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11-2-2022

# Arts Course-taking and Math Achievement in US High Schools with Daniel Mackin Freeman

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## Repository Citation

Freeman, Daniel Mackin, "Arts Course-taking and Math Achievement in US High Schools with Daniel Mackin Freeman" (2022). *PDXPLORES Podcast*. 23.  
<https://pdxscholar.library.pdx.edu/pdxplores/23>

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# Daniel Mackin

Welcome to PDXPLORES, a Portland State University research podcast featuring scholarship, innovations, and discoveries pushing the boundaries of knowledge, practice, and what is possible, for the benefit of our communities and the world.

My name is Daniel Mackin Freeman. I'm a PhD candidate in the Department of Sociology and an adjunct faculty member in the Honors College. Generally I'm interested in educational inequality, with a focus on high school and the transition to adulthood. So more, more specifically, I'm interested in using quantitative methods to better understand how course taking and curriculum in high school contributes to or perpetuates broader social inequalities.

So I started working with Dr. Dara Schiffer, an associate professor in the sociology department when I entered the graduate program. At that time I was interested in studying educational inequality, but was more focused on adults arts, education, and qualitative methods. So Dara's work attracted me because I could see a clear connection to policy, or that our scholarly work was directly relevant to informing the creation of policies geared towards curbing educational inequality based on race, social class, and disability.

Her work and the NSF grant or the National Science Foundation grant that funded the research for the past five years was focused on academic disparities and underrepresentation in science, technology, engineering, and mathematics or STEM. The focus was to understand what contributes to, represents barriers to student success in STEM and the effects of race, poverty, and disability in that process.

First, the purpose of school in the U.S. is underpinned by a fundamental tension between democracy and capitalism. We look at schools to serve the democratic needs of society. That is cultivating critically literate civic actors capable of governing themselves or creating skilled workers capable and ready to enter the labor force.

While we tend to think of schools doing both, we lean more and more towards schools serving the needs of the labor market. And this is especially true for lower class student bodies. So national, state and local educational policy has come to reflect this with science and math learning being considered core or the most important subjects for overall student success.

The formal research question this paper addresses is, is course taking in fine arts subjects associated with higher math test scores in high school. And importantly, does this, uh, does school SES, or socioeconomic status differentiate this potential association? So much of the research in STEM education disparities often focuses on structural or invisible barriers to STEM success for disadvantaged youth. And with this project, I was interested in looking at a sort of inverse or complimentary framing focusing on pathways or invisible advantages that encourage and support success in STEM subjects for more advantaged youth that are not available to the less advantaged peers. Kind of looking at the many things, although seemingly, seemingly unrelated to STEM, grease the wheels of success for more advantaged students.

To answer the research questions for this particular study, we turned to the high school longitudinal study of 2009, which we adoringly call HSLs, which is a large nationally representative longitudinal data set that was developed and administered by the NCES or the National Center for Education Statistics, which is a division of the Department of Education, meaning that it's very high quality data that we can analyze to understand patterns in the entire US population of high school students. The data was uniquely situated to answer our research questions.

As far as investigating whether any relationship between arts course taking varied depending on the social class or school level socioeconomic status rather than individual level social we used administrator reports of the percent of the student body who were eligible for free or reduced lunch. Although imperfect this gets at inequality based on differences between schools rather than individual families.

So the first step in analysis was to look at differences in course taking by different levels of school level SES. So we grouped them into three tiers. The first were schools with 100% to 75% of their student bodies who were eligible for free reduced lunch programs. So this is the low SES schools group. The second was 76% to 25% of the student body eligible for free reduced lunch. So this is representing the mid SES group. And then finally, 24% to 0% eligible for free reduced lunch represented the high SES group. The differences across groups were quite striking, but what you might expect, the most privileged schools were composed of mostly white students from socially advantaged families. They took more courses overall in more varied subjects, and took many more music and visual arts courses than their peers in mid and especially low SES schools.

Based on other work in this area, we expected that math proficiency to be lower at the mid and lower SES schools, but we're surprised at how much lower. And we know that these inequalities are not just due to schools having access to vastly different educational resources, so things like funding, teachers, equipment, books, et cetera, but also because of staggering levels of inequalities outside of the schools.

Besides what more advantaged families can provide their students with extracurricular activities, school funding in the US is most commonly tied to property values in the neighborhood where the school is located. This means that schools located in more affluent areas, which in the US are segregated both racially and in terms of social class, simply have more resources to support learning.

This means that no matter how well intentioned the higher SES high schools are they are just fundamentally better positioned to deliver a higher quality curriculum. And then as schools faced a policy that emphasized math and science achievement, under-resourced schools were and are forced to cut or underfund programs that are not understood to directly benefit math and science achievement.

This has affected liberal arts and civics education overall in under-resourced schools, but this process has been especially bad for fine arts education in the U.S. currently a zero sum game. So currently students attending high SES schools, who haven't had to face the same sort of math and science or everything else dilemma are much more likely to not only offer high quality math and science curriculum, but also a wide range, and more holistic curricular offerings including fine arts programming.

So currently we don't know much about any relationships between arts course taking and mathematics achievement. There have been studies that focus on this relationship and the results are contested. Mainly this is because of data limitations or analyses that don't take into account many other possible alternative explanations.

There have been other studies that provide evidence that arts education is linked to critical thinking skills, positive attitudes towards schools, as well as several social emotional outcomes. But the link between math proficiency is less understood, and especially so if you disaggregate or separate the arts subjects.

Social and cultural capital are both distinct and interrelated in educational contexts. Broadly speaking, dominant cultural capital in schools has to do with

knowing what is expected of a “good student”. This includes things like dress, ways of speaking and behaving as well as knowledge that is deemed to be important in schools in the U.S,

We don't test this due to data limitations. But we speculate that taking more arts courses could provide more dominant cultural capital that in turn signals to math teachers that that particular student is a good one, and then this could translate to specialized attention and more encouragement from teachers. a higher math achievement.

So dominant social capital in the context of this study refers to social networks that are academically beneficial. Again, I don't wanna speak past the data, and we don't test this mechanism, but we speculate that another reason for fine arts relating to higher math achievement could be higher levels of social capital in those courses.

Think about music and theater courses, these classrooms could be organized in a way that students form closer bonds and the courses might attract more academically engaged students. And then this could translate, uh, to study groups or a culture of academic engagement that's unique within those courses.

So first we find an overall association between taking more music classes on average and higher 11th grade math test scores. This is net of all of our other factors that we were considering. However, once we consider differences by school SES, we find that this is only the case for youth attending more socially advantaged schools. Additionally, we find an association between taking more visual arts courses and lower math test scores. but this is only the case in mid SES schools.

Previous studies suggested that the benefit we find between fine arts courses and math would be larger at less advantaged schools. We were surprised to find that taking more arts courses in these schools didn't seem to matter in terms of math test scores.

Additionally, the visual arts finding was surprising, but makes sense when you think about it. If you're attending a school where there is high quality music education, the connection between reading, music and arithmetic might be more obvious, let alone if you have access to advanced music courses that emphasize this connection. If you're attending a school that can barely afford working instruments, this connection might be harder to make. Additionally, while taking a lot of visual arts courses at more advantaged schools might not relate to higher

math test scores. It doesn't hurt. and it might signal in the college admissions process that the student is, you know, well rounded.

So on the most basic level, we provide evidence that learning doesn't occur in subject silos. This means that if we're invested in educational equity and closing stem achievement gaps, it might require us to focus more holistically rather than zeroing in on more math and science specific content. So policy geared towards making curricular offerings at higher SES schools, more available to disadvantaged students might help curb the advantage that those students get from music.

One of the most important aspects of this research is to pay attention to the value of non STEM based education, right? So visual arts learning could be incredibly beneficial in other educational outcomes, like, I mean, just showing up to class or being more engaged because they know that they have this, you know, really exciting visual arts course that's coming up after lunch.

So we don't by any means, want this research to be understood as something that is negative or looking at the negative, uh, impact of visual arts education. More that we're focusing specifically on arts course taking relationship to math achievement, and our society's emphasis on math achievement is imperfect by nature.

My name is Daniel McIn Freeman, and the research I conduct is meant to contribute to our understanding of the roles school plays in perpetuating social inequalities.