

INTRODUCTION

For a Duke Service-Learning class, we partnered with Arts NC to develop a short deliverable for House Bill 418. H418 would require every K–5 student in North Carolina to receive at least 30 minutes of visual and performing arts instruction every five school days. Arts NC's executive director, Nate McGaha, reported that one in twenty K–5 students statewide receives no arts instruction. I was tasked with creating a short 1-page deliverable highlighting research articles, statewide statistics, & persuasive reasoning to help support the bill. Using arts-enrollment, student-outcome, and demographic datasets, my goal is to supplement these policy goals with novel statistical analyses to demonstrate the measurable benefits of K–5 arts education.

RELATED WORK

Current North Carolina statutes & state laws for K-5 arts education are impeded by vague language: "Instruction shall be offered in the areas of arts [...]." (N.C. Gen. Stat. Ann. § 115C-81.5). This is the only reference in the general course of study. A majority of other states, like South Carolina, include more descriptive time requirements & course topics: "(II.) Basic Program/Curriculum, Grades 1-5; Instruction in the subject areas shall be scheduled for each student for a minimum of 1800 minutes or 30 hours per week including lunch, or the equivalent time on a yearly basis. The subjects shall include, but not be limited to:... Visual & Performing Arts (S.C. Code Ann. Regs. 43-231)"

Comparative policy analysis reveals other states with explicitly defined & enforced arts education requirements outperform North Carolina in arts accessibility and per-capita arts funding. In 2023, Nate McGaha tried to push House Bill 498, which similarly required every K-5 student in North Carolina to receive visual and performing arts instruction. It was introduced to the General Assembly in April of that year. However, after some deliberation, it was unsuccessful in passing and died in committee. In the 2025-26 cycle, Nate McGaha seeks to reintroduce this provision under Bill H418. Previous attempts by McGaha to correlate arts education enrollment directly with improved academic metrics yielded ambiguous results, demonstrating the importance of nuanced,

statistically rigorous approaches in policy advocacy efforts. Additionally, critical sources of arts education data, such as the National Report Card, have deprioritized arts in recent assessments, creating challenges in accessing recent data for arts education. Thus, there remains a critical need for localized, recent, and statistically sound analyses to substantiate advocacy claims effectively. Our work may help find underlying statistics & distributions within NC K-5 schools.

METHODOLOGY

This project integrates data acquisition, cleaning, and analysis using publicly available data and some internally sourced data that is also published online. Our approach incorporates data normalization, statistical aggregation, and some geospatial visualization.

1. [North Carolina School Report Cards](#): This is a publicly available webpage that offers recent data on course enrollment, school sizes, school grade, end of year standardized testing, and stratifying features like the proportion of Economically Disadvantaged students. It sorts schools based on a district level while offering holistic information about the schools. It is not offered in tabular (e.g. csv, XLSX) format, but we were able to request some of the information from NC Arts.
2. [NC Department of Public Instruction \(NCDPI\) Reports](#): These comprehensive reports contain detailed information on school-level demographics, student performance metrics, attendance records, disciplinary statistics, and teacher qualifications.
3. NC Arts: This was data offered by Brandon Roeder of NC Arts. He helps manage the data collection for arts enrollment around the state and works with the data team at the organization. This resource offers vital insight into the actual state of arts instruction accessibility and engagement of the district and school levels.

- Economically Disadvantaged Students (EDS)
Data: Provided separately through the NC Department of Public Instruction (NCDPI) reports, detailing the proportion of economically disadvantaged students at each school.

Acquiring these datasets took the longest amount of time, as we had to communicate through a chain of command at the organization for the arts enrollment data. This was critical in seeing what disparities in arts education access existed in North Carolina.

Firstly, we needed to filter out the data to only K-5 public schools, since this is the target demographic of the House Bill 418. Then, we would need to add features for arts enrollment, end of year testing, and proficiency scores to each school. Our final merged “data” may consist of the following features: LEA (District) Name, LEA Code, School Name, School Code, Music Students, Visual Arts Students, Theatre Students, Dance Students, School Enrollment, Percent Economically Disadvantaged, Aggregated Nonproficiency Percentage, Aggregated Career & College Readiness, Chronic Absenteeism, and Aggregated Nonproficiency of End of Grade (EOG) Testing.

It is very *important* to note that due to data privacy laws, we cannot give any percentages <5% or >95%. A lot of our data may be skewed, where a lot of schools report >95% instead of a particular percentage outright. Therefore, we need to normalize these scores before doing data analysis. Since we have the data for almost all K-5 schools in North Carolina, we would compare the distributions outright. There is no need to do sampling and run probabilistic testing. If we decided to do it on an individual student basis, we would shift our methodology to sampling and probabilistic statistics.

Our statistical analysis focused on quantifying the relationship between arts education access and student outcomes. Given the lack of resolution on how many hours an arts course was offered by students, we decided that anything less than 95% of all students being enrolled in at least 1 arts class was considered “insufficient” arts access.

In addition to stratifying only K-5 public schools in NC, we needed to differentiate between higher and

lower-income schools. Since we cannot obtain specific per capita student income, we used the economically disadvantaged percentage. It gives the approximate fraction of the student body who are on government assistance programs or qualify for free & reduced lunch. Such students meet the poverty or student income threshold to qualify for these programs and are labeled “Economically Disadvantaged.”

Using the FSA (*Federal Student Aid*) guidelines for economically disadvantaged institutions and appeals, we also came to classify that any school with over $\frac{2}{3}$ or 66% of its student population classified as “economically disadvantaged” we would consider the entire school an “economically disadvantaged” institution. This is important to differentiate schools that had more affluent student bodies to be compared to more impoverished student bodies. Moreover, more affluent schools may have more funding to offer more arts courses. We know that this is an unfair comparison, so it is important to stratify this so that affluence does not confound our results.

To highlight disparities in arts education access, we developed geospatial mapping of arts enrollment and per-capita arts participation across North Carolina’s school districts. We used *geopandas* and *matplotlib* to explore regional variations and underscore areas with limited arts instruction, particularly in economically disadvantaged communities. We used maps from the United States Census Bureau.

We performed principal component analysis to see the variance and spread of our distribution. From the PCA contribution, we can measure the. Since we have approximately census data of all public schools, we will directly compare their distributions, and these results will be in the following section.

RESULTS

It is important to mention that two major areas are exempted from our data collection, which are Department of Defense Education Institutions and schools on Native American reservations. North Carolina has limited jurisdiction over these areas, and we do not count them in our distributions. They are highlighted in red in Figure 1 below. Figure 1 highlights counties where more than 5% of students

do not have arts education. We see a pattern that more rural counties are highlighted.

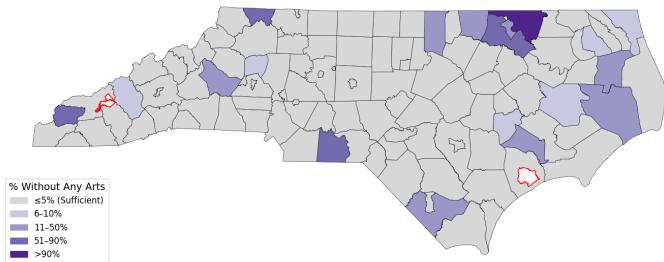


Figure 1. Map of North Carolina Districts with Percentage of Students Not Enrolled in Arts Courses

We also observe that many schools within the country are economically disadvantaged, particularly those in these rural counties. From Figure 2, we can see the distribution of schools skews rightward, where the median percentage of economically disadvantaged students is 60.7%. Most schools have more than *half* of their student body subsisting on government assistance programs.

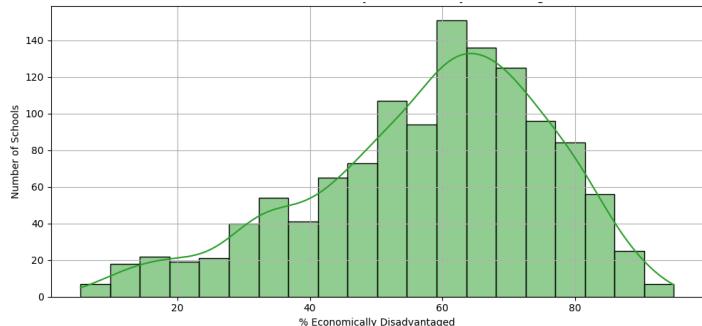


Figure 2. Distribution of K-5 schools by percent of student body Economically Disadvantaged

We conducted PCA on the three most important features: arts access, economic disadvantage, and overall non-proficiency, which groups non-proficient scores in all end-of-grade standardized testing. Conducting PCA on our data, we observe the result in Figure 3 and Table 1. We see there is a very clear pattern in PCA 1, which corresponds to our loadings in Table 1, that higher poverty, higher non-proficiency, and overall lower arts access. It suggests that economics is a more appropriate measure of academic proficiency. From our loadings from Table 1, we see that PC2 is dominated by Arts Per Capita, with some contributions from the other 2 features. This suggests that PC2 more directly labels arts access. However, we see that

from the graph, visually, that arts participation is slightly more ambiguous in terms of the outcomes or patterns of student proficiency.

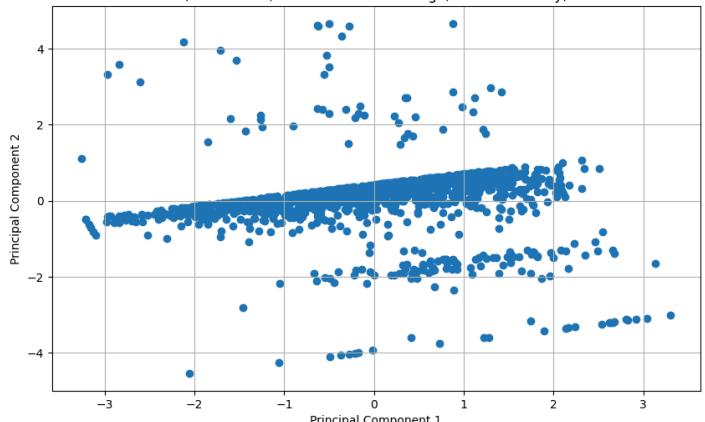


Figure 3. PCA of K-5 Schools Based on Arts Access, Economic Disadvantage, & Non-Proficiency Scores

Table 1. Loadings of PCA of K-5 Schools Based on Arts Access, Economic Disadvantage, & Non-Proficiency Scores

Feature	PC1	PC2
Arts per Capita	-0.273988	0.96169
Percent Economically Disadvantaged	0.680854	0.187256
Percentage of Nonproficiency Scores	0.679241	0.20022

I initially suspected that economic disadvantage is confounding the results due to the PCA analysis, where a clear correlation is seen with economic disadvantage and student outcomes, but less so with arts per capita. Therefore, I split the schools alongside FSA guidelines of economically disadvantaged institutions of >66% in the student body. Then I compared the amount of non-proficient students averaged across all standardized tests and college & career readiness scores. These two metrics aggregate all of the standardized tests taken by all K-5 students in NC.

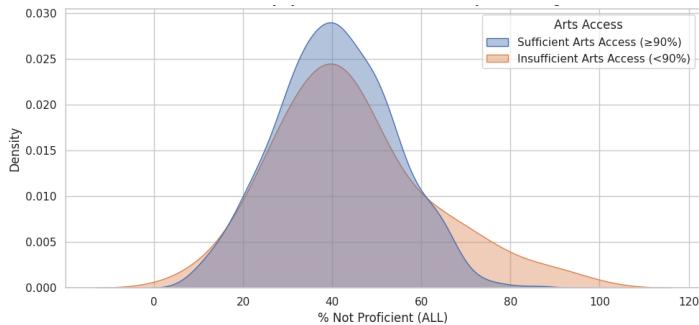


Figure 4. Non-Proficiency Scores by Arts Access with Not Economically Disadvantaged Schools

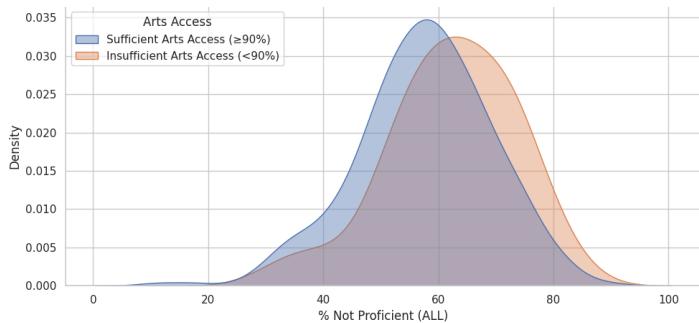


Figure 5. Non-Proficiency Scores by Arts Access with Economically Disadvantaged Schools

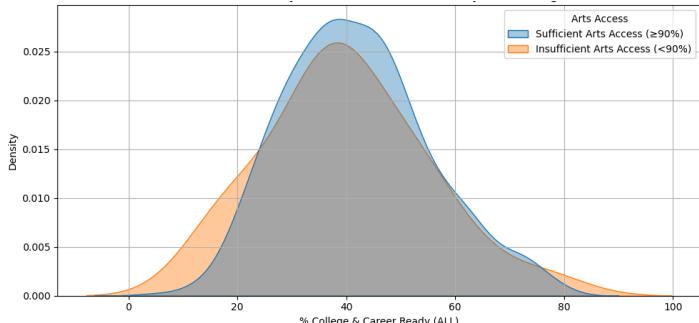


Figure 6. Career & College Readiness Scores by Arts Access with Not Economically Disadvantaged Schools

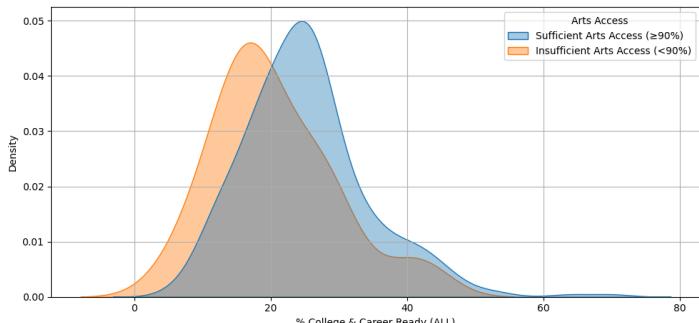


Figure 7. Career & College Readiness Scores by Arts Access with Economically Disadvantaged Schools

In Figures 4 & 6, we see that for schools with no economic disadvantage (<66% student body), there is no clear distinction between the student outcomes. Non-proficiency and college & career readiness scores have no clear separation between the two

distributions of schools with arts access & schools with insufficient arts access. However, this is slightly altered when we compare schools with similar economic disadvantages. From Appendix 1, we see that schools with arts access have a median percentage difference of 4% in non-proficiency. This suggests that around 4% of students in schools with arts access score better in standardized testing for grade-level requirements. Similarly, career & college readiness scores improve by 6.3%. We can also see that the distributions in Figures 5 & 7 are more clearly separated.

CONCLUSION

Our analysis suggests that arts education shows distinguishing differences in academic outcomes, especially for economically disadvantaged K-5 students. In schools where over 66% of students qualify as economically disadvantaged, greater access to arts instruction corresponded to a 4-6 percentage point improvement in both standardized non-proficiency rates and college & career readiness scores. By contrast, schools without a high concentration of economically disadvantaged students showed no significant difference in student outcomes.

From the US Department of the Interior study¹ into arts education and adolescent outcomes, it is noted that many students reported more positive outcomes alongside GPA, standardized testing, and chronic absenteeism with arts access outside of school. My foremost hypothesis is that more affluent students have access to arts outside of the classroom, so the need for arts education access inside the classroom is already substantiated. Therefore, we do not see a difference between arts access & no arts access standardized testing in Figures 4 and 6. However, in schools with more impoverished students, the only arts access students may receive is from their curriculum. Therefore, implementing structured arts education access as outlined in House Bill 418 has the potential not just to enhance arts engagement, but to support broader academic achievement and opportunity equity in North Carolina's most vulnerable K-5 student populations.

¹Office of Research & Analysis, Sunil Iyengar, Melissa Menzer, Patricia Mullaney-Loss, and Patricia Moore Shaffer, [Snapshot of Arts Education in Childhood and Adolescence: Access and Outcomes](#) (2025).

APPENDIX

I have attached a [website](#) with an extended bibliography and more information. I will need to request from Arts NC if it is possible to disclose their in-house information. Even though it is published online, it is not published in a neat tabular format like other published datasets. Moreover, my work with their project is not finished and will be more finalized throughout the coming week.

Stratum	Metric	Mean Change	Median Change
Economically Disadvantaged (>66%)	Percentage of Students Not Proficient	-4.71	-4.05
Economically Disadvantaged (>66%)	Career and College Readiness Scores	4.59	6.3
Not Economically Disadvantaged (<66%)	Percentage of Students Not Proficient	-3.52	-2.4
Not Economically Disadvantaged (<66%)	Career and College Readiness Scores	1.96	1.3

Appendix 1. Mean and Median Difference Stratified by Economic Disadvantage of Schools with Arts Access (>90% Arts Enrollment) and Insufficient Arts Access (<90% Arts Enrollment)