

DATA ANALYSIS EXHIBITS

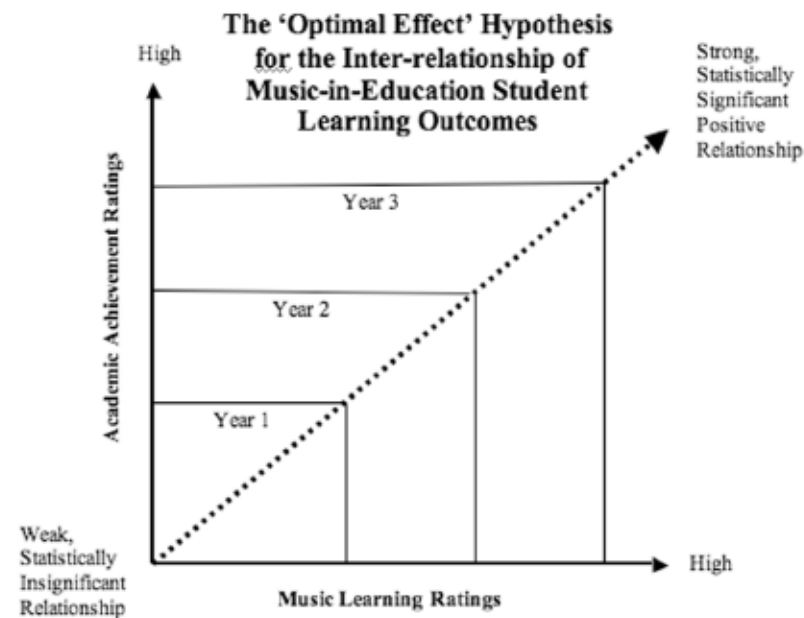
The previous exhibits illustrate prototypical aspects of the RUBRICS CUBE System in terms of qualities such as curriculum design, teaching practices, teacher professional development outcomes, and documentation of student work [see RUBRICS CUBE Program Evaluation Outcomes 2-5 in previous article]. The following examples demonstrate how student academic, music, and music-integrated learning outcomes can be analyzed, displayed, and employed to further the institutional advancement of a laboratory school and contribute to research in the field of music-in-education [RUBRICS CUBE Program Evaluation Outcomes 6-8].

EXHIBIT 1

The Conceptual Framework for the Optimal Interaction Between Music and Academic Skills Assessments Over Time

THE MUSIC-IN-EDUCATION OPTIMAL EFFECT HYPOTHESIS

The data display below illustrates a three-pronged strategy for measuring the possible 'optimal effect' of a laboratory school 'learning through music' program: (1) measure changes in academic achievement [vertical axis], (2) measure changes in music learning [horizontal axis], and (3) measure the 'strength of correlation' between these two previous factors over time [the degree of the positive relationship between both learning outcomes].



The positive confluence of these three factors supports the 'optimal effect' hypothesis for learning outcomes in a laboratory school music-in-education partnership. As illustrated, if improvement of student academic achievement outcomes occurs at the same time music learning outcomes increase AND there is an increasingly strong, positive and statistically significant correlation between these two factors, these findings would support the hypothesis that learning transfer between these subjects areas has likely occurred in the context of authentic, comprehensive and interdisciplinary 'learning through music' teaching practices.

EXHIBIT 2

The Music-in-Education School Performance Rubric

The matrix below frames four broad CLCS program outcomes according to the Music-in-Education School Performance Rubric. Note that only the top left box in the matrix supports the 'optimal effect' mission of the Learning Through Music laboratory school program.

		Music Learning Outcomes	
		+	-
Academic Performance Outcomes	+	ACADEMIC, MUSIC & MUSIC INTEGRATION SUCCESS <ul style="list-style-type: none"> The school is increasingly able to meet or exceed both academic and music learning standards. Increasingly strong, positive and statistically significant relationships between academic and music learning outcomes over time indicate that the music integration aspects of the music-in-education program has succeeded and that the optimal effect hypothesis has been confirmed. 	ACADEMIC SUCCESS, MUSIC LEARNING & MUSIC INTEGRATION FAILURE <ul style="list-style-type: none"> The academic program is succeeding, but the music program is failing; thus, the music integration curriculum is limited in its relevance or effectiveness. The correlation between music and music learning may be weak, statistically insignificant or irrelevant.
	-	MUSIC LEARNING SUCCESS, ACADEMIC & MUSIC INTEGRATION FAILURE <ul style="list-style-type: none"> The music program is succeeding, but the academic program is failing; thus, the music integration curriculum is limited in its relevance or effectiveness. The correlation between music and music learning is weak, statistically insignificant or irrelevant. 	MUSIC AND ACADEMIC FAILURE <ul style="list-style-type: none"> School is failing to meet measurable goals aligned with both academic and music standards; The correlation between music and music learning is irrelevant.

MUSIC-IN-EDUCATION SCHOOL PERFORMANCE RUBRIC

Note also that results displayed in the following data exhibits present evidence of improvement and coherency of music and academic outcomes that are consistent with the 'optimal effect' hypothesis as framed and categorized in the previous two figures.

EXHIBIT 3

Three-Year Longitudinal Analysis of Averaged Rhythm and Pitch Music Reading Skills Related to Stanford 9 Verbal Reading Skill Scores (Grades K-4)

ANALYSIS IN TERMS OF THE OPTIMAL EFFECT HYPOTHESIS

Step 1: Academic Skill Analysis.

According to the chart below, we see that the 'blue' sections of the pie charts are getting larger over time. Since the blue sections indicate the percentage of students across all grade levels who are scoring above the 50th percentile in Stanford reading tests, we can conclude that academic performance has improved significantly, especially in the third year.

Step 2: Music Skill Development Analysis.

These graphs indicate that both rhythm and pitch (and melodic) literacy skills, as indicated by the solid and near solid textures, increased in sophistication in both the second and third year. Note that increasingly sophisticated musical literacy skills—as measured by highest levels of achievement in listening, performance, improvisation, reading, error detection, dictation, and composition tasks in the NEC Music Literacy Skills Test—predated the dramatic improvement in academic ratings in the third year. Overall, the relatively homogeneous levels of pitch and rhythm performance skill in the third year suggest a school culture of musical literacy and its positive association with academic performance.

Step 3: The Relationship between Academic and Music Skill Development Analysis.

The relationship between verbal reading and rhythm reading is statistically significant in all of the first three years of the CLCS Learning Through Music program, indicating that the relationship between music literacy and math basic skills are associated and perhaps intrinsically related to musical skill development.

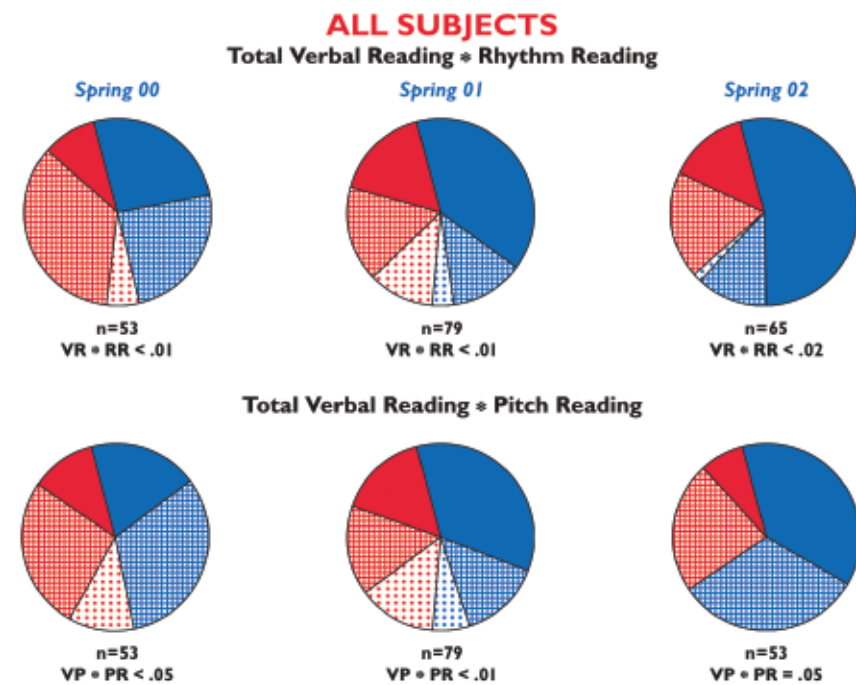


Figure 1a

IMPLICATIONS

The correlations indicate a significant relationship exists between these two domains throughout the three-year period, indicating that when students learn to read music well they are more likely to rate highly in language reading skills; and conversely, when students do not read music well, their language skills are more likely to suffer accordingly.

EXHIBIT 4

Evidence of Cohort Differences in Academic Achievement According to the Initiation Point and Degree of Program Participation (Spring 2001 - Spring 2002)

The table below provides more detailed evidence of academic progress in both reading and math as indicated by Stanford 9 test results:

- I. All Students at the CLCS show statistically significant improvement from 2001-2002 in READING and MATH;
- II. The cohort of students who have been with the CLCS more than two years show higher test scores in READING and MATH; and
- III. Those students who have been with the CLCS two or more years starting with Kindergarten or First Grade show the highest levels of development and improvement in READING and MATH.

Percent At Or Above 50th Percentile of Stanford Achievement Ratings

STUDENTS	READING		MATHEMATICS	
	2001(k-3)	2002(1-4)	2001(k-3)	2002(1-4)
I. All Students at the CLCS continuing and progressing 2001-2002 (N = 68/80)	55.7	72.1 **	47.8	62.3 *
II. Students with more than 2 years of LTM program (N = 53/60)	60.4	78.8 **	52.8	67.9 *
III. Students with 2 or more years of LTM program who started at K or 1 (N = 41/60)	65.9	90.9 **	61.0	80.5 **

The data display summarizes improvement in Academic Skill Test Scores in Reading and Mathematics at the CLCS during the years 2-3 of the CLCS according to three strands of cohort analysis (*p<.05; **p<.01).

IMPLICATIONS

The cohort analysis of changes in academic performance over the first three years of the Learning Through Music Program indicate clearly that the sooner and longer students are exposed to authentic, comprehensive, and interdisciplinary music education at the CLCS, the better they will perform on both language arts and math standardized tests.

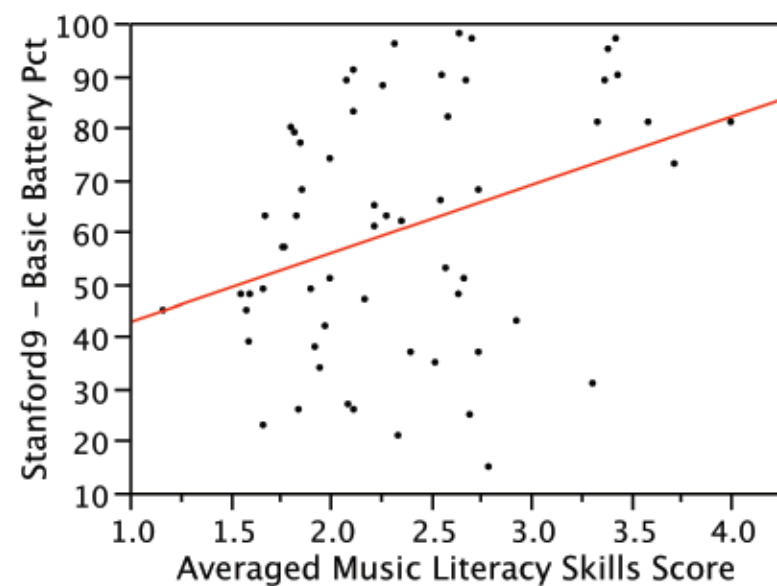
EXHIBIT 5

Student Cohort Differences in the Strength of Association between Academic and Music Learning Outcomes

In the fourth year of the CLCS program, NEC researchers looked at the cohort analysis from the point of view of a quasi-control group study. That is, we looked at the suddenly larger influx of transfer students into the CLCS as an opportunity to determine differences in the 'degree of correlation' between students who began with the CLCS and who stayed for at least two years (*full treatment students*), and those who had not (*partial treatment students*). The hypothesis was that the 'degree of correlation' would best indicate the extent to which students achieved an integrative understanding of music, math, and language skills.

The findings charted below capture the significant differences between the two cohorts. The first chart shows that for the partial treatment group, the correlation between averaged academic and music learning skills is weak, though statistically significant.

Control Group (partial treatment) Cohort Profile of the Relationship Between Music Learning (averaged) and a basic battery of standardized reading and math test scores (averaged), Conservatory Lab Charter School, K-5, 2003.



IMPLICATIONS

For students who have not received the full effect of the laboratory school program, the 'learning through music' effect of the increasingly strong relationship between music and academic learning is *beginning* to take place, as indicated by a relatively weak, though statistically significant bivariate fit between averaged music and academic test scores.

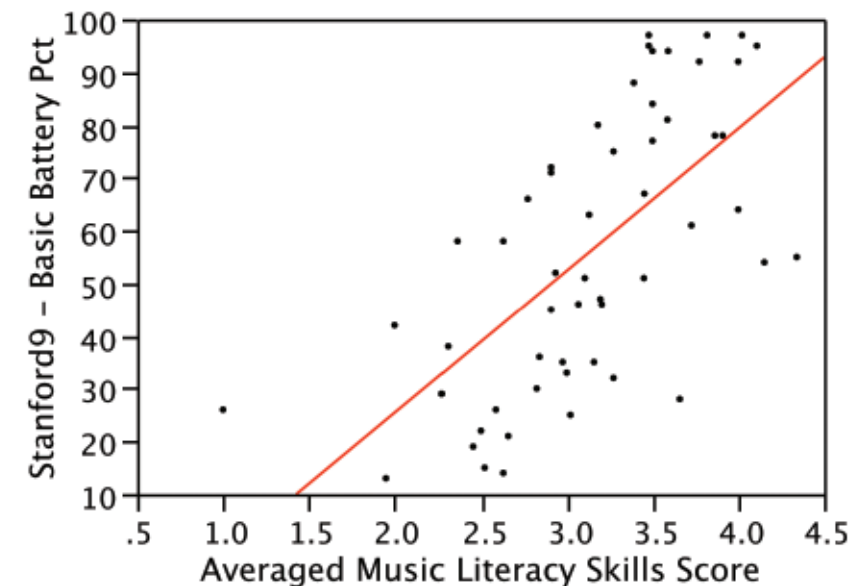
As seen in the next data display, those students who received the full benefit of a Learning Through Music program project a very different profile of music connection to other areas of learning in the context of music-integrated instruction.

EXHIBIT 6

Comparison Experimental Group (full treatment) Cohort Profile of the Relationship Between Music Learning (averaged) and a basic battery of standardized reading and math test scores (averaged), Conservatory Lab Charter School, K-5, 2003.

For students who have received the full benefit of the CLCS-NEC 'Learning Through Music' program, the data show extremely strong patterns of correlation. Comparing this data display (Figure 20 below) with the previous scatterplot (Figure 19 above) reveals that the *bivariate fit*, the *music learning mean scores*, and the *strength of correlation* measures are significantly more powerful (t ratio = 6.68, $p < .0001$; F Ratio = 44.61, $p < .0001$).

Most significantly, the variance accounted for by the index of correlation indicates a vastly different effect of the full program treatment (r^2 statistic): the control group accounts for only 12% of the variance in test score correlation, while the full treatment group accounts for 43% of the variance. This last statistic suggests an exponentially strengthened association between excellence in music skills and general academic achievement.



IMPLICATIONS

The overall differences between these two cohorts suggest that the optimal coherency of the program takes place after at least two years of program exposure, ideally beginning with kindergarten. This finding provides an important causal link between the powerful associations between music-integrated teaching and learning and academic achievement.

EXHIBIT 7

Measuring the Impact of Music Learning on Overall Academic Achievement Controlling for Non-Curricular Variables

Going beyond paired factor correlations, stepwise regression techniques reveal the relative predictive strength of each contributing variable to a single outcome (Averaged Stanford Basic Battery mean scores). The next to the far right column measures the relative strength of the variable's contribution to academic achievement, the far right column its statistical probability that it could be due to chance.

Judging these two factors, the averaged music literacy score (ML – Total Average, the bottom variable) appears as the most important factor by far in predicting academic achievement in terms of grade level nationally-normed percentiles derived from the Stanford 9 academic achievement test results. Note that the only other positive, yet weak correlations occurred due to grade level effects (attributed to significant differences in teacher success with academic tests) and students designated for special education. Note also that the overall regression model, dominated by music literacy skills, explains over half (54% as indicated by the r^2 statistic) of the variance in academic tests.

Stepwise Regression Analysis of Factors Affecting Academic Achievement at the CLCS, 2003

SSE		DFE	MSE	RSquare	RSquare Adj	Cp	AIC
21728.872		73	297.65578	0.5905	0.5400	7.2303793	482.1072
Lock	Entered	Parameter	Estimate	nDF	SS	F Ratio	Prob>F
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Intercept	-20.275323	1	0	0.000	1.0000
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Cohort Designation{0-1}	3.62845857	1	584.38	1.963	0.1654
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Grade{1&2-3&4&5}	1.79799526	3	3561.093	3.988	0.0109
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Grade{1-2}	8.82366777	1	1627.344	5.467	0.0221
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Grade{3-4&5}	6.66770315	1	1803.402	6.059	0.0162
<input type="checkbox"/>	<input type="checkbox"/>	Grade{4-5}	0	1	6.046592	0.020	0.8878
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Gender{F-M}	-2.4409338	1	462.3892	1.553	0.2166
<input type="checkbox"/>	<input type="checkbox"/>	Suspensions{yes-no}	0	1	312.802	1.052	0.3086
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Low Income{yes-no}	-4.6325375	1	1280.621	4.302	0.0416
<input type="checkbox"/>	<input checked="" type="checkbox"/>	LEP{yes-no}	-5.6857253	1	626.3092	2.104	0.1512
<input type="checkbox"/>	<input checked="" type="checkbox"/>	SPED{yes-Yes&no}	-7.7470421	1	1985.137	6.669	0.0118
<input type="checkbox"/>	<input type="checkbox"/>	SPED{Yes-no}	0	1	112.7033	0.375	0.5420
<input type="checkbox"/>	<input type="checkbox"/>	Violin – Total Average	0	1	253.6604	0.850	0.3595
<input type="checkbox"/>	<input type="checkbox"/>	ML – Rhythm Average	0	1	34.85109	0.116	0.7348
<input type="checkbox"/>	<input type="checkbox"/>	ML– Pitch Average	0	1	18.64991	0.062	0.8043
<input type="checkbox"/>	<input checked="" type="checkbox"/>	ML – Total Average	23.4193012	1	9104.68	30.588	0.0000

IMPLICATIONS

The chart above demonstrates that averaged measures of *Music Literacy Skill*—controlling for gender, social economic status, English language proficiency, special education designation, misbehavior, and teacher (grade level) effects—is the most powerful predictor by far of overall academic achievement at the CLCS in 2003.

Further regression analysis into the subskill factor effects on overall academic achievement revealed *rhythmic composition* and *pitch pattern reading* as the most significant predictors of academic achievement within the average musical literacy skill ratings. Regression models that distinguish between experimental (full treatment) and control (partial treatment) cohorts revealed that *averaged music literacy skill levels* again dominated other non-academic factors for both cohorts and outperformed other measures of school academic achievement.