arts assessment across the years from 2011 to 2017?



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Method

Participants: Fourth-grade students from 34 elementary schools from 2011 to 2017.

- Music test: 11,322 students (5,666 males, 5,655 females)
- Visual Arts test: 11,155 students (5,581 males, 5,573 females)

Dependent variables: Students' multiple-choice scores were aggregated into school-level scores. The 25th percentile, 50th percentile, and 75th percentile scores were calculated.



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Method (con't)

Independent variables:

1. School enrollment size
2. School location
 - “Rural” and “Urban”
3. School ratings: A measure of overall school quality. 5 ordinal categories:
 - “Excellent”, “Good”, “Average”, “Below Average”, “At-Risk”
4. Poverty Index
5. Gender
 - Proportion of males and females in a school
6. Race/Ethnicity
 - Proportion of Black students and other groups in a school



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Data Analyses

1. Descriptive analyses were conducted using SAS 9.4 software.
2. Multivariate normality (MVN) was assessed using R software.
3. Marginal models were used to test the population-average effects of school variables.
 - Normal distribution and an identity link function;
 - Generalized Estimating Equations (GEE);
 - Exchangeable matrix was assumed.



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Results

School Descriptive Results for Music Schools (N=34)

	Enrollment		Poverty Index		School Location		School Rating ^a					Proportion Female		Proportion Black	
	Size				(N)		(N)								
	M	SD	M	SD	Urban	Rural	B	A	G	E	M	SD	M	SD	
Overall	487	199.18	75.01	20.22	20	14	14	61	27	45	0.49	0.06	0.52	0.28	
2011	542	259.33	73.00	21.56	20	14	2	6	1	4	0.51	0.05	0.49	0.27	
2012	522	173.67	74.06	20.94	20	14	2	6	3	5	0.49	0.06	0.51	0.32	
2013	507	176.43	75.77	20.59	20	14	4	6	2	5	0.49	0.06	0.51	0.32	
2014	464	192.34	78.18	21.05	20	14	2	11	6	7	0.49	0.05	0.53	0.28	
2015	469	195.81	78.82	19.96	20	14	2	13	7	9	0.50	0.06	0.52	0.29	
2016	470	210.14	73.35	20.10	20	14	2	11	5	8	0.50	0.06	0.54	0.29	
2017	481	212.38	67.85	18.66	20	14	0	8	3	7	0.50	0.06	0.53	0.25	

Note: B=Below average; A=Average; G=Good; E=Excellent; No school is in the At-risk category

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Results (con't)

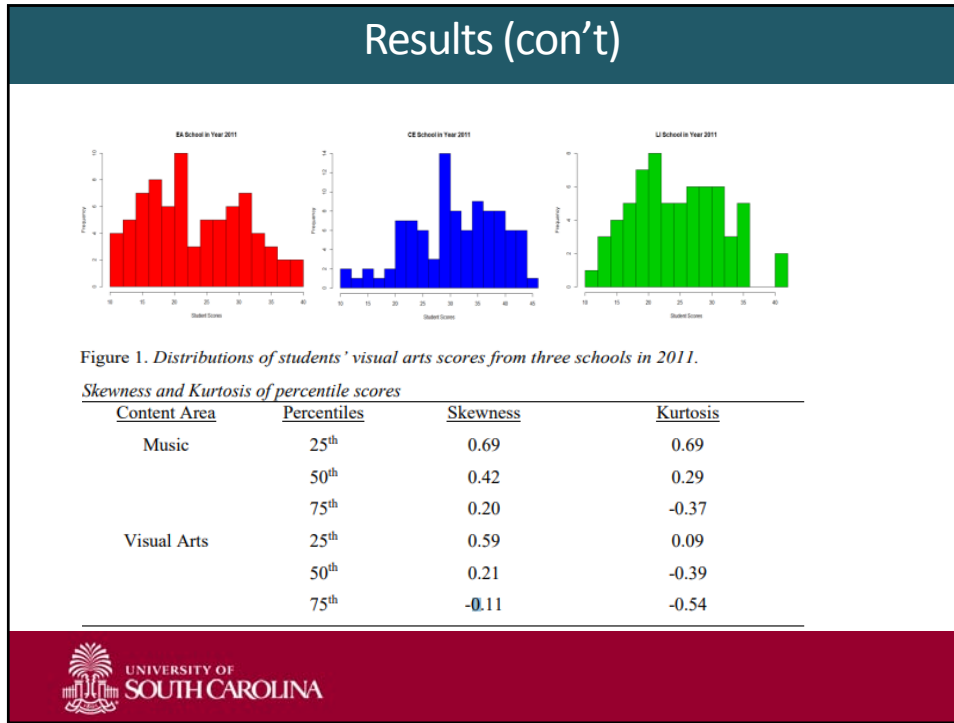
School Descriptive Results for Visual Arts Schools (N=34)

	Enrollment		Poverty Index		School Location		School Rating ^a					Proportion Female		Proportion Black	
	Size				(N)		(N)								
	M	SD	M	SD	Urban	Rural	B	A	G	E	M	SD	M	SD	
Overall	490	198.64	75.01	20.22	20	14	14	59	27	45	0.49	0.06	0.52	0.28	
2011	542	259.33	73.00	21.56	20	14	2	6	4	1	0.50	0.05	0.58	0.27	
2012	539	163.70	75.32	20.85	20	14	2	5	3	5	0.49	0.06	0.49	0.29	
2013	522	170.04	76.95	20.53	20	14	4	5	2	5	0.49	0.06	0.56	0.27	
2014	464	192.34	78.18	21.05	20	14	2	11	6	7	0.49	0.05	0.52	0.29	
2015	469	195.81	78.82	19.96	20	14	2	13	7	9	0.50	0.06	0.54	0.30	
2016	470	210.14	73.35	20.10	20	14	2	11	5	8	0.50	0.06	0.50	0.29	
2017	481	212.38	67.85	18.66	20	14	0	8	3	7	0.50	0.06	0.47	0.27	

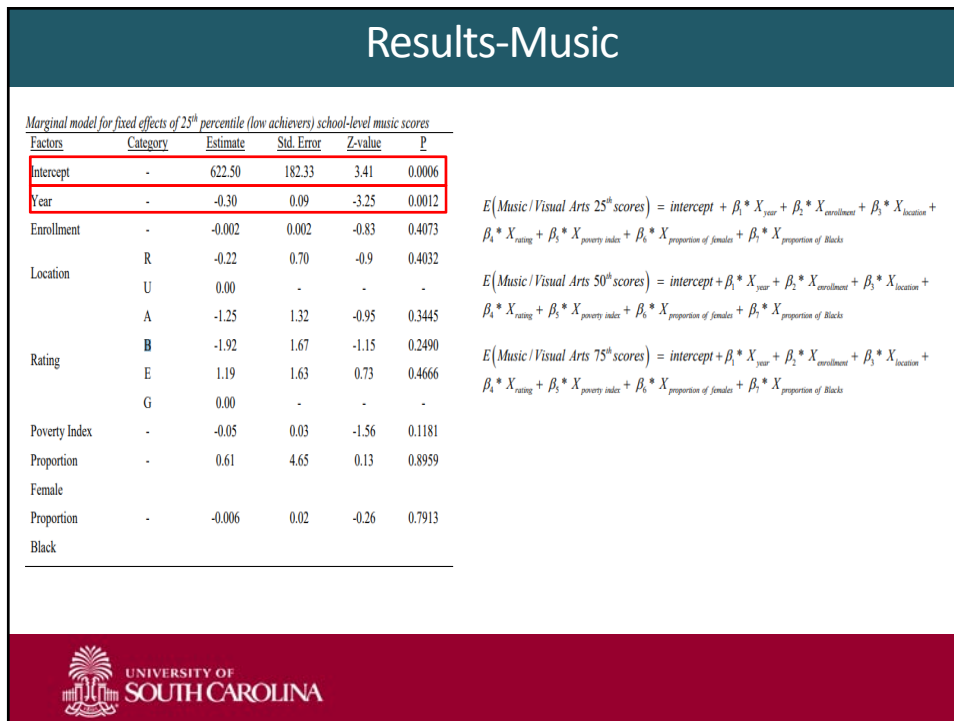
Note: B=Below average; A=Average; G=Good; E=Excellent; No school is in the At-risk category

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Results-Music (con't)

Marginal model for fixed effects of 50th percentile (middle achievers) school-level music scores

Factors	Category	Estimate	Std. Error	Z-value	P
Intercept	-	671.78	168.70	3.98	<0.0001
Year	-	-0.32	0.08	-3.78	0.0002
Enrollment	-	-0.001	0.003	-0.47	0.6357
Location	R	-0.19	0.59	-0.32	0.7465
	U	0.00	0.00	-	-
Rating	A	-0.74	1.46	0.50	0.6141
	B	-1.84	1.77	-1.04	0.3002
	E	1.49	1.65	0.90	0.3656
Poverty Index	G	0.00	0.00	-	-
	-	-0.04	0.04	-1.20	0.2293
Proportion of Female	-	0.001	0.05	0.02	0.9830
Proportion of Blacks	-	-0.02	0.03	-0.72	0.4702

Marginal model for fixed effects of 75th percentile (high achievers) school-level music scores

Factors	Category	Estimate	Std. Error	Z-value	P
Intercept	-	966.73	161.75	5.98	<0.0001
Year	-	-0.47	0.08	-5.73	<0.0001
Enrollment	-	-0.001	0.003	-0.49	0.6227
Location	R	-0.40	0.60	-0.67	0.5030
	U	0.00	0.00	-	-
Rating	A	-0.29	1.52	-0.19	0.8495
	B	-0.80	1.75	-0.46	0.6455
	E	2.00	1.60	1.26	0.2092
Poverty Index	G	0.00	0.00	-	-
	-	-0.03	0.04	-0.94	0.3458
Proportion of Female	-	0.02	0.06	0.25	0.8043
Proportion of Blacks	-	-0.02	0.03	-0.79	0.4308



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Results-Visual Arts

Marginal model for fixed effects of 25th percentile (low achievers) school-level visual arts scores

Factors	Category	Estimate	Std. Error	Z-value	P
Intercept	-	692.09	199.30	3.47	0.0005
Year	-	-0.33	0.10	-3.37	0.0008
Enrollment	-	-0.001	0.002	-0.82	0.4140
Location	R	-0.90	0.45	-2.02	0.0432
	U	0.00	0.00	-	-
Rating	A	-1.32	0.96	-1.37	0.1693
	B	-2.91	1.11	-2.63	0.0084
	E	1.94	1.30	1.49	0.1360
Poverty Index	G	0.00	0.00	-	-
	-	-0.09	0.02	-3.71	0.0002
Proportion of Female	-	0.08	0.04	2.25	0.0242
Proportion of Blacks	-	-0.008	0.008	-0.97	0.3313

Marginal model for fixed effects of 50th percentile (middle achievers) school-level visual arts scores

Factors	Category	Estimate	Std. Error	Z-value	P
Intercept	-	1122.70	191.46	5.86	<0.0001
Year	-	-0.54	0.10	-5.74	<0.0001
Enrollment	-	-0.0001	0.002	-0.07	0.9466
Location	R	-1.01	0.56	-1.79	0.0739
	U	0.00	0.00	-	-
Rating	A	-1.40	1.00	-1.42	0.1567
	B	-2.81	1.27	-2.21	0.0274
	E	2.24	1.31	1.71	0.0878
Poverty Index	G	0.00	0.00	-	-
	-	-0.08	0.03	-2.81	0.0049
Proportion of Female	-	0.06	0.04	1.51	0.1305
Proportion of Blacks	-	-0.005	0.008	-0.63	0.5316




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Results-Visual Arts

Marginal model for fixed effects of 75th percentile (high achievers) school-level visual arts scores

Factors	Category	Estimate	Std. Error	Z-value	P
Intercept	-	1180.84	182.96	6.45	<.0001
Year	-	-0.57	0.09	-6.30	<.0001
Enrollment	-	0.0003	0.002	0.13	0.8945
Location	R	-0.90	0.68	-1.32	0.1872
	U	0.00	0.00	-	-
Rating	A	-1.85	0.98	-1.88	0.0596
	B	-2.52	1.30	-1.94	0.0518
	E	1.61	1.17	1.38	0.1685
Poverty Index	G	0.00	0.00	-	-
	-	-0.08	0.03	-2.81	0.0050
Proportion of Female	-	0.02	0.04	0.45	0.6512
Proportion of Blacks	-	-0.003	0.008	-0.37	0.7135



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- ### Discussion
1. School-level factors **do** have statistically significant effects on achievement scores for both music and visual arts.
 2. School-level factors **do not** affect music and visual arts scores for high, middle, and low achieving students **equally**.
 - the year was the only significant factor affecting both music and visual arts scores at all percentiles.
 - Visual arts scores appear to be more influenced by school factors than music scores, with school location, school quality and school poverty level all having significant effects.
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Limitations

- More school factors can be added into the models such as teacher effectiveness, family engagement, or the amount of time spent in arts education.
- What is it about a rural location that affects low achieving students but not middle and high achieving ones?
- The effects of school quality are deserving of additional investigation.
- Other arts areas such as theater, dance, and creative writing can be included in future studies.



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Thank you!

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