



A Cohort Study of Arts Participation and Academic Performance



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A Cohort Study of Arts Participation and Academic Performance

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August 2012

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Keywords

Arts Participation, Academic Performance, Proficiency, Logistic Regression, Mathematics Achievement, Reading/Language Arts Achievement

Suggested Citation

Whisman S. A., Hixson N. K. (2012). *A cohort study of arts participation and academic performance*. Charleston, WV: West Virginia Department of Education, Division of Curriculum and Instructional Services, Office of Research.

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Abstract

In West Virginia one arts credit is required for graduation. This study examined whether participation in arts instruction beyond the one-credit minimum correlated with improved academic proficiency.

Method of study. We studied a cohort of 14,653 public high school students who stayed at grade level during the 4-year period from 2007 through 2010. Overall 37% of the students were economically disadvantaged and 11% were students with disabilities. Arts participation was defined as the total number of arts-related credits in all disciplines—music, visual arts, and performance arts—earned during students’ tenure from Grade 9 through Grade 12. We used binary logistic regression to examine the presence and magnitude of associations between arts participation and proficiency (Mastery or above) in mathematics and reading/language arts on the WESTEST 2 and for scoring at or above the national average composite score on ACT PLAN. We also calculated the odds of achieving these outcomes relative to arts participation as a measure of effect size. Results of the study included the following:

Findings. Students who earn 2 or more arts credits during high school were about 1.3 and 1.6 times more likely to score at proficient levels for mathematics and reading/language arts, respectively. Students who earned 2 or more arts credits also were about 1.5 times more likely to have scored at or above the national average composite score on the ACT PLAN.

Significant associations between arts participation and reading/language arts proficiency held across subgroups of students with and without disabilities and/or economic disadvantage; however, for mathematics, we observed significant associations only for students with neither low family income nor disabilities, and students with low family income. The odds of scoring at proficient levels in reading/language arts among students with disabilities and students with both disabilities and low family income indicated that while few of these students reach proficiency they were up to twice as likely to do so if they exceeded the minimum number of arts credits required for graduation. Compared to earning a single arts credit, for mathematics there was no advantage in earning a second arts credit; however, students were about 1.3 times more likely to reach proficiency when earning 3 arts credits and 1.6 times more likely when earning 4 or more. The odds were better for reading/language arts. There was a slight advantage in proficiency for students earning 2 credits, but the advantage rose to 1.6 and 2.2 times when students earned 3, or 4 or more arts credits, respectively.

While few students reached Above Mastery and Distinguished status, their odds of doing so increased somewhat if they earned additional arts credits. The odds of achieving Mastery in mathematics were only modestly improved—1.3 times greater when students earned 2 or more arts credits and 1.5 times greater for achieving Distinguished; but were slightly higher for reading/language, rising from about 1.4 times for Mastery to 2.0 times for Distinguished.

Limitations of study. The highest grade WESTEST 2 is administered in is 11th grade, yet arts participation was measured through students’ 12th-grade year. Likewise, the students completed ACT PLAN testing in 10th grade, 2 years prior to their scheduled graduation. Finally, the study was correlational and no claims were made as to causation.

Contents

Abstract.....	iii
Introduction.....	1
Description of Relevant Scholarship.....	1
Research Questions.....	2
Methods	2
Participant Characteristics.....	2
Measures and Covariates	4
Analytical Approach.....	4
Results ⁵	
Cohort Characteristics	5
Research Question 1 (RQ1)	6
Research Question 2 (RQ2)	8
Research Question 3 (RQ3)	8
Research Question 4 (RQ4)	9
Discussion.....	11
Limitations of the Study.....	11
References.....	12

List of Tables

Table 1. Variable Coding for Binary Logistic Regression Analysis.	4
Table 2. Proficiency and Arts Participation Rates Among all Students and Subgroup Categories.....	6
Table 3. Binary Logistic Regression of Mathematics and Reading/Language Arts Proficiency on Earned Arts Credit.	7
Table 4. Binary Logistic Regression of Levels of ACT PLAN® on Earned Arts Credit.8	
Table 5. Binary Logistic Regression of Mathematics and Reading/Language Arts Proficiency on the Progressive Number of Earned Arts Credits.	9
Table 6. Binary Logistic Regression of Mastery, Above Mastery, and Distinguished Levels of Mathematics and Reading/Language Arts Proficiency on Earned Arts Credit.....	10

Introduction

It has been argued that the era of high-stakes testing and accountability has carried with it an intense focus on assessment results and test preparation. Some would say this has occurred at the expense of activities that enhance student engagement, and ultimately academic achievement. In this study, we assessed the associations between participation in arts instruction and academic performance, specifically mathematics and reading/language arts proficiency, among a cohort of West Virginia public high school students. The basic assumption tested is that arts participation is correlated with improved academic outcomes.

Description of Relevant Scholarship

The research literature on effects of arts education spans a wide range of topics from associations with neurological and cognitive development, including the development of IQ, to impacts on students' self-concepts, dropout rates, absenteeism, and other topics. Here we focus on correlations with changes in student academic performance as measured using standardized tests. This segment of the literature is dominated by studies of music education, with far fewer studies of the visual arts and other performance arts, such as dance and theater. Highlights include the following large-scale studies, meta-analyses, and comprehensive reviews of research that met criteria for acceptable rigor:

- In a meta-analysis of 80 reports, Hetland and Winner (2001) found reliable, medium-size positive effect of *classroom drama* (enacting texts) on a variety of verbal areas, including reading achievement, reading readiness, writing, and others; a large positive effect on written understanding/recall of stories; and a small effect on vocabulary.
- In a study of various types of extracurricular programming and academic achievement using the National Educational Longitudinal Study (NELS:88) dataset, which included a representative sample of about 24,600 eighth graders, Broh (2002) found that participation in *school drama clubs* was associated with improved English grades and reading test scores.
- Broh (2002) found in the same study that participation in *school music groups* improved mathematics and English grades and mathematics achievement test scores.
- A meta-analysis of correlational studies found that music students have higher scores on standardized reading tests (Butzlaff, 2000).
- In a recent comprehensive review of the literature, Hodges and O'Connell (2007) identified a number of studies that "support the contention that students who participate in formal music education have higher academic achievement scores than students who do not participate in formal music education (Babo, 2001; Cardarelli, 2003; Cobb, 1997; Cox, 2001; Frakes, 1984; Huang, 2004; Linch, 1993; Miranda, 2001; Mitchell, 1994; Parrish, 1984; Schneider & Klotz, 2000; Trent, 1996; Underwood, 2000; Zanutto, 1997)." However, Hodges and O'Connell note that not all researchers obtained such clear results, with some studies finding music participants had higher achievement scores in some content areas and not others, or no significant differences at all.

- The quality of music education programs mattered, as well, according to Johnson and Memmot (2006). In a study involving more than 4,700 elementary and middle school students from across the United States, they found that elementary students in exemplary music programs scored higher on English and mathematics standardized tests than those in lower-quality music programs, although the effect sizes were small. Middle schoolers in both high-quality music programs and low-quality instrumental programs scored higher in English and mathematics than their counterparts in low-quality choral programs or no music classes at all—again with effects sizes that were not large.
- In another study using large, nationally representative datasets (Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 [ECLS-K] and NELS:88), Southgate and Roscigno (2009) found that music participation, “both inside and outside of school, is associated with measures of academic achievement among children and adolescents.” They also found that music involvement varies systematically by class and gender, and that “although music does mediate some student background effects, this mediation is only minimal.”

Research Questions

In West Virginia, our questions were less discipline-specific (e.g., music or visual arts), investigating instead the effects of various levels of participation in arts instruction of any type. To this end, we posed four questions:

- RQ1. Do the odds of achieving proficiency (*Mastery* or above) in mathematics and reading/language arts on WESTEST 2 increase when students earn at least 2 arts credits during high school; and how do these associations compare for students with and without disabilities and/or economic disadvantage?
- RQ2. Do the odds of scoring at or above the national average composite score on the ACT PLAN® increase when students earn at least 2 arts credits during high school?
- RQ3. Does the number of additional arts credits students earn (i.e., 2, 3, or 4 or more) increase their odds of reaching proficiency (*Mastery* or above) in mathematics and reading/language arts on WESTEST 2?
- RQ4. Does the likelihood of scoring at higher levels of proficiency (i.e., *Above Mastery* or *Distinguished*) in mathematics and reading/language arts on WESTEST 2 increase for students who earn 2 or more arts credits?

Methods

Participant Characteristics

To address the research questions, we studied West Virginia public school students who were in Grade 9 during the 2006-2007 school year and who stayed on track during the 4-year period through the 2009-2010 school year. For all four research questions, we examined associations between arts participation and academic performance for all students in the

population. For RQ1, we further examined the extent to which associations observed among all students held for four mutually exclusive subgroups of students who did—or did not—experience challenges due to low family income or disability. These groups were uniquely treated in the analysis and are identified as students with

- neither low family income nor disabilities,
- low family income,
- disabilities, or
- both low family income and disabilities.

We did not perform analyses by race/ethnicity subgroup because in West Virginia approximately 95% of students self-identify as being White, and as result tend to disproportionately influence subgroup comparisons. Nor did we perform analyses by gender as the cohort was evenly split between female and male students and, while a gender difference may be present in terms of arts participation, it was not of primary interest in this study.

We reduced the total population (N = 16,920) to a final study cohort of 14,653 students for this study as follows:

- To assure a fair assessment of the association between arts participation and academic performance the cohort was restricted to those students who were on track in the final year of their participation in WESTEST 2—that is, who were assessed as 11th graders in the 2008-2009 school year. We thought it probable that students assessed at a lower grade level in that year were experiencing challenges beyond what could be accounted for by participation in arts-related instruction, and their inclusion might have disproportionately biased the arts associations tested. Their exclusion limited the cohort to 15,999 students.
- A small number of students in the original cohort had not earned the minimum of 1 required arts credit by the culmination of the 2010 school year; removing these students reduced the cohort dataset to 15,866 students.
- Finally, we drew WESTEST 2 scale score data in the original cohort dataset from the NCLB accountability files. In the cohort dataset, we suppressed test scores for any students who had been filtered from their respective schools' accountability files. Additionally, approximately 500 of the remaining students had missing values for 2009 WESTEST 2 mathematics or reading/language arts scale score data. Removal of these two groups of students resulted in the final cohort of 14,653 students.

We considered this final cohort to be the *population* of students and, as such, the usual assumptions about statistical significance in inferential statistics do not apply to our analyses. Further, with such a large number of students in the analysis, even very small group differences may prove statistically significant yet have little practical consequence. Nonetheless, we indicated statistically significant findings in tables, where present, in the Results section.

Measures and Covariates

For the purposes of this study, we operationalized *arts participation* as the total number of arts-related credits earned during students' tenure from Grade 9 through Grade 12 during the 4-year period from 2006-2007 through 2009-2010. In West Virginia, a minimum of 1 arts credit is required for graduation, which students may earn in visual arts, dance, performing arts, music, or theater.

For RQ1, *low family income* was defined as participation in the free or reduced-price meals program, and *disability* status was defined based on students' designation as having a disability exceptionality in the 2009 WESTEST 2 data file.

We operationalized *academic performance* as academic proficiency rates—that is, the percentage of students having scored at *Mastery* or above—in mathematics or reading/language arts for the 2009 WESTEST 2 testing year. This assessment took place in Grade 11 for the cohort students, which was 1 year prior to the end of their opportunity to accumulate arts-related credits.

The RQ2 analysis includes an additional measure of academic performance—composite scores on the ACT PLAN test—which provides measures of content knowledge and complex critical thinking skills acquired in the early years of high school. Students complete the PLAN assessment during 10th grade. For this study, we coded PLAN test scores dichotomously to indicate a composite score below the national average (0), or at or above the national average (1). As with WESTEST 2, students complete PLAN prior to the end of their opportunity to accumulate arts-related credits.

Analytical Approach

We used binary logistic regression to examine the presence and magnitude of associations between arts participation and academic achievement. We also calculated odds ratios of scoring at the proficient level on WESTEST 2 or of scoring at or above the national average composite score on ACT PLAN, relative to arts participation (1 arts credit versus 2 or more). Odds ratios also are measures of effect size and indicate the relative importance of the independent variable (arts participation) in terms of the odds of the dependent variable (proficiency) occurring. To accommodate the logistic regression, variables were coded dichotomously for each respective research question (Table 1).

Table 1. Variable Coding for Binary Logistic Regression Analysis.

Research question	Dependent variable (proficiency)	Covariate (arts participation)
RQ1	0 = Not at proficiency 1 = At proficiency	0 = Earned 1 Arts Credit 1 = Earned More than 1 Arts Credit
RQ2	0 = Below the National Average ACT PLAN® Composite Score 1 = At or Above the National Average ACT PLAN® Composite Score	0 = Earned 1 Arts Credit 1 = Earned More than 1 Arts Credit
RQ3	0 = Not at proficiency 1 = At proficiency	0 = Earned 1 Arts Credit 1 = Earned 2 Arts Credits

Table 1 continues on next page

Table 1. Variable Coding for Binary Logistic Regression Analysis.

Research question	Dependent variable (proficiency)	Covariate (arts participation)
	0 = Not at proficiency 1 = At proficiency	0 = Earned 1 Arts Credit 1 = Earned 3 Arts Credits
	0 = Not at proficiency 1 = At proficiency	0 = Earned 1 Arts Credit 1 = Earned 4 or More Arts Credits
RQ4	0 = Not at proficiency 1 = At <i>Mastery</i>	0 = Earned 1 Arts Credit 1 = Earned More than 1 Arts Credit
	0 = Not at proficiency 1 = At <i>Above Mastery</i>	0 = Earned 1 Arts Credit 1 = Earned More than 1 Arts Credit
	0 = Not at proficiency 1 = At <i>Distinguished</i>	0 = Earned 1 Arts Credit 1 = Earned More than 1 Arts Credit

Results

Cohort Characteristics

As noted earlier, the cohort was evenly split by gender (50.4% female). In terms of race/ethnicity, it was predominately White (94.4%); Black students made up 4.3% of the cohort with all other races/ethnicities making up the remaining 1.3%. Virtually all students in the cohort were marked as having graduated. The difference in graduation rates by arts participation—1 arts credit (96.4%) vs. 2 or more arts credits (97.4%)—was of such small magnitude as to be of little practical significance for further consideration in the analysis. Initial analysis of senior year attendance rates (as defined in WV Policy 4110¹) yielded similar results. Attendance among students earning just 1 arts credit was on average 91.8% whereas that for students earning 2 or more arts credits was 92.4%.

Overall 37.2% of the students in the cohort were identified to be economically disadvantaged (i.e., low family income) as determined by their participation in the federal free- or reduced-price meals program. An additional 11.3% were identified as students with disabilities. These percentages are not reflective of the mutually exclusive subgroups described earlier for which the distribution of students was as follows:

- 8,527 (58.2%) had neither low family income nor disabilities;
- 4,472 (30.5%) had low family income;
- 670 (4.6%) had disabilities,
- 984 (6.7%) had both low family income and disabilities.

When looking at the aggregated cohort of all students combined, about 60% scored at proficient levels in mathematics while about 54% were at proficiency in reading/language arts (Table 2). Among students identified as having neither low family income nor disabilities, the percentages jump to about 71% and 65%, respectively; but the percentages proficient sharply fall among the other groups—such that 21% or fewer students with disabilities or who also

¹ WV Policy 4110 provides guidelines for the development of local county attendance policies. To view this policy, see <http://wvde.state.wv.us/policies/p4110.pdf>.

experience economic challenges score at proficiency in either mathematics or reading/language arts (Table 2).

In terms of arts participation, the variation among the groups is much more balanced. Slightly over half of students overall earned 2 or more arts credits, and for the most part that held steady when looking at students identified as having neither low family income nor disabilities, or who had low family income (Table 2). The percentages of students with disabilities or who also were identified as having low family income and who earned 2 or more arts credits were 8 to 10 percentage points lower than the other groups.

Table 2. Proficiency and Arts Participation Rates Among all Students and Subgroup Categories.

Identified student group	Mathematics		Reading/language arts		Arts participation	
	Percent not at proficiency	Percent at proficiency	Percent not at proficiency	Percent at proficiency	Percent earned 1 arts credit	Percent earned 2 or more arts credits
Aggregated cohort	39.5	60.5	45.8	54.2	48.6	51.4
Neither low family income nor disability	29.2	70.8	34.6	65.4	47.2	52.8
Low family income	43.4	56.6	50.3	49.7	48.6	51.4
Disability	79.1	20.9	88.2	11.8	57.2	42.8
Both low family income and disability	84.0	16.0	93.8	6.2	55.8	44.2
	$\chi^2 (3) = 1667.4, p < .0001$		$\chi^2 (3) = 1866.8, p < .0001$		$\chi^2 (3) = 47.2, p < .0001$	

Research Question 1 (RQ1)

For RQ1, we investigated whether earning more than the required 1 arts credit was associated with students scoring at proficiency in mathematics and reading/language arts on WESTEST 2 in Grade 11. First, we conducted logistic regression of the aggregated cohort without regard to membership in the subgroups, which provided an indication of the presence and magnitude of the association between arts participation and academic performance among all students. In that initial analysis the associations between arts participation and proficiency were statistically significant for both mathematics and reading/language arts (Table 3). The resulting odds ratios indicated that students who earn 2 or more arts credits during their high school tenure were about 1.3 and 1.6 times more likely to have scored at proficient levels for mathematics and reading/language arts, respectively.

We had similar results in the subgroup analysis. The association between arts participation and reading/language arts proficiency was statistically significant across all subgroups; however, for mathematics, we observed significant associations for only two subgroups—students with neither low family income nor disabilities, and students with low family income. The odds ratio values point to an interesting finding, however, among the subgroups. The likelihood that two of the subgroups—students with neither low family income nor disabilities and students with low family income—would score at proficiency was about the same as for all students combined. For reading/language arts, students with disabilities and students with both disabilities and low family income were more likely to achieve proficiency

than other subgroup configurations. This is noteworthy because as shown in Table 2, far fewer of these students scored at proficiency, but the odds of being at proficiency were much higher when they earned 2 or more arts credits.

Table 3. Binary Logistic Regression of Mathematics and Reading/Language Arts Proficiency on Earned Arts Credit.

Aggregated cohort					
				95% C.I. for odds ratio	
Mathematics proficiency	B (SE)	Sig.	Odds ratio	Lower	Upper
Earned 2 or more arts credits	0.26 (0.03)	0.000	1.292	1.21	1.38
Constant	0.3 (0.02)	0.000	1.347		
R ² = 0.004 (Cox & Snell), 0.005 (Nagelkerke), Model X ² (1) = 57.2, p > 0.0001					
Reading/language arts proficiency					
Earned 2 or more arts credits	0.46 (0.03)	0.000	1.589	1.49	1.7
Constant	-0.07 (0.02)	0.004	0.934		
R ² = 0.013 (Cox & Snell), 0.018 (Nagelkerke), Model X ² (1) = 193.92, p > 0.0001					
Students with neither low family incomes nor disabilities					
				95% C.I. for odds ratio	
Mathematics proficiency	B (SE)	Sig.	Odds ratio	Lower	Upper
Earned 2 or more arts credits	0.19 (0.05)	0.000	1.213	1.1	1.33
Constant	0.79 (0.03)	0.000	2.199		
R ² = 0.002 (Cox & Snell), 0.003 (Nagelkerke), Model X ² (1) = 16.33, p > 0.0001					
Reading/language arts proficiency					
Earned 2 or more arts credits	0.41 (0.05)	0.000	1.510	1.38	1.65
Constant	0.43 (0.03)	0.000	1.531		
R ² = 0.01 (Cox & Snell), 0.013 (Nagelkerke), Model X ² (1) = 81.44, p > 0.0001					
Students with low family incomes					
				95% C.I. for odds ratio	
Mathematics proficiency	B (SE)	Sig.	Odds ratio	Lower	Upper
Earned 2 or more arts credits	0.25 (0.06)	0.000	1.278	1.14	1.44
Constant	0.14 (0.04)	0.001	1.151		
R ² = 0.004 (Cox & Snell), 0.005 (Nagelkerke), Model X ² (1) = 16.53, p > 0.0001					
Reading/language arts proficiency					
Earned 2 or more arts credits	0.46 (0.06)	0.000	1.586	1.41	1.78
Constant	-0.25 (0.04)	0.000	0.778		
R ² = 0.013 (Cox & Snell), 0.017 (Nagelkerke), Model X ² (1) = 58.99, p > 0.0001					
Students with disabilities					
				95% C.I. for odds ratio	
Mathematics proficiency	B (SE)	Sig.	Odds ratio	Lower	Upper
Earned 2 or more arts credits	0.18 (0.19)	0.334	1.202	0.83	1.75
Constant	-1.41 (0.13)	0.000	0.244		
R ² = 0.001 (Cox & Snell), 0.002 (Nagelkerke), Model X ² (1) = 0.93, p > 0.335					

Table 3 continues on next page

Table 3. Binary Logistic Regression of Mathematics and Reading/Language Arts Proficiency on Earned Arts Credit.

Reading/language arts proficiency					
Earned 2 or more arts credit	0.76 (0.24)	0.002	2.148	1.33	3.47
Constant	-2.4 (0.18)	0.000	0.091		
R ² = 0.015 (Cox & Snell), 0.029 (Nagelkerke), Model X ² (1) = 10.04, p > 0.002					
Students with both low family income and disabilities					
			95% C.I. for Odds Ratio		
Mathematics proficiency	B (SE)	Sig.	Odds Ratio	Lower	Upper
Earned 2 or More Arts Credit	-0.01 (0.18)	0.943	0.988	0.7	1.39
Constant	-1.66 (0.12)	0.000	0.191		
R ² = 0 (Cox & Snell), 0 (Nagelkerke), Model X ² (1) = 0.005, p > 0.943					
Reading/language arts proficiency					
Earned 2 or More Arts Credit	0.57 (0.27)	0.034	1.760	1.04	2.97
Constant	-3 (0.2)	0.000	0.050		
R ² = 0.005 (Cox & Snell), 0.012 (Nagelkerke), Model X ² (1) = 4.54, p > 0.033					

Research Question 2 (RQ2)

Forty percent of students in the cohort scored at or above the national average composite score on the ACT PLAN test as 10th graders during the 2007-2008 school year. As with WESTEST 2, the association between this accomplishment and cumulative arts participation was statistically significant. Students who earned 2 or more arts credits throughout their high school years were about 1.5 times more likely to have scored at or above the national average composite score on the ACT PLAN (Table 4).

Table 4. Binary Logistic Regression of Levels of ACT PLAN® on Earned Arts Credit.

			95% C.I. for Odds Ratio		
	B (SE)	Sig.	Odds Ratio	Lower	Upper
Earned 2 or More Arts Credit	0.41 (0.03)	.000	1.506	1.41	1.61
Constant	-0.55 (0.03)	.000	.576		
R ² = 0.1 (Cox & Snell), 0.14 (Nagelkerke). Model X ² (1) = 142.09, p < 0					

Research Question 3 (RQ3)

On average students in the cohort earned about 2.3 total arts credits; however the distribution ranged from 1 to 17 credits and was positively skewed to a moderate degree. About half (48.6%) of the students earned a single arts credit, 21.3% earned 2, 12.3% earned 3, and 17.8% earned 4 or more. With RQ3, we investigated whether earning progressively more arts credits increased the likelihood of achieving proficiency in mathematics and/or reading/language arts on WESTEST 2 in Grade 11.

Compared to earning a single arts credit, for mathematics there was no advantage in earning a second arts credit, however students were about 1.3 times more likely to reach proficiency when earning 3 arts credits and 1.6 times more likely when earning 4 or more. The odds were better for reading/language arts. There was a slight advantage in proficiency for

students earning 2 credits, but these improved to 1.6 and 2.2 times higher likelihood when students earned 3, or 4 or more arts credits, respectively, as shown in Table 5.

Table 5. Binary Logistic Regression of Mathematics and Reading/Language Arts Proficiency on the Progressive Number of Earned Arts Credits.

1 versus 2 arts credits					
Mathematics	B (SE)	Sig.	Odds ratio	95% C.I. for odds ratio	
				Lower	Upper
Earned 2 or more arts credits	0.07 (0.04)	.110	1.073	.98	1.17
Constant	0.3 (0.02)	.000	1.347		
R2 = 0 (Cox & Snell), 0 (Nagelkerke). Model X2(1) = 2.59, p < 0.107					
Reading/language arts					
Earned 2 or more arts credits	0.19 (0.04)	.000	1.212	1.11	1.32
Constant	-0.07 (0.02)	.000	.934		
R2 = 0.002 (Cox & Snell), 0.003 (Nagelkerke). Model X2(1) = 20.07, p < 0.0001					
1 versus 3 arts credits					
Mathematics	B (SE)	Sig.	Odds ratio	95% C.I. for odds ratio	
				Lower	Upper
Earned 2 or more arts credits	0.28 (0.05)	.000	1.329	1.19	1.48
Constant	0.3 (0.02)	.000	1.347		
R2 = 0.003 (Cox & Snell), 0.004 (Nagelkerke). Model X2(1) = 27.47, p < 0.0001					
Reading/language arts					
Earned 2 or more arts credits	0.49 (0.05)	.000	1.625	1.46	1.81
Constant	-0.07 (0.02)	.000	.934		
R2 = 0.009 (Cox & Snell), 0.012 (Nagelkerke). Model X2(1) = 83.35, p < 0.0001					
1 versus 4 or more arts credits					
Mathematics	B (SE)	Sig.	Odds ratio	95% C.I. for odds ratio	
				Lower	Upper
Earned 2 or more arts credits	0.47 (0.05)	.000	1.601	1.46	1.76
Constant	0.3 (0.02)	.000	1.347		
R2 = 0.01 (Cox & Snell), 0.013 (Nagelkerke). Model X2(1) = 96.91, p < 0.0001					
Reading/language arts					
Earned 2 or more arts credits	0.79 (0.05)	.000	2.206	2.01	2.42
Constant	-0.07 (0.02)	.000	.934		
R2 = 0.029 (Cox & Snell), 0.038 (Nagelkerke). Model X2(1) = 283.06, p < 0.0001					

Research Question 4 (RQ4)

For RQ4 we investigated whether students were more likely to score at progressively higher levels of proficiency—that is, at *Above Mastery* or *Distinguished*—levels in mathematics and reading/language arts, when they earned more than the required single arts credit. Once again, we used a series of binary logistic regressions for each content area and coded the successive dependent variables to determine the probability of scoring at proficiency (i.e., *Mastery*, *Above Mastery*, or *Distinguished* levels) compared to scoring below proficiency (i.e., *Novice* or *Below Mastery* levels). For both mathematics and reading/language arts, most of the

cohort scored at below proficiency (39.5% and 45.8%, respectively) or at *Mastery* (50.2% and 36.5%, respectively).

As for the association between arts participation and progressively higher levels of proficiency, students who earn additional arts credits seem to have an advantage in gaining proficiency—including higher levels of proficiency—based on the statistically significant results we obtained from all models we tested (Table 6). Yet, the odds ratios indicate only modest increases in the likelihood of reaching progressively higher levels of proficiency by earning 2 or more arts credits. This was especially true for mathematics, where the odds of achieving *Mastery* were 1.3 times greater when students earned 2 or more arts credits, but were only about 1.5 times greater for achieving *Distinguished* status. The increase in odds ratios for reading/language arts was slightly greater, from about 1.4 times for *Mastery* to 2.0 times for *Distinguished* (Table 6).

Table 6. Binary Logistic Regression of Mastery, Above Mastery, and Distinguished Levels of Mathematics and Reading/Language Arts Proficiency on Earned Arts Credit.

Mastery					
Mathematics	B (SE)	Sig.	Odds ratio	95% C.I. for odds ratio	
				Lower	Upper
Earned 2 or more arts credit	0.24 (0.04)	.000	1.277	1.19	1.37
Constant	0.22 (0.02)	.000	1.123		
R2 = 0.004 (Cox & Snell), 0.005 (Nagelkerke). Model X2(1) = 48.17, p < 0.0001					
Reading/language arts					
Earned 2 or more arts credit	0.35 (0.04)	.000	1.413	1.32	1.52
Constant	0.22 (0.02)	.000	.624		
R2 = 0.008 (Cox & Snell), 0.011 (Nagelkerke). Model X2(1) = 95.63, p < 0.0001					
Above mastery					
Mathematics	B (SE)	Sig.	Odds ratio	95% C.I. for odds ratio	
				Lower	Upper
Earned 2 or more arts credit	0.28 (0.06)	.000	1.329	1.17	1.51
Constant	0.22 (0.02)	.000	.172		
R2 = 0.003 (Cox & Snell), 0.005 (Nagelkerke). Model X2(1) = 19.39, p < 0.0001					
Reading/language arts					
Earned 2 or more arts credit	0.68 (0.05)	.000	1.973	1.79	2.18
Constant	0.22 (0.02)	.000	.228		
R2 = 0.021 (Cox & Snell), 0.031 (Nagelkerke). Model X2(1) = 187.62, p < 0.0001					
Distinguished					
Mathematics	B (SE)	Sig.	Odds ratio	95% C.I. for odds ratio	
				Lower	Upper
Earned 2 or more arts credit	0.4 (0.11)	.000	1.492	1.21	1.85
Constant	0.22 (0.02)	.000	.052		
R2 = 0.002 (Cox & Snell), 0.006 (Nagelkerke). Model X2(1) = 13.77, p < 0.0001					
Reading/language arts					
Earned 2 or more arts credit	0.7 (0.11)	.000	2.021	1.64	2.50
Constant	0.22 (0.02)	.000	.039		
R2 = 0.006 (Cox & Snell), 0.018 (Nagelkerke). Model X2(1) = 44.07, p < 0.0001					

Discussion

We tested the association between arts participation—that is, the accumulation of arts credits throughout high school—and academic performance to address four research questions. The first and second questions examined the presence and magnitude of such associations for proficiency in mathematics and reading/language arts and for scoring at or above the national average composite score on the ACT PLAN test. Our analysis confirmed the existence of the association by showing that the odds of students' achieving mathematics and reading/language arts proficiency and of meeting or exceeding the ACT PLAN national average score rose by amassing more than the minimum high school requirement of a single arts credit.

For mathematics and reading/language arts proficiency outcomes, we further examined the association between exceeding the minimal arts participation and higher academic performance to find out if it held for specific, mutually exclusive student subgroups. With the exceptions of two subgroups—students with disabilities and students with both disabilities and low family incomes—the associations endured for proficiency in mathematics. For students with neither low family income nor disabilities, and for students with low family income, the odds of scoring at proficiency were essentially equivalent to all students combined for both mathematics and reading/language arts. The odds ratios of scoring at proficient levels in reading/language arts among two subgroups—students with disabilities and students with both disabilities and low family income—were comparatively higher, indicating that while few of these students reach proficiency they were about twice as likely to do so if they exceeded the minimum number of arts credits required for graduation.

We examined these associations further in two additional research questions by determining (a) whether the number of additional arts credits earned increased students odds of reaching proficiency (RQ3), and (b) if students were more likely to score at higher levels of proficiency when they exceeded the minimum arts requirement (RQ4). About 80%–90% percent of students in WV either fell below proficiency, or if they reached proficiency, scored at the *Mastery* level in 2009. The odds of the latter, however, were only about 1.3 to 1.4 times greater in mathematics and reading/language arts, respectively. As with the subgroups described previously, few students reached *Above Mastery* and *Distinguished* status, but their odds of doing so appear to have increased somewhat if they earned additional arts credits. The increases were modest for mathematics, but slightly higher for reading/language arts. As for any association between earning progressively higher numbers of arts credits and scoring at proficiency, there appeared to be little advantage to earning 2 credits versus earning only 1, but the advantage appears to increase slightly by earning 3 credits, and even more by earning 4 or more.

Limitations of the Study

An unavoidable limitation of the study was that the highest grade for which WESTEST 2 is administered is 11th grade, yet arts participation was measured through students' 12th-grade year. In essence, the outcomes were measured a year prior to the end of students' opportunity to continue to accumulate arts-related credits. Likewise, the students in the study population completed ACT PLAN testing in 10th grade, 2 years prior to their scheduled graduation. No

consideration was given to the quality of arts instruction or to the level of engagement of students in their participation in arts courses. Finally, the study was correlational in nature and no claims were made as to causation in the observed relationships between arts participation and academic outcomes.

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