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ORIGINAL ARTICLE

# Arts education and the high school dropout problem

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**Abstract** Arts education advocates belief that quality education in the arts can engage at-risk students in ways other subjects cannot and is therefore an important tool in preventing high school dropout. Although some studies point to lower dropout rates, most do not follow a large number of students over time or account for student and school characteristics expected to influence one's educational path. We fill this gap in the current literature by tracking nearly 175,000 first-time 9th-graders for 5 years using survival analysis with longitudinal administrative data from Texas. We find that cumulative credits in the arts are consistently associated with reduced dropout, even after controlling for prior achievement and contemporaneous course completion in core subjects. Our results provide evidence that the arts are a potential lever in education reform. Experimental and/or quasi-experimental research studies are needed to isolate the salient conditions under which arts participation can reduce dropout.

**Keywords** Education · Dropout · Survival analysis · Hazard estimates

**JEL Classification** I21 · I24

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## 1 Introduction

Dropping out of the educational pipeline continues to garner considerable attention at the federal, state, and local level not only because of the sheer numbers of students who are exiting school without a degree and not returning, but because this phenomenon disproportionately affects low-income, minority, and limited English proficient students. The choice to drop out of high school carries with it substantial personal and societal costs. Dropouts have trouble finding jobs, earn lower wages on average when they do, often experience poor health, and are incarcerated at rates much greater than their more educated peers (Rumberger 2011). There is no single, identifiable cause of dropping out. The challenging life circumstances and poor choices leading up to a decision to quit school often begin years earlier and have a cumulative impact on education and labor market outcomes (Rumberger 2011). Numerous interventions have been shown to produce modest effects on reducing high school dropout, and the Institute of Education Sciences provides recommendations for targeted and whole-school reforms through a What Works Clearinghouse dropout prevention guide (Dynarski et al. 2008). The authors conclude that the most promising dropout prevention initiatives are part of a comprehensive strategy that involves multiple actions aimed at increasing student engagement. In this paper, we investigate the potential of high school arts education to serve as one of these actions.

Courses in the arts involve active learning and are creative and engaging by their very nature. Arts participation often involves practice and performance with peers which can foster student attachment to a group and forge connections between a student and his school. Ask any high school dropout why they did not finish, and you are likely to hear that their classes were boring (Bridgeland et al. 2006). Davis (2012), founder of the Arts in Education Program at the Harvard Graduate School of Education, believes that encouraging at-risk students to participate in arts courses is a way to stave this tide of disinterest by enabling these students to become agents in their own learning. Students bring their own ideas into the arts classroom and create out of their own life experience.

The arts may also encourage persistence by providing a safe place for students to fail and learn from mistakes in ways that might not be available to them in other subjects. Davis (2012) quotes a theater teacher explaining how this safety is generated through process-oriented learning:

> “In the arts class, failure is not a bad thing and there is not a strong need for students to be ‘right.’ There is a great lesson in the exploration, and results are not framed as such, for it is the process that is the lesson” (p. 73).

Davis maintains the arts support process-oriented learning well, and that the act of making art causes students to reflect on the progression of their creations and not just the end result. Current research continues to reveal how important it is for students to develop noncognitive skills to be successful (e.g., Heckman et al. 2006; Cobb-Clark and Tan 2011), particularly perseverance, attention, motivation, and self-confidence (Heckman 2008). If arts education can produce self-directed, goal-oriented learning in an environment that explicitly supports learning from mistakes, arts students may be able to build the soft skills they need to help them stay in school.

Despite the transformative power that the arts can have in the lives of youth, the flow of resources into arts education is often stagnant at the best. According to the Center for Arts Education, New York City public schools eliminated or failed to replace 135 arts teachers during the 2009–2010 school year. This left 23 % of all New York City public schools with no full or part-time licensed instructors in the arts. For the 4-year period ending with the 2009–2010 school year, the budget for arts supplies, equipment, and musical instruments was also slashed by 80 % (Israel 2011). The Los Angeles Unified School District cut the arts education budget by 76 % between 2007 and 2012. As explained by Steven McCarthy, the only remaining member of the district's arts education branch (down from 20 staff members), the realities of school budget cuts are that "…legal mandates win, and other things fall to the wayside." (Abdollah October 10, 2012). Mr. McCarthy echoes a common belief in the arts education community—that the accountability movement largely safeguards traditionally tested subjects such as math and English language arts (ELA) from extreme cuts, while the arts are often the first to suffer when budgets are constrained. Although eligible for federal funding through the No Child Left Behind Act of 2001 (Sect. 5551 Assistance for Arts Education), arts education is typically not a priority, particularly in schools serving a large fraction of disadvantaged students. Learning in the arts is not assessed on a widespread basis like math and ELA, and consequently, many school districts report reducing instructional time in the arts to allow more time for math and English tutoring (Center on Education Policy 2006).

The evidence linking arts involvement to student dropout behavior is thin. We have not identified any studies that track a large number of students over time and control for the wide variety of student and school characteristics expected to impact one's educational path. For example, Barry et al. (1990) conduct a qualitative study by surveying 40 students identified as at risk. They find that 27 % of the respondents state they stayed in school because of the arts. Mahoney and Cairns (1997) follow 392 students from 7th- to 12th-grade and find that high school arts participation is positively associated with completing 11th-grade. Their findings are limited because they track a small number of students from two middle schools, control only for a basic socioeconomic status (SES) index, a teacher-rated scale of academic and social competence, and extracurricular participation.

Catterall (2009) and Catterall et al. (2012) provide the most rigorous evidence to date that arts participation is associated with reduced dropout and other positive education outcomes by examining nationally representative, longitudinal databases. The authors of both studies compare outcomes for low SES/low arts students, low SES/high arts students, high SES/low arts students, and high SES/high arts students. Catterall et al. (2012) find that more students in the low SES/low arts category (22 %) fail to graduate high school than those in the low SES/high arts category (4 %) compared with 7 % across all SES groups. While both studies benefit from the longitudinal structure of large databases, the analyses are parsimonious and do not consider how including other student or school characteristics might weaken the contrasts between arts and non-arts students.

Our main contribution to the current literature is that we track a large number of the same students over time while controlling for a host of student and school characteristics we expect to influence both arts participation and student dropout behavior. The empirical approach we utilize, known as survival or event history analysis, models the amount of time to a particular event—in this case dropping out of high school. We follow 174,947 first-time 9th-graders who entered a Texas public high school in the fall of 2005 for 5 years using longitudinal administrative data from the University of Texas at Dallas Education Research Center (UTD–ERC). In addition to arts course-taking, the available data include standardized test scores in math and reading as well as the courses students complete in math and ELA—the most frequently tested subjects and the ones most consistently linked to positive education and labor market outcomes. While we are not making the claim that arts and non-arts students differ only by their observable characteristics, we believe that our selection on observables model is well specified and brings us closer to a causal interpretation than prior research.

## 2 Data

We estimate the impact of high school arts participation on time to dropout for a cohort of 9th-graders over 5 years using Texas state administrative data. The 9th-graders in our cohort enter a Texas public high school for the first time in the fall of 2005. We exclude those attending magnet or charter schools as well as those without 8th-grade Texas Assessment of Knowledge and Skills (TAKS) scores. We also restrict the sample to include only those students who remain at the same high school over our observation period. Details about our censoring procedure follow. Table 1 provides descriptive statistics for the 174,947 first-time 9th-graders in our cohort in the first year of observation—2006, which we reference by the spring term. Covariates include both time-invariant and time-varying characteristics at the student and school level. Our treatment variable is arts exposure, and the dose is reflected in our variable of interest—the number of cumulative credits in the arts. The arts are defined as the aggregate of courses in visual arts, music, theater, and dance. The average number of arts credits received for this cohort of 9th-graders in 2006 is one-half credit. In order to graduate with the recommended or advanced diploma, students in our cohort must complete one Carnegie unit in a single artistic discipline: visual art, music, theater, or dance (Texas Administrative Code 2010).

In Table 1, we also provide descriptive statistics for arts and non-arts students. Forty-two percent of the students in our cohort complete a full arts credit in 9th-grade. The typical student who does so is a white female with substantially higher than average standardized test scores compared with the typical student who does not complete a full credit in the arts in the first year. Arts students are also less likely to be low-income or identified as at risk compared with non-arts students. The primary reason a student is given at-risk status in the state of Texas is because he or she is not advancing from one grade to the next. However, students who perform poorly on state standardized tests, who are pregnant or parents, or who are expelled from school are also identified as at risk (Texas Education Agency 2010). As such,

**Table 1** First-time 9th-graders in Texas public high schools in 2006

| | Mean (SD) | | |
|---|---|---|---|
| | Full sample | No arts | Arts |
| *Time-constant student characteristics* | | | |
| Male | 0.49 (0.50) | 0.55 (0.50) | 0.41 (0.49) |
| Black | 0.12 (0.32) | 0.13 (0.34) | 0.10 (0.30) |
| Hispanic | 0.39 (0.49) | 0.43(0.50) | 0.35(0.48) |
| Asian | 0.03 (0.18) | 0.03 (0.16) | 0.04 (0.19) |
| Native American | 0.00 (0.06) | 0.00 (0.06) | 0.00 (0.06) |
| 8th-Grade Math TAKS (Z-score) | 0.10 (0.97) | −0.05 (0.98) | 0.29 (0.91) |
| 8th-Grade Reading TAKS (Z-score) | 0.09 (0.93) | −0.05 (1.01) | 0.27 (0.78) |
| Low-income | 0.42 (0.49) | 0.47 (0.50) | 0.36 (0.48) |
| At risk | 0.42 (0.49) | 0.48 (0.50) | 0.34 (0.47) |
| Limited English proficient | 0.04 (0.19) | 0.05 (0.21) | 0.02 (0.14) |
| Special education | 0.03 (0.17) | 0.03 (0.18) | 0.03 (0.16) |
| *Time-constant school characteristics* | | | |
| Rural (2000 census) | 0.31 (0.46) | 0.31 (0.46) | 0.32 (0.47) |
| *Time-varying student characteristics* | | | |
| Cumulative Science credits | 0.85 (0.34) | 0.79 (0.38) | 0.92 (0.25) |
| Cumulative Math credits | 0.82 (0.38) | 0.76 (0.42) | 0.90 (0.30) |
| Cumulative English Lang arts credits | 1.25 (0.64) | 1.24 (0.70) | 1.26 (0.54) |
| Cumulative Social Science credits | 0.87 (0.33) | 0.82 (0.37) | 0.93 (0.25) |
| Cumulative arts credits 2006 | 0.53 (0.64) | 0.04 (0.13) | 1.19 (0.42) |
| Cumulative arts credits 2007 | 1.07 (1.08) | 0.06 (0.16) | 1.67 (0.93) |
| Cumulative arts credits 2008 | 1.62 (1.48) | 0.10 (0.20) | 1.99 (1.42) |
| Cumulative arts credits 2009 | 2.21 (1.95) | 0.21 (0.25) | 2.33 (1.95) |
| *Time-varying school characteristics* | | | |
| Percent low-income | 41.21 (23.9) | 43.3 (24.2) | 38.4 (23.1) |
| Percent limited English proficient | 6.1 (6.7) | 6.5 (7.0) | 5.6 (6.3) |
| Percent black | 12.6 (14.9) | 13.2 (15.8) | 11.9 (13.5) |
| Percent hispanic | 38.7 (29.6) | 40.5 (30.2) | 36.2 (28.6) |
| Total enrollment | 1,915 (1,027) | 1,898 (1,019) | 1,938 (1,038) |
| Number of observations 2006 | 174,947 | 100,801 | 74,146 |
| Number of observations 2007 | 154,100 | 57,397 | 96,703 |
| Number of observations 2008 | 139,750 | 27,921 | 111,829 |
| Number of observations 2009 | 126,377 | 7,106 | 119,271 |

*Source:* UTD–ERC data; descriptive statistics for time-varying variables are for the initial year of study except where indicated. All models include enrollment squared. The sample excludes students attending charters, magnets, and campuses that include grades other than the 9–12 grade span. The students identified as participating in the arts completed at least one arts credit. The students identified as not participating in the arts completed <1 arts credit, most of whom completed zero credits the at-risk designation serves as a proxy for a student's connection to school. The data patterns reflected in Table 1 are the typical patterns researchers observe when examining arts participation using other sources of observational data (e.g., Catterall 2009), and they indicate positive selection is at work.

## 3 Analysis and results

### 3.1 Unconditional and conditional hazard estimates

Survival analysis illuminates how the risk of dropping out changes as time passes for the students who have yet to finish or drop out. Standard linear regression techniques are not appropriate in this context because data are right censored for the following reasons: (1) Students experience the failure event and dropout of high school; (2) students graduate high school; (3) students are still in school at the end of our 5-year observation period; (4) students leave high school for other reasons such as transferring to a private or out-of-state school or choosing to become homeschooled; or (5) students transfer to another Texas public high school. Once these events occur, the students are no longer at risk of dropping out of the high school to which they originally enrolled. Consequently, the risk pool is made up of the students who have survived up until that point and are still at risk of dropping out.

Dropping out of high school is a failure with a risk profile that can be described over time via a hazard function. The hazard function given by Eq. 1 depicts the risk of dropping out as a function of time for student $i$ in school $j$ in a proportional hazards framework (Cox 1972):

$$h_{ij}(t) = h_0(t)\exp(x_{ij}\beta_x) \tag{1}$$

Equation 1 defines the hazard as a function of the baseline hazard, $h_0(t)$, which profiles the risk all students face, modified by the observable student and school characteristics described in Table 1.

Figure 1 depicts the cumulative hazard function until the first dropout for students without a full arts credit, for those who meet the graduation requirement with exactly one credit in the arts, and for those who accumulate more than one credit before they exit high school. The cumulative hazard function represents the total amount of risk accumulated with each passing year. Because these functions are proportional, the shapes are identical, and any estimated differences are represented by shifts in the hazard function relative to the baseline (Cleves et al. 2010). Generally speaking, one can interpret these shifts as intercept changes instead of changes in slope. We are not interested in the shape of the hazard functions, *per se*, but the distances between the functions that are generated by student participation in the arts.

The students without a full arts credit include those students with no arts experiences and those students with only minimal exposure—typically the completion of one-half credit. Students facing the lowest risk of dropout in any

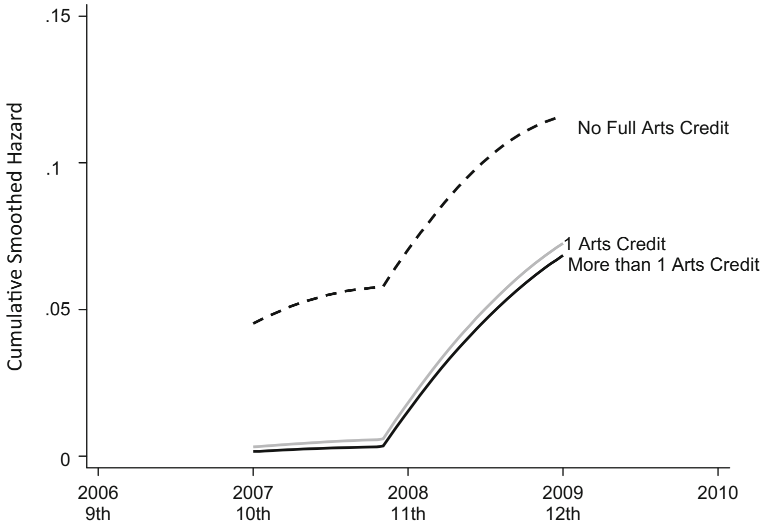


**Fig. 1** Unconditional smoothed hazard rate estimates until time to first dropout by arts credits: time-constant coefficients. *Source:* UTD–ERC. *Note:* depicts the typical on-time progression to graduation. Every year after 2006 includes the students repeating previous grades. We estimate hazards by smoothing the Nelson–Aalen cumulative hazard with a kernel (Gaussian) smoother. Although we follow our cohort for 5 years, beginning and ending years in our time period are not plotted because of the boundary bias kernel smoothing creates due to insufficient data at the endpoints. The null hypothesis for the equality of the hazard functions can be rejected at >99 % confidence level using log rank test statistics

year, given that they have persisted through the previous year, are the students taking courses in the arts. We see a jump in all of the estimated hazard functions in 2008 when students reach the age at which they can legally leave school. However, without controlling for any other student or school characteristics, we can see in Fig. 1 that the risk of dropping out is elevated for students without a full arts credit at every year in our time period.

Because many of the students who bypass arts education are minority students from economically disadvantaged families (Catterall 2009), it is likely that at least some of the unconditional difference between the hazard functions is due to other characteristics, both observable and unobservable, that drive student participation in the arts and positive education outcomes. The gap between the estimated hazard functions of those students with and without arts experiences could be due to (1) the causal impact that arts participation has on dropping out, (2) selection effects, or (3) the fact that not having met a graduation requirement in the arts is serving as a proxy for not having met other graduation requirements.

Figure 2 reproduces the hazard functions depicted in Fig. 1, but now controls for student and school characteristics, assuming time-constant coefficients. Students who have not earned a full credit in the arts face an increased risk of dropping out of high school at every year in our time frame. However, the gap between those with and without arts experiences is significantly reduced once we control for observable characteristics. The students in our cohort who face the lowest risk of dropping out

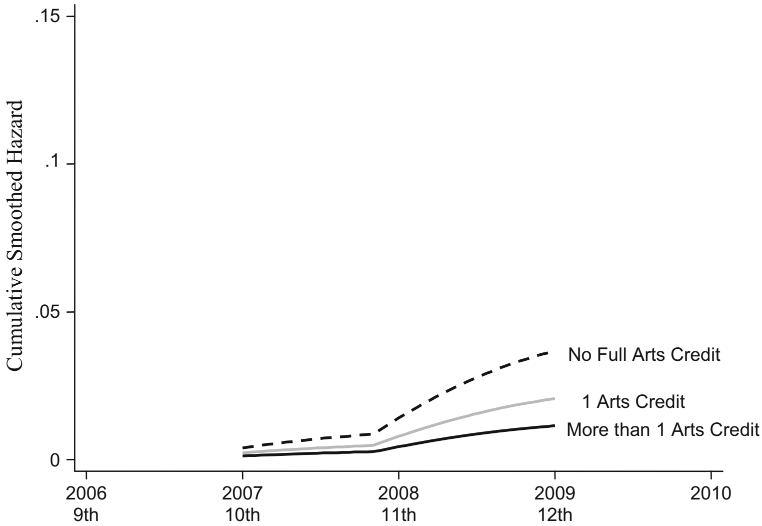


**Fig. 2** Conditional smoothed hazard rate estimates until time to first dropout by arts credits: time-constant coefficients. *Source:* UTD–ERC. *Note:* depicts the typical on-time progression to graduation for a baseline student who possesses the average characteristics of the sample. Every year after 2006 includes the students repeating previous grades. We estimate hazards by smoothing the Nelson–Aalen cumulative hazard with a kernel (Gaussian) smoother. Although we follow our cohort for 5 years, beginning and ending years in our time period are not plotted because of the boundary bias kernel smoothing creates due to insufficient data at the endpoints

are the students who have chosen to study the arts more intensely and have moved beyond the one-credit graduation requirement.

To further illustrate the importance of selection effects, we show in Table 2 how the estimated hazard ratios for our treatment variable change as we add control variables in a series of time-constant Cox proportional hazards models. Coefficient estimates in these models are always positive, with coefficients $<1$ indicating a reduced risk of dropping out and coefficients $>1$ indicating an increased risk of dropping out. When controlling only for cumulative arts credits in model 1, the estimated coefficient indicates that students who complete an arts credit face a risk of dropping out that is half the baseline hazard of a non-arts student. As additional controls are added, the negative association between accumulating credits in the arts and the risk of dropping out of high school becomes less and less pronounced. When controlling for all observable characteristics defined in Table 1, the estimated hazard ratio for cumulative credits in the arts is 84 % of the baseline hazard in a time-constant model, illustrating the danger in interpreting the estimate in model 1 as causal.

We provide Fig. 2 and Table 2 purely for descriptive purposes. Not surprisingly, as is true in many empirical applications, the proportional hazard assumption does not hold in any of the models we estimate with time-constant effects. The primary Cox model we present corrects this shortcoming by incorporating time-varying coefficients, a common way to deal with the violation of this restrictive assumption (Royston 2001).

**Table 2** Impact of arts credits on the risk of dropping out: time-constant coefficients

| Hazard ratio estimates for arts credits | |
|---|---|
| Model 1 includes arts credits only | 0.51*** (0.015) |
| Model 2 adds student characteristics except test scores | 0.57*** (0.015) |
| Model 3 adds 8th-grade TAKS scores | 0.62*** (0.015) |
| Model 4 adds school characteristics | 0.62*** (0.015) |
| Model 5 adds other course credits | 0.84*** (0.014) |

Estimates are from Cox proportional hazards models. Arts credits are cumulative. Robust standard errors are in parentheses, clustered on high school. Coefficients <1 indicate a reduced risk of dropping out, and coefficients >1 indicate an increased risk of dropping out

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

## 3.2 Cox proportional hazards model with time-varying effects and shared frailty

The Cox model given by Eq. 2 estimates hazard ratios for each year of our time period:

$$h_{ij}(t) = h_0(t)\alpha_j \exp(x_{ij}\beta_x) \tag{2}$$

In addition to allowing the estimated coefficients to vary over time, our primary model also incorporates a shared frailty term to address selection bias at the school level. Shared frailty survival models are appropriate specifications when one expects observations within a group, such as schools, to be correlated. Accounting for unobserved heterogeneity at the school level is particularly important when examining student dropout because evidence indicates that a majority of our nation's dropouts are produced by a small number of high schools commonly known as "dropout factories" (Balfanz and Legters 2004). Even after accounting for observable student and school characteristics, we would expect some students to be at increased risk of dropout because they attend such schools.

Essentially, shared frailty can be thought of as a random effects model that accounts for unobservable group effects expected to impact the time to event. An unobserved group frailty effect, $\alpha_j$, enters multiplicatively into the hazard function. The frailty effect is assumed to have mean 1 and variance $\theta$ which is estimated from the data (Cleves et al. 2010). Including $\alpha_j$ mitigates the selection bias that can arise from unobservable school characteristics affecting student persistence to later grades. Our results for the full model show that the shared frailty effect is indeed significant at the 1-percent level indicating the presence of unobserved heterogeneity at the school level. This is consistent with the supposition that some schools create unmeasured risk that increases the chance of student dropout.

Table 3 provides estimated hazard ratios for cumulative credits in the arts for 4 years of our time period for the pooled analytic sample and for samples divided between low and high achievers as well as boys and girls. We define low achievers as students who do not make the proficiency threshold for the math TAKS as defined by the Texas Education Agency. The proportional hazards assumption holds globally and for most of the individual covariates, including our treatment variable.

**Table 3** Impact of arts credits on the risk of dropping out: time-varying coefficients

| | Year 1 | Year 2 | Year 3 | Year 4 |
|---|---|---|---|---|
| Full model | 0.59*** (0.07) | 0.78*** (0.04) | 0.84*** (0.03) | 0.84*** (0.02) |
| Low achievers | 0.48*** (0.08) | 0.77*** (0.05) | 0.81*** (0.04) | 0.85** (0.02) |
| High achievers | 0.83 (0.16) | 0.80*** (0.07) | 0.86*** (0.05) | 0.80*** (0.04) |
| Boys | 0.77 (0.14) | 0.72*** (0.06) | 0.76*** (0.04) | 0.78** (0.03) |
| Girls | 0.49*** (0.08) | 0.81*** (0.06) | 0.87*** (0.04) | 0.86*** (0.02) |

Estimates are from Cox proportional hazards models with shared frailty based on high school attended. Arts credits are cumulative. Standard errors are in parentheses. Coefficients <1 indicate a reduced risk of dropping out, and coefficients >1 indicate an increased risk of dropping out

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

The hazard ratio estimates for our time-varying arts course completion variable for the pooled sample indicates that receiving credit in an arts course reduces the likelihood of dropping out in all 4 years. The greatest effect size for course completion in the arts is in the first year when a student earning an additional arts credit faces a hazard, or risk of dropping out, that is 59 % of that of an otherwise similar non-arts student for a given level of frailty. This first-year effect is even more pronounced in the subsamples for low achievers and girls. Low achievers participating in arts education their first year of high school face an estimated hazard of dropping out that is half the hazard faced by similar low achieving students who bypass the arts their first year. We see no such impact for high achievers where the estimated hazard is 83 % of the baseline and not statistically significant. Supporters of robust arts education programs have long argued that the arts are particularly important for struggling students, and our results for low and high achievers support that claim.

A large and statistically significant first-year effect is also apparent in the subsample for girls, even after holding constant the degree to which students are connected to school through the at-risk designation. A burgeoning literature in the past decade has documented a disengagement of boys from school culminating in decreased postsecondary enrollment rates and educational attainment for boys (e.g., Fortin et al. 2013). If girls are more open to forming school connections relative to boys, the arts may have a ready conduit in which to operate–engagement can foster further engagement. We do still observe a negative association between cumulative arts credits and dropout behavior in years 2–4 for boys, but the associations are not as striking as they are for girls in the first year.

The arts impact for all of the models with large first-year effects decay substantially by the second year and steadily after that. This could indicate that the best time to encourage students to enroll in an arts course is when they matriculate high school. However, we do not know whether the dissipating arts effect is because students take different numbers of credits over time or because the effect of taking arts courses differs by grade. Perhaps, we observe the greatest impact in the first year because the more motivated students take the only arts course they ever intend to take in their first year. Procrastinators may possess different unobservable characteristics that dampen the arts effect in later years, especially given that the risk pool is shrinking and is populated by more and more survivors. Undoubtedly, some of the students who delay taking an arts course do so because poor performance in their first year requires remediation, leaving no room for courses outside the core academic areas. These are all plausible explanations for what we are currently observing in our data, but we cannot confirm that these are the underlying mechanisms driving student behavior in this study. We hope to disentangle these different explanations for the observed pattern in future work.

## 4 Conclusions

To date, the evidence supporting the inclusion of arts education in our public school curriculum has been based largely on correlational studies that fail to account for the student and school characteristics that drive both arts participation and high school dropout. We have pushed the field forward by utilizing longitudinal education data from the state of Texas and employing a more rigorous methodology to explore the link between earning arts credits, accumulated over time, and dropout behavior. By using survival analysis, we have shown that the gap between the estimated hazard rates for students with and without arts experiences closes substantially once we include school and student covariates in the models, but it does not disappear. This is particularly telling given recent evidence that some positive education outcomes might be driven entirely by the observable characteristics of students who choose to enroll in courses in the arts (Elpus 2013). We do not find that to be the case here.

Because arts environments are not randomly assigned across high schools, we account for school level selection by incorporating shared frailty in a model with time-varying coefficients. We also control for the number of credits students complete over time in math, ELA, science, and social studies to ensure that accumulating credits in the arts is not merely serving as a proxy for accumulating credits in the other core subjects required for graduation. Including these covariates does not eliminate the estimated arts effect, and given the richness of our data, we posit that at least a portion of the estimated arts effect captures the causal impact of arts participation on reducing high school dropout. Successful completion of courses in the arts is associated with students remaining in school, especially for girls and students who are struggling academically. However, because we are unable to account for unobserved individual heterogeneity, we cannot ignore the possibility that our results are partially driven by student-level selection into the arts. Courses in the visual arts, music, theater, and dance are not required subjects for all Texas students to graduate in our years of observation, and only one credit in one artistic discipline is required for those students who are college-bound. We cannot know the counterfactual outcome—if the students who chose to accumulate multiple credits in the arts would have graduated anyway, even if they had not participated in arts courses while in high school.

Because we lack a clear identification strategy, we fall short of making the causal claim that would justify recommending investment in arts education as a specific strategy schools undertake to address the high school dropout problem. However, we do believe our results suggest that when faced with budget cuts, decision-makers should pause before cutting the arts from our public schools, especially for those with high dropout rates. Given the current state of the economy and the proliferation of budget cuts to arts education that have already occurred, this is a challenging proposition. A recent report from the US Department of Education (Parsad and Spiegelman 2011) reveals that over the decade 2000–2010 the percentage of public elementary schools and high schools offering courses in the visual arts, theater, and dance all declined, despite increased public school enrollment over the same period (Aud et al. 2012).

The next step for the field should be the undertaking of experimental and/or quasi-experimental research studies that can isolate the most promising conditions under which arts participation can mitigate the high school dropout problem. This potential certainly exists. For example, while historically the National Endowment for the Arts (NEA) has not provided competitive grant funding for researchers, it began an initiative in 2012 to fund small 1-year research studies to examine the impact of the arts primarily using existing data from a variety of sources. In 2014, the NEA awarded a total of $330,000 to 21 organizations through its Art Works Research Grant Program, even funding a handful of randomized control trials. This is a move in the right direction and a significant achievement for the NEA given increased political pressure to reduce federal spending. But we surmise that the field has exhausted the benefits of small-scale research studies that produce localized and largely descriptive evidence of the impact of the arts. We suggest that the NEA and other interested stakeholders pool resources and seek to fund one or two large-scale, multi-year studies that propose to use an experimental or quasi-experimental research design. Our results using administrative data indicate that investing in such efforts could be fruitful for the field.

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## References

Abdollah, T. ( 2012, October 10). LAUSD arts funding cut 76 percent in five years.89.3 KPCC Southern California Public Radio. http://www.scpr.org/blogs/education/2012/10/10/10421/lausd-arts-funding-cut-76-five-years/. Accessed November 28, 2012.

Aud, S., Hussar, W., Johnson, F., Kena, G., Roth, E., Manning, E., Wang, X., & Zhang, J. (2012). *The condition of education. 2012 NCES 2012-045*. Washington, DC: U.S. Department of Education, National Center for Education Statistics. http://nces.ed.gov/pubsearch. Accessed November 29, 2012.

Balfanz, R. & Legters, N. (2004). Locating the dropout crisis: Which high schools produce the nation's dropouts? Where are they located? Who attends them? Report 70. Center for Research on the Education of Students Placed At Risk. http://www.csos.jhu.edu/crespar/techReports/Report70.pdf. Accessed June 12, 2013.

Barry, N, Taylor. J. & Walls, K. (1990). *The role of the fine and performing arts in high school dropout prevention*. Center for Music Research, Florida State University. http://www.eric.gov/PDFS/ED354168.pdf. Accessed June 12, 2013.

Bridgeland, J. M., DiIulio, Jr., J. J. & Morison, K. B. (2006). The silent epidemic: Perspectives of high school dropouts. A report by Civic Enterprises in association with Peter D. Hart Research Associates for the Bill and Melinda Gates Foundation. http://www.gatesfoundation.org/united-states/Documents/TheSilentEpidemic3-06Final.pdf

Catterall, J. S. (2009). *Doing well and doing good by doing art: A 12-year national study of education in the visual and performing arts; effects on the achievements and values of young adults*. Los Angeles: Imagination Group.

Catterall, J. S., Dumais, S. A., & Hampden-Thompson, G. (2012). The arts and achievement in at-risk youth: Findings from four longitudinal studies. Research Report #55. Washington, DC: National Endowment for the Arts.

Center on Education Policy. (2006). *From the capital to the classroom: Year four of the no child left behind act*. Washington, DC.

Cleves, M., Gould, W., Gutierrez, R., & Marchenko, Y. (2010). *An introduction to survival analysis using Stata* (3rd ed.). College Station, TX: Stata Press.

Cobb-Clark, D. A., & Tan, M. (2011). Noncognitive skills, occupational attainment, and relative wages. *Labour Economics, 18*, 1–13.

Cox, D.R. (1972). Regression models and life-tables (with discussion). *Journal of the Royal Statistical Society*, Series B, 187-220.

Davis, J. H. (2012). *Why our high schools need the arts*. New York: Teachers College Press.

Dynarski, M., Clarke, L., Cobb, B., Finn, J., Rumberger, R., & Smink, J. (2008). *Dropout prevention: A practice guide (NCEE 2008–4025)*. Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. http://ies.ed.gov/ncee/wwc. Accessed October 07, 2014.

Elpus, K. (2013). Is it the music or is it selection-bias? A nationwide analysis of music and non-music students' SAT scores. *Journal of Research in Music Education, 61*, 175–194.

Fortin, N.M., Oreopoulos, P. & Phipps, S. (2013). Leaving boys behind: Gender disparities in high academic achievement. *NBER Working Paper No. 19331*.

Heckman, J. J. (2008). Schools, skills, and synapses. *Economic Inquiry, 46*, 289–324.

Heckman, J. J., Stixrud, J., & Urzua, S. (2006). The effects of cognitive and noncognitive abilities on labor market outcomes and social behavior. *Journal of Labor Economics, 24*, 411–482.

Israel, D. 2011, July. Accelerating arts education funding cuts and loss of arts teachers paint grim picture for city schools. The Center for Arts Education. www.cae-nyc.org/sites/default/files/docs/Research-Brief-Accelerating-Arts-Education-Cuts-June-2011.pdf. Accessed November 27, 2012.

Mahoney, J. L., & Cairns, R. B. (1997). Do extracurricular activities protect against early school dropout?*Developmental*. *Psychology, 33*, 241–253.

No Child Left Behind Act of 2001, 20 U.S.C., 6301 et. seq. (2009).

Parsad, B., & Spiegelman, M. (2011). *A snapshot of arts education in public elementary and secondary schools: 2009–10 (NCES 2011–078)*. Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S Department of Education.

Royston, P. R. (2001). Flexible parametric alternatives to the Cox model, and more. *The Stata Journal, 1*, 1–28.

Rumberger, R. W. (2011). *Dropping out: Why students drop out of high school and what can be done about it*. Cambridge, MA: Harvard University Press.

Texas Administrative Code. (2010). Title 19, Part 2, Chapter 74, Subchapter E, Rule §74.54.

Texas Education Agency. (2010). Academic Excellence Indicator System Glossary. http://ritter.tea.state.tx.us/perfreport/aeis/2010/glossary.html. Accessed August 07, 2013.