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Estimating the Payoffs of K-12 Arts Education

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Estimating the Payoffs of K-12 Arts Education

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Abstract

Arts education has been in debate since the United States introduced formal education system. While some argue its lack of significance, others argue its crucial underpinnings to our society. This paper explores the significance of arts education using the Higher Order Thinking (HOT) program in Connecticut schools to measure students' payoff on statewide standardized testing, namely Connecticut Academic Performance Test (CAPT). The sample includes 20 schools that have either been HOT or have become HOT within a five year period from the 2008-2009 to 2012- 2013 school year. We use a fixed effects Ordinary Least Squares (OLS) regression to estimate five equations with the overall score as the dependent variable as well as the scores in individual subjects. The paper has found that the HOT program, a program instilling arts education into every classroom, has placed slight downward pressure on students' performance. It is theorized that this may be due to the added stress on teachers and students by means of school reform as well as a poor school's inability to adapt to a school reform affectively.

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Introduction

Arts education can be defined as an accumulation of knowledge in the areas of mass communications, creative arts and design, studio art, and languages (Comunian et al, 2014). Studies found that arts education is beneficial for early childhood development because it helps children focus in the classroom and transfer knowledge to be used in other areas (Galligan, 2001). Unfortunately, not much economic theory has been used to measure the payoffs of K-12 arts education. In a time when early arts education is being threatened by budget cuts, it is important to accurately estimate a true payoff from learning the arts during a child's developmental years.

The current president of the United States has been proposing a massive budget cut to programs that directly fund the majority of arts education in the nation such as, but not limited to: Institute of Museum and Library Services, the National Endowment for the Humanities, the National Endowment for the Arts, and the Corporation for Public Broadcasting (Peet, 2017). This budget cut will most likely force federal agencies to shut down many public programs that bring arts education to the community. When it comes to budget cuts, the programs that produce the lowest payoffs are the first to go. Because arts education often results in subjective, difficult to measure outcomes, it is the target of decreased government spending. This paper adds to the exploration of the role of arts education .

The economic debate on arts education mainly focus on secondary education and the creative economy specifically. For this reason, I focus on arts education on the population as a whole (both A&H and non A&H K-12 students) and measure the payoffs of students that are both classified as creatives and non-creatives through standardized testing (overall school performance, and performance in a specific subject: math, reading, writing, and science). By

doing such, the economic disadvantages and volatility of the creative economy would not cloud the benefits of an arts education.

The results of this model showed moderate, downward pressure as a result of arts education. This pressure is believed to be a result of too sudden reform on economically impoverished schools. This would not only cause stress on the school environment and create inefficiency in learning, but take away classroom time for impoverished students who are already struggling in core subjects.

The paper will follow as such: a literature review followed by an exploration of the treatment in the paper's empirical model, the Higher Order Thinking program in Connecticut, as an exploration in Connecticut's standardized testing method and the impact of expenditures. Then, the data and methodology will be presented and discussed. The paper will conclude with a summary and further research suggestions.

Literature Review

The majority of literature on arts education mainly focuses on the positive relationship between arts education and a student's outcome. There are, however, classical philosophers, like Plato, who have contributed to the critique of integrating the arts into education. This critique was a poignant one that may have influenced western civilization today harming the arts' best interest. In this context, arts is generally defined as "representational, expressive, and formal dimension" subject matter that engages its viewer through a focus on thought and emotions (Tate, 2016). The definition of arts education in use of this paper is based on how Comunian et al (2012) defines it: the accumulation of knowledge in the areas of mass communications, creative/studio arts and design, and languages.

One of the most prevalent and common themes among the literature on the role of education is the findings of arts education as a promoter of transfer knowledge. As Lackey and Huxhold (2016) state, the arts promote “habits of mind” by means of “engaging and persisting, envisioning, observing, and reflecting. Their conclusion comes from a two-year study of a public school’s art program conducted by Hetland et al. (2013). They explain that these skills help students learn more quickly and efficiently in non-arts courses (Lackey & Huxhold, 2016). The findings by Galligan (2001) reiterate that arts education in K-12 can be linked to development and improvement in mental agility, dexterity, and autonomy. These attributes along with curiosity, creativity, imagination, and capacity for evaluation are not only concluded to be enhanced by the arts, but are also grouped as higher-order thinking and affective skills in the workforce by Psilos (2002) as well as Iyenger and Hudson (2014). Psilos found through empirical research that students who studied the arts at a young age were more likely to self assess, rise to a higher academic standing, and possess the ability to plan ahead for a professional future (2002).

In addition to improving students’ efficiency in various classrooms, previous literature claims that the integration of arts education may level the playing field for at-risk and economically impoverished students. Galligan points out through his research that in large urban cities, where the arts are taken with high regard in schools, the gaps between economic classes in terms of school performance are more narrow (2001). As stated by Hancock and Wright (2018), arts integration into classrooms has the largest impact on disadvantaged students by giving them means of communication, enthusiasm, and generally improving inappropriate behavior within the classroom. In an extensive two-year study of a school utilizing a local theatrical company to integrate the arts into the classroom, they recorded an almost sudden and dramatic improvement

in student behavior. With the arts being implemented, students at the school were not only more enthusiastic in school activities, but were more willing and able to participate in group projects (Hancock & Wright, 2018). Another study that examined student behavior in result to arts education, numerous teachers have reported that the students who have experienced an increase in confidence, participation, and enthusiasm have done so as a result of the teachers gaining new ways to reach them and connect to various types of learners by means of the arts (Lackey & Huxhold, 2016).

Not all arts education produces the same results, however, Hetland (2017) states that arts education is only effective in enhancing other areas when employed in the correct manner. Hetland explains that students who were taking a visual art course scored better in Geometry than the students in the Geometry course that were not also taking a visual art course. When he tested the students on visualizing, however, they did not show any signs of improvements. The study illustrated that while the art class did correlate with improvement in Geometry, a numerical causal pathway was not made clear (2017). Tate (2016) further explains the importance of utilizing arts education strategically to achieve a desired outcome. He states that by having art electives that only require an “essence” of art doesn’t necessarily have any guaranteed benefit for the student. Lackey and Huxhold (2016) state that blankly using art to increase test scores in other areas proves a weak argument for integrating the arts. Their justification comes from a pattern of arts integration collapsing once a more effective way of increasing test scores is introduced. They, instead, argue for using the arts to “make contributions to education that no other content areas do or can.” As stated, arts education proves most useful when used as a way to nurture higher order thinking skills and close the gap between disadvantaged and other students.

In fact, using arts curriculum in a less than strategic approach has led to defining critiques from ancient philosophers to modern policymakers. One of the loudest critiques comes from the philosopher Plato: “at its best, then, art is merely mimetic of a secondary reality. As such, it may be harmless, if often irrelevant, but at its worst actively harmful where it appeals to powerful feelings, represents and encourages immoral behavior, promotes illusions masquerading as wisdom and is indifferent to truth” (Tate, 2016). Plato’s concerns, as discussed by Tate (2016), were placed heavily in the art’s ability to tap into a viewer’s emotions in such a way that their reason and logic were masked. Further, he explains that was observing a boom of easily accessible and digestible art that in turn made people passive learners and observers. Plato’s pupil, Aristotle, shared his views on art, however, after social exploration, he challenged that view through discovering that art can be a vehicle to shape character and encourage deep thought (Tate 2016).

Around the 1930’s, Leon Winslow originally started to advocate the importance of arts education/integration in American public schools. This early debate in American education advocated for three objectives of arts education: instruction, appreciation, and expression (Klar 1933). Winslow expressed that instruction of art comes in the form of teaching art as historical information and should be greatly integrated with social studies. Further, the information of art helps many occupations understand how to use color, composition, and design to maximize customers’ utility (Klar 1933). According to Klar (1933) Winslow uses the concept of art appreciation to recommended how art should be taught: teachers should never practice harsh examine on art to allow students to form the ability to examine, process, and form an opinion. His third objective for arts education was its use to nurture children’s inherent need to express

themselves through material (Klar 1933). While Winslow's early discourse in the debate of arts education was poignant, not much was done to incorporate his views into American education.

Arts education hadn't started to gain traction until Elliot Eisner stirred up the debate nearly forty years later. Eisner was a professor of Art and Education at the Stanford Graduate School of Education and was one of the leaders in support for arts education (Parsons 1977). According to Parsons (1977), Eisner's main point in arts education was its focus to the response to art as opposed to the creation of it. By this, the skills that are applicable to non-art subjects are developed and practiced. Eisner's side of the debate was in response to many academics feeling as if the arts were being neglected. Much like Plato's view on art, policy makers in the seventies were neglecting art due to their feeling that schools were a place of only intellectual matters and art was not one of them (Parsons 1977).

This Plato view holds constant in today's education policies. With No Child Left Behind, school policy experienced a shift into heavy standardized testing (Tutt, 2014). As Tutt (2014) explains, art curriculum was not included in the subjects to be tested so funding, incentives, and time in the classroom for arts education/integration fell dramatically. He also states that with the legislation of No Child Left Behind, the place for the arts in a school's curriculum is in limbo as it's not seen as necessary.

Recently, there have been a few school districts that have recognized the importance of an arts education and have taken drastic steps to integrate art into the curriculum. Lackey and Huxhold (2016) conducted a thorough study of one school's adoption of a new art integrated curriculum. Under the belief that arts education provides valuable transfer knowledge to core subjects, Madison High School went through a curriculum reform that required the teachers of the school to undergo intense training in the summer prior. Lackey and Huxhold (2016)

conducted several interviews with the teaching staff that underwent this training. It was revealed that the stress of re-training how to teach on top of the addition of various projects to get students artistically involved left the teachers inefficient and would often abandon the new reform altogether. Their study made clear “reform demands that the structure and culture of the school change in ways that different practices are possible, supported, and become the norm...

politicians avoid acknowledging the complexity of school reform, instead defining it narrowly as accountability and evidence by the raising of test scores” (Lackey & Huxhold, 2016). Another school district underwent a study with a local theatrical company to mimic curriculum reform to integrate arts education into the school (Hancock & Wright, 2017). 38 teachers throughout the district were selected to be a part of the study. Under this “reform,” instead of retraining all of the teachers, arts education specialists from the local theatrical company toured to each school and implemented the program themselves. This elevated the stress off of the teachers allowing them to effectively teach while the outsourced workers implemented the arts education. As a result, 94.74% of students recorded an increase in confidence/self awareness, 90% of students increased in comprehension, and 94% rose in participation (Hancock & Wright, 2017).

In summary, arts education is a tool that when implemented correctly can increase students’ skill set necessary for learning, behaving appropriately, and performing better in school. Without the utilization of arts education, education is “narrowed, which [limits] students’ depth of understanding and knowledge of the world” (Tutt, 2014).

The Role of the HOT Program

In 1994, an academic program, Higher Order Thinking (HOT), was implemented into now over 47 public schools in every Connecticut congressional district. The program integrates and teaches arts education throughout their students’ entire academic career. Within the HOT

program, subjects are not only taught through the arts, but the arts are taken as a serious subject themselves (Koba, 2017).

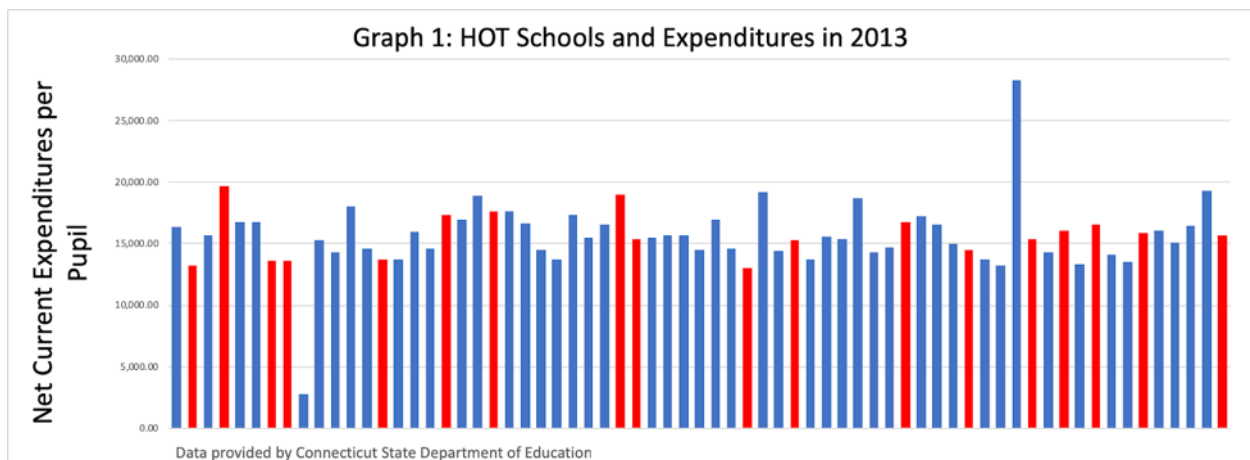
The HOT program was initiated by the Connecticut Office of the Arts whose mission is to animate “a culture of creativity across Connecticut by supporting arts making and arts participation for all people” (2017). The program carries out this mission through a strong standard of learning in arts education, integrating arts education into core subjects across the board, and as well as through democratic practices (Koba, 2017).

Arts education in the HOT program is implemented by requiring all students ages k-12 to take and participate in art classes: music, dance, and the fine arts, as well as work on collaborative projects with local artists. Through such classes, teachers are instructed to implement a teaching style that teaches their respective subject with the same rigor and standard of a core subject like Math or Reading. Derron Wood, a HOT teaching artist, orchestrated an experiment to test the rigor and effectiveness of these strong art classes and collaborations. Fourth graders at one of the schools with the HOT program collaborated with Wood to put on a shadow play written by him to test that artistic expression impact on student’s fluency rates. By the end of the sixteen-day study, Wood found that the fluency rate of the students who participated rose by 22.6% by means of practicing diction, volume, and pronunciation. This is more than twice as much as the 11% rise in students who simply observed (Koba, 2017).

Integration carries these practices into non-art related courses. For example, at one school students were assigned to collect rocks for their science class, examine and identify them, then write a report to present to the class. After the HOT program was implemented into the science class, students were then redirected to write songs instead of reports on the rocks they have

collected. Retainment of the information on the rocks increased considerably by both the students who were presenting and the students listening (Koba, 2017).

When the HOT program was initiated in 1994, the program selected 20 schools spanning across every congressional district in the state to be taken under the program's direction. The 20 schools were selected evenly between urban, rural, low income, and high-income neighborhoods. The details pertaining to the exact method on a school's selection are not available, however, a correlation between schools with the HOT program and low expenditure per pupil school districts is observed. Given a random sample of schools, HOT and not HOT programs spreading across each socio-economic landscape, the average expenditure per pupil for schools with the HOT program is approximately \$5,713. The average net current expenditure per pupil for non-HOT program schools is approximately \$14,998. Graph 1 illustrates net current expenditures per pupil in HOT program schools (red) versus non-HOT program schools (blue). This may suggest that HOT program schools were chosen based on their level in expenditures per pupil which have historical upward pressure on school performance.



It can also be theorized that the HOT program was brought into play due to *The Goals 2000: Educate America Act* that was enacted into law within the same year, 1994. Under this law is the “Opportunity to Learn Standards.” This introduced standardized testing nationwide that brought a standard in core curriculum (Math, Science, and English) in which students are pressured to meet (Galligan, 2001). This pressure was criticized by many for neglecting the arts which may have led to a response from the Connecticut Office of the Arts to produce a program to protect the arts; the Higher Order Thinking program.

Through the treatment of schools with HOT programs, arts education and its impact on students’ outcome in standardized tests can be effectively gauged. This paper tests schools with the HOT program in place with the expectation to observe a better performance overall. Of course, there are many factors that cannot be measured in terms of the arts: time spent creating art, viewing art, discussing art, etc. To simplify the analysis, we make the assumption that the HOT program adequately engages its students in different areas of art, in the same ways, and for the same amount of time from kindergarten to twelfth grade.

Connecticut Academic Performance Test as a Dependent Variable

In 1995, the state of Connecticut launched a statewide standardized test, Connecticut Academic Performance Test (CAPT). This test was launched to adequately assess Connecticut pupils’ standing in core subjects: reading, writing, math, and science through high standards and accountability. Students were tested with the same questions, same format, and at the same time statewide to ensure that each student is being assessed uniformly. The subjects up for assessment are, reading: response to literature and reading for information, writing across the disciplines: critical writing, editing and revising, math, and science (Greig, 2008).

Furthermore, the assessment on reading requires students to read a short story and respond to four questions. These questions test a student's initial understanding, interpretation, connecting context clues, and thinking critically. The student will then be directed to read and be tested on three non-fiction articles to measure how efficient the student is in interpretation and evaluation. To assess the writing portion of the test, the student will write a persuasive essay in order to measure their ability to compose a clear though using information from two articles to back up their points. To measure a student's capabilities in mathematics, the CAPT assesses algebraic reasoning, numerical and proportional reasoning, geometry and measurement, and probability and statistics. The last part of the test assesses where a student stands in Science through five content strands: energy transformations, chemistry, global interdependence, and biology (Greig, 2008).

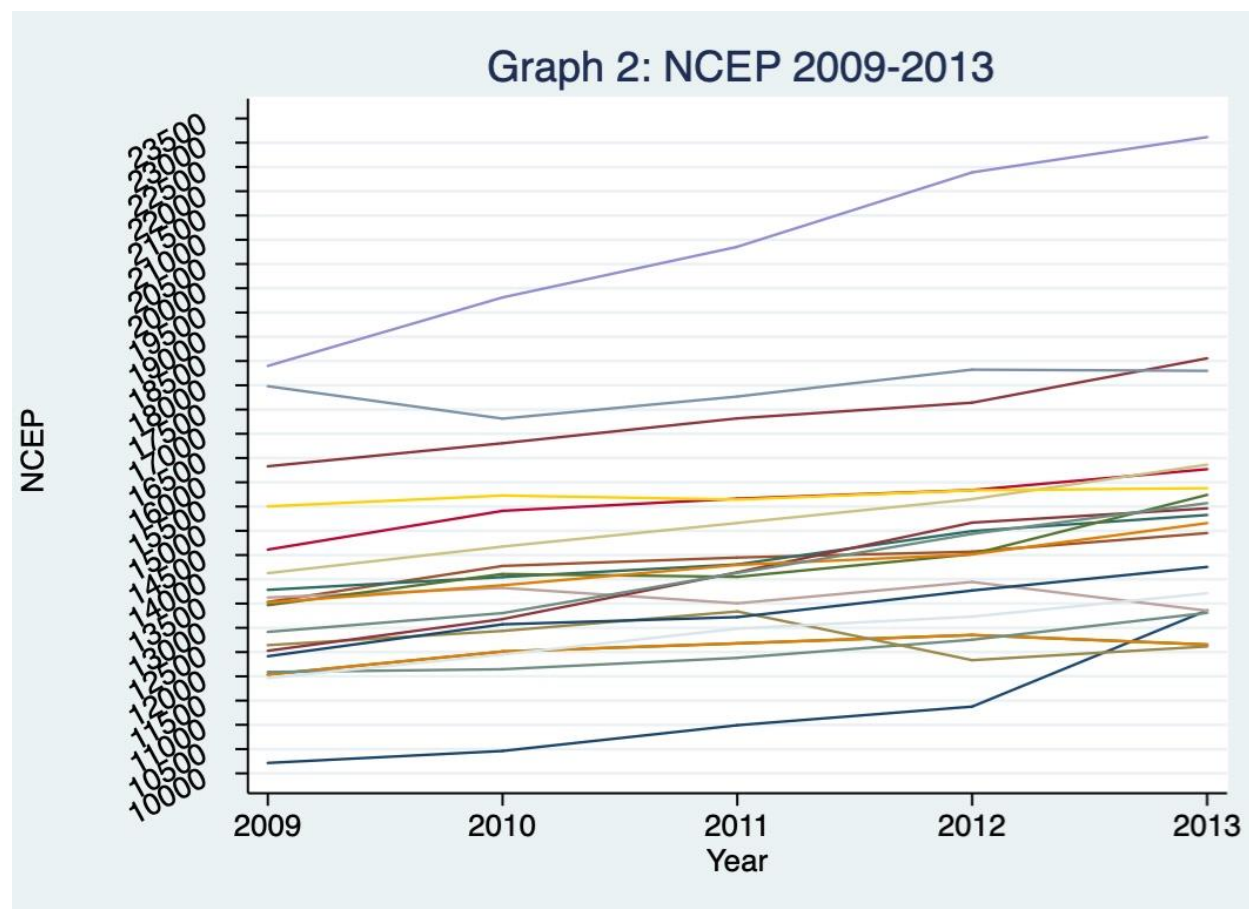
Net Current Expenditures per Pupil

Expenditures have historically been known to place positive pressure on a payoff, but by how much in terms of education? In their recent paper, Stephen R. Neely and Jeffrey Diebold discuss "public expenditures and the production of education" (2016). Their paper branches off of previous literature by means of longitudinal, fixed-effects models, and a disaggregation of instructional expenditures to measure the probability that subcategories of expenditures affect a student's outcome. The subcategories used as independent variables are as follows: regular programming, special education, and vocational instruction (Neely, 2016).

Their findings suggested that previous literature has underestimated the impact of expenditures by not controlling for subcategories. Through their models mentioned above, Neely and Diebold statistically accounted for a moderate causal pathway between specific spending on a student's related outcome. Their results include, but are not limited to, an increase in

standardized Mathematics through instructional expenditures by approximately 14% (Neely, 2016).

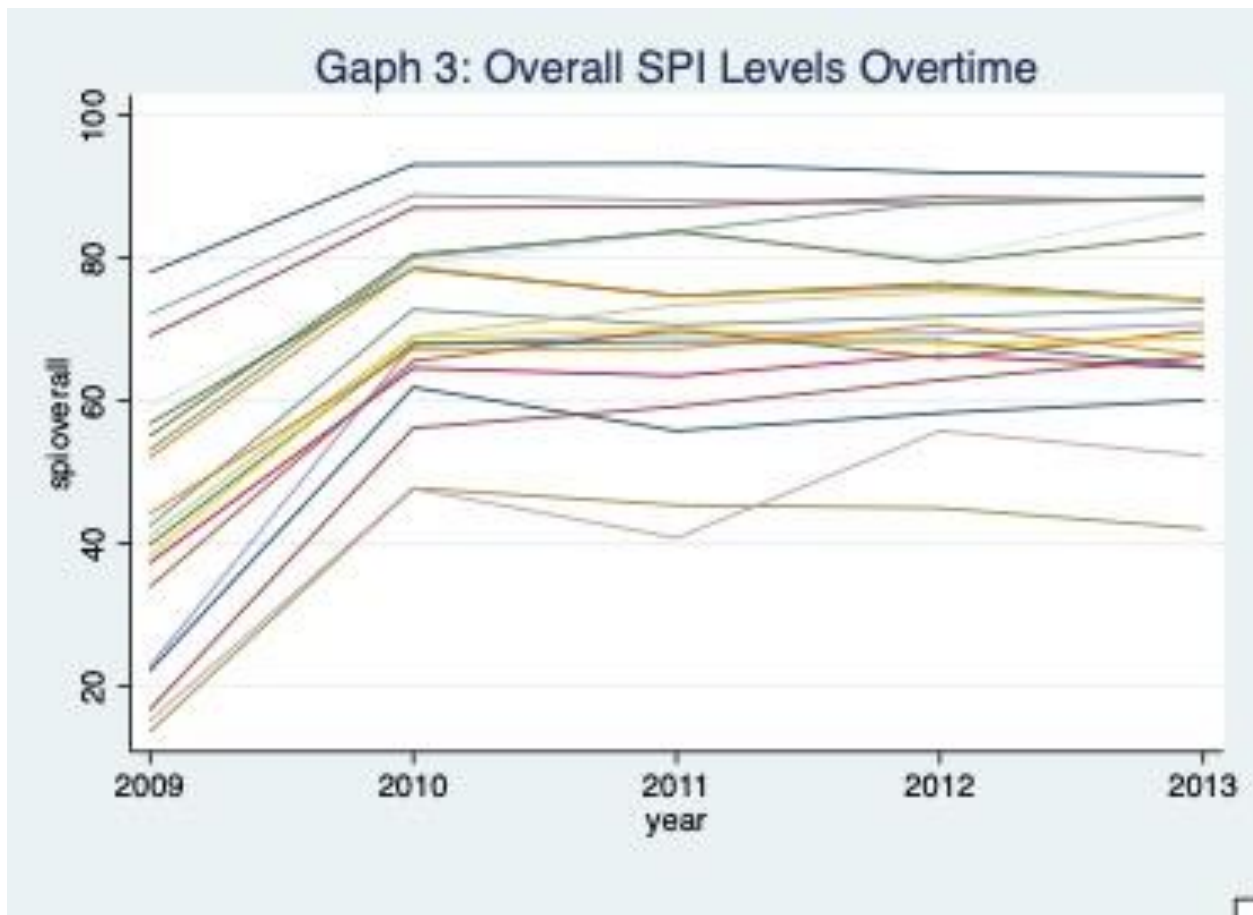
The model later discussed in this paper holds constant net current expenditures per pupil for the significance mentioned above. Graph 2 below illustrates the behavior of net current expenditures per pupil (NCEP) in the paper's sample of 20 schools with the HOT program from the 2008-2009 school year to the 2012-2013 school year. As you can see, NCEP has not fluctuated substantially over the given time series. The low fluctuation from year to year may not hold such a significant effect on student outcome, however, expenditures' previous results prove it necessary to our model.



Data and Methodology

To estimate and interpret the payoffs of K-12 arts education on students, this paper will use panel data collected from 20 schools in Connecticut's public school system from 2009 to 2013 that have either switched to a HOT program or have had the HOT program for that span of five years. The HOT program began in 1994, however, data for these schools at that time are unattainable (Kaba, 2017). The earliest set of data for school and student performance is 2010 and the latest data attainable is 2013.

For student performance analysis, data was collected on each school's overall performance, performance in Math, Reading, Writing, and Science through. Data on the performance of subjects defined as Arts and Humanities were omitted to focus on arts education's impact on fields outside of its own. To measure a student's performance in these areas, this paper will use and analyze data collected from statewide standardized testing for the state of Connecticut: Connecticut Academic Performance Test (CAPT) as described above. The test is scored between 100-400. The paper will only account for the percentage of students that met the benchmark of proficient for the CAPT (a score of at least 220) (Greig, 2008). This benchmark is notated as Student Performance Indices (SPI). Interestingly enough, Graph 3 below depicts overall SPI for the five years the panel data spans across: 2008-2009 to 2012-2013 school years. The average of schools with the HOT program included in this sample adopted the HOT program beginning in the 2009-2010 school year. Notice that around the 2010 year mark, rising overall SPI is recorded then begins to level out. The direct cause of this is unknown.



To control for demographic, three variables are held constant to indicate the percentage of race at a given school within the panel: *black*, *asian*, *hispanic*. The indicator variable, *hotschool*, is this paper's primary variable as it indicates whether or not a school in our sample is a part of the HOT program or not.

The sample of schools, as well as their performance overall and by subject, graduation rates, and expenditures, was collected from the School Performance Reports released by the Connecticut State Department of Education (CSDE). SAT scores and participation data was collected from the College Board and the Connecticut State Department of Education (CSDE). A main caveat in the data is the short time series. With only five years to analyze, it may be hard to observe and interpret the true impact of the HOT program on a student's performance. While

controlling for demographic, expenditures, and performance in specific subjects, there are still omitted variables that cannot be obtained or measured. For instance, after-school activities in the arts, time spent being creative, measuring artistic talent, the stress placed on the teachers/students under new academic reform, etc.. This may cause strain on the coefficients and the standard errors of the independent variables due to autocorrelation among the residuals.

To estimate the effect HOT programs have on students' immediate payoff, this paper will be utilizing a fixed effects regression. A fixed effects regression was chosen by conducting the Hausman Test with a large statistic of -74. The analysis in the paper will mainly focus on the HOT program's effect on the school's overall performance. The below equation represents the empirical approach:

$$SPI_{j,t} = \beta_0 + \beta_1 hotschool_{it} + \beta_2 ncep_{it} + \beta_3 gradrate_{it} + \beta_4 black_{it} + \beta_5 hispanic_{it} + \beta_6 asian_{it} + \varepsilon_{it}$$

While SPI is the percentage of students meeting the proficiency benchmark on the CAPT for core subject j , at school i , in year t . Each core subject dependent variable and overall dependent variable is naturally logged for a more intuitive interpretation. The indicator variable, *hotschool*, will be the paper's main focus as it indicates when a school has become adopted the HOT program. The second variable, *ncep*, represents the net current expenditure per pupil's weight on a student's performance per subject, j . An explanatory variable, *gradrate*, has been placed in the model to control for graduation rate's effect on SPI. To control for demographic, *black*, *hispanic*, and *asian* variables illustrate the percentage of the race listed for school i at time t . Finally, of course, the error term, ε_{it} .

Results

As seen in Table 1, the coefficients and their error terms for the empirical model above are listed. It appears that the HOT program puts un-statistically significant ($p>0.01$) downward pressure on SPI. Furthermore, the core subjects reading and science seem to receive the larger impact from the treatment of the HOT program. These results display that, on average, the HOT program will decrease their SPI by 0.06%.

Net current expenditures per pupil have, on average, little to no impact on a school's SPI, however, the relationship is still positive. This is to be predicted as student expenditures historically have a positive relationship with a student's outcome. The minor impact is also as predicted due to the nature that expenditures per pupil have not changed drastically in the sample from 2009 to 2013 as indicated previously in Graph 2. Black and Hispanic populations seem to have negative pressure on a student's performance with Asian populations seeing a positive relationship.

Table 1: SPI Effects per Subject

	(1) <u>lnoverall</u>	(2) <u>lnmath</u>	(3) <u>lnread</u>	(4) <u>lnwrite</u>	(5) <u>lnscience</u>
<u>hotschool</u>	-0.0484 (0.0364)	-0.0523 (0.0486)	-0.0856* (0.0499)	-0.0495 (0.0374)	-0.0526 (0.0384)
<u>ncep</u>	0.0000121*** (0.00000373)	0.00000381 (0.00000499)	0.0000137*** (0.00000511)	0.0000183*** (0.00000383)	0.0000146*** (0.00000393)
<u>black</u>	-0.00176** (0.000794)	-0.00301*** (0.00106)	-0.00158 (0.00109)	-0.000949 (0.000816)	-0.00218*** (0.000837)
<u>hispanic</u>	-0.00228 (0.00206)	-0.000675 (0.00276)	-0.00523* (0.00283)	0.0000173 (0.00212)	-0.00286 (0.00217)
<u>asian</u>	0.00107 (0.000719)	0.000829 (0.000961)	0.00113 (0.000985)	0.000930 (0.000739)	0.00106 (0.000758)
<u>_cons</u>	4.240*** (0.0495)	4.321*** (0.0662)	4.233*** (0.0678)	4.203*** (0.0509)	4.217*** (0.0522)
<i>N</i>	268	268	268	268	268
<i>R</i> ²	0.095	0.051	0.065	0.159	0.117

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Results Discussed

The main variable, *hotschool*, represented little to no impact among the fixed effects regression. First off, holding NCEP and demographic constant, the HOT program appears to put a downward pressure on overall SPI by an average of approximately 0.06%. The core subject with the most pressure is Reading SPI by approximately negative 0.09% holding all else constant.

This downward pressure on all dependent variables by the HOT program, holding all else constant, is rather moderate. Based off of past studies in school reform similar to the HOT program, this negative pressure could be a result of too much stress being placed on the school's environment (Lackey & Huxhold 2016). The negative pressure brought by the HOT program on students' performance on standardized testing may also be a result of the schools being relatively

poor as per graph 1: HOT schools and Expenditures in 2013. Poor schools are historically known to slack in performance on students' performance on average. An already low performing, poor school may not be able to handle a large school reform like the HOT program as it pulls away time spent directly learning core subjects. It's also worth noting that most schools among the sample transitioned into the HOT program in 2010. Referring back to graph 2: NCEP 2009-2013, expenditures did not jump or even adjust dramatically at this time. Perhaps the schools are not investing enough to jump start the HOT program to function efficiently.

Net current expenditure per pupil represented little to no impact on SPI overall and per subject. Looking further, the five coefficients also lack statistical significance. Perhaps these unsatisfactory results are due to a concept Neely and Diebold (2016) recognized and tested. Within their paper, as mentioned before, they noticed that past literature failed to deviate expenditures to a point where they could be controlled for their specific effects on specific categories. When they did so, a moderate but measurable result was recorded (Neely, 2016). It may be that this paper's model is experiencing the same effect from the lack of proper control of specific expenditures. It's not believed that this is impacting the rest of the coefficients but rather just the coefficient of the variable itself.

Conclusion

There are many sources suggesting the psychological and emotional benefits of studying the arts, however, an empirical model had yet to have been used to measure the actual payoff of an education of this sort. The only economic studies available on the subject have been modeled after secondary arts education and its impact on the creative economy specifically. Still, the payoffs of an early arts education in areas unrelated to the arts had yet to be measured outside of psychological.

In 1994, the state of Connecticut's Office of the Arts initiated the Higher Order Thinking (HOT) program to preserve arts education as well as enhancing performance in core subject areas (Koba, 2017). The following year, as part of the No Child Left Behind initiative, a standardized testing method was put into motion in all Connecticut public schools to accurately measure student performance on a level playing field. The Connecticut Academic Performance Test (CAPT) asks all students the same questions, same amount of questions, and is administered during the same part of the year (Greig, 2008).

Connecticut schools gradually became "HOT schools" over the years, and the CAPT is a standardized test for all Connecticut students, thus both became key components in the paper's model. The paper estimated the effects of the HOT program on a school's overall score on the CAPT as well as the score per core subject: math, reading, writing, and science. The scores on the CAPT range from 100-400, so the model utilized a pre-converted score by the Connecticut Department of Education to a score of 1-100 called Student Performance Indices (SPI). The paper utilized an OLS Fixed Effects linear regression model, used the natural log of SPIs, utilized the treatment of the HOT program as the main indicator variable, and controlled for NCEP and demographic.

The findings resulted in the HOT program as a moderate hindrance in a student's SPI across the board. The impact of the program was a slight one with the largest coefficient being approximately -0.09% and being of little statistical significance. It is theorized that the main contributing factors are the overwhelming nature of school reform and the implications of a poor school. Previous studies on arts education being implemented through school reform have observed significantly positive effects, however, the schools among those samples were among middle class to wealthy schools. Arts education may only be effective in already high performing

and wealthy schools as their opportunity cost of spending more time on art is not as high and in turn can experience the perceived positive effects of arts education. Poor schools may even suffer from such reform as they are already struggling to meet the standard in student performance.

The caveats that haunt this paper are first order autocorrelation by unmeasurable effects and the variation in how the HOT program is actually implemented. Many factors within this study cannot be measured that have the possibility to impact a student's performance in school. The first of which being societal pressure to either succeed or be suppressed. Different demographics have historically seen systematic oppression in the school system, which is nearly impossible to control for. More unmeasurable factors include, but are not limited to, a student's willingness and ability to learn/participate. Another factor to think about within autocorrelation is the use of net expenditures as opposed to breaking expenditures up into subcategories to control for each sector.

Variation in how the HOT program is implemented may have a slight impact on the results. The HOT program is carried out through a standard of mission, beliefs, and values, not by a standardized curriculum. HOT programs have the potential to vary across school as each school utilizes local artists for collaborations (Koba, 2017). For example, schools in one area may only have access to a painter while another school only has access to a local dancer. That being said, however, the specific types of art being implemented into each school alone is not a large concern. As previously mentioned, arts education is being defined as a relatively broad term: architecture/building/planning, mass communications, creative arts and design, studio art, and languages. Although this slight variation in the curriculum has a low probability in altering the results of the paper's model, it is worth noting.

In further research, it would be beneficial to first break down expenditures by subcategory to hold constant any specific expenditures that may have direct benefit to core subject performance. It also may be beneficial to select a sample of schools in another state that are under the same type of treatment like the HOT program; possibly one whose curriculum is more standardized throughout the schools that are participating. In further research, expanding the sample to include a comparison of wealthy to poor schools who have undergone similar arts education school reform. By doing such, the theory that poor schools suffer from arts education reform and wealthy schools benefit could be tested and possibly proven.

For future policy; when integrating in arts education, it would serve as most effective when done so in a slow manner. At the start, outsourcing local artists in schools would alleviate the stress of reforming teaching patterns and habits among teachers. This would limit any hinderance to teachers' efficiency while undergoing the stress of reform.

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Appendix

Appendix A

	Coefficients			
	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
hotschool	-.0467587	-.0570314	.0102727	.032732
ncep	.0000119	.0000117	1.96e-07	2.71e-06
gradrate	-.0005164	.0013116	-.001828	.
black	-.0017428	-.0031619	.0014191	.0005998
hispanic	-.0024504	-.0070148	.0045644	.0019172
asian	.0010122	.0020626	-.0010504	.

b = consistent under H_0 and H_a ; obtained from xtreg
 B = inconsistent under H_a , efficient under H_0 ; obtained from xtreg

Test: H_0 : difference in coefficients not systematic

chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
 = -74.00 chi2<0 ==> model fitted on these
 data fails to meet the asymptotic
 assumptions of the Hausman test;
 see [suest](#) for a generalized test

Appendix B

. eststo: xtreg lnoverall hotschool ncep gradrate black hispanic asian, fe

Fixed-effects (within) regression
 Group variable: schoolname1

Number of obs = 268
 Number of groups = 67

R-sq: within = 0.1000
 between = 0.6078
 overall = 0.5838

Obs per group: min = 4
 avg = 4.0
 max = 4

F(6,195) = 3.61
 Prob > F = 0.0020

corr(u_i, Xb) = 0.5369

lnoverall	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
hotschool	-.0467587	.0364276	-1.28	0.201	-.1186013	.025084
ncep	.0000119	3.74e-06	3.20	0.002	4.57e-06	.0000193
gradrate	-.0005164	.0005207	-0.99	0.323	-.0015433	.0005105
black	-.0017428	.0007944	-2.19	0.029	-.0033095	-.0001761
hispanic	-.0024504	.002071	-1.18	0.238	-.0065348	.001634
asian	.0010122	.0007213	1.40	0.162	-.0004103	.0024348
_cons	4.290647	.0711063	60.34	0.000	4.150411	4.430884
sigma_u	.10605718					
sigma_e	.03137558					
rho	.919524	(fraction of variance due to u_i)				

F test that all $u_i=0$: F(66, 195) = 14.79 Prob > F = 0.0000
 (est1 stored)

Appendix C

```
. eststo: xtreg lnmath hotschool ncep gradrate black hispanic asian, fe
```

```
Fixed-effects (within) regression      Number of obs      =      268
Group variable: schoolname1           Number of groups    =      67

R-sq:  within = 0.0584                Obs per group: min =      4
      between = 0.5527                    avg =      4.0
      overall  = 0.5236                    max =      4

                                         F(6,195)           =      2.02
corr(u_i, Xb) = 0.5397                 Prob > F            =      0.0652
```

lnmath	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
hotschool	-.0496205	.0486077	-1.02	0.309	-.1454848	.0462439
ncep	3.46e-06	4.99e-06	0.69	0.488	-6.37e-06	.0000133
gradrate	-.0008648	.0006948	-1.24	0.215	-.0022351	.0005055
black	-.002974	.00106	-2.81	0.006	-.0050645	-.0008834
hispanic	-.0009592	.0027634	-0.35	0.729	-.0064092	.0044909
asian	.0007315	.0009625	0.76	0.448	-.0011667	.0026296
_cons	4.40591	.0948818	46.44	0.000	4.218784	4.593036
sigma_u	.13263668					
sigma_e	.04186649					
rho	.90939382	(fraction of variance due to u_i)				

```
F test that all u_i=0:      F(66, 195) =      11.73      Prob > F = 0.0000
(est2 stored)
```

Appendix D

```
. eststo: xtreg lnread hotschool ncep gradrate black hispanic asian, fe
```

```
Fixed-effects (within) regression      Number of obs   =      268
Group variable: schoolname1           Number of groups =      67

R-sq:  within = 0.0653                 Obs per group:  min =      4
      between = 0.6260                  avg   =      4.0
      overall  = 0.5891                  max   =      4

                                         F(6,195)        =      2.27
corr(u_i, Xb) = 0.2536                 Prob > F         =      0.0385
```

lnread	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
hotschool	-.0859659	.0500259	-1.72	0.087	-.1846272	.0126953
ncep	.0000138	5.13e-06	2.68	0.008	3.66e-06	.0000239
gradrate	.0001193	.0007151	0.17	0.868	-.001291	.0015295
black	-.0015832	.0010909	-1.45	0.148	-.0037348	.0005683
hispanic	-.0051862	.0028441	-1.82	0.070	-.0107953	.0004229
asian	.0011437	.0009905	1.15	0.250	-.0008099	.0030972
_cons	4.221224	.09765	43.23	0.000	4.028638	4.413809
sigma_u	.09159611					
sigma_e	.04308796					
rho	.81880774	(fraction of variance due to u_i)				

```
F test that all u_i=0:      F(66, 195) =      10.19      Prob > F = 0.0000
(est3 stored)
```

Appendix E

```

.  eststo: xtreg lnwrite hotschool ncep gradrate black hispanic asian, fe

```

Fixed-effects (within) regression

Group variable: **schoolname1**

R-sq: within = **0.2227**
between = **0.0815**
overall = **0.0912**

Number of obs = **268**
Number of groups = **67**
Obs per group: min = **4**
avg = **4.0**
max = **4**

F(6,195) = **9.31**
Prob > F = **0.0000**

corr(u_i, Xb) = **-0.0487**

lnwrite	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
hotschool	-.0431119	.0360754	-1.20	0.234	-.1142599	.0280361
ncep	.0000175	3.70e-06	4.72	0.000	.0000102	.0000248
gradrate	-.0020691	.0005157	-4.01	0.000	-.0030861	-.0010521
black	-.0008726	.0007867	-1.11	0.269	-.0024242	.0006789
hispanic	-.0006627	.0020509	-0.32	0.747	-.0047076	.0033822
asian	.0006963	.0007143	0.97	0.331	-.0007125	.002105
_cons	4.405961	.0704188	62.57	0.000	4.267081	4.544841
sigma_u	.10529222					
sigma_e	.03107221					
rho	.91988986	(fraction of variance due to u_i)				

F test that all u_i=0: F(66, 195) = **14.00** Prob > F = **0.0000**
(est4 stored)

Appendix F

```
. eststo: xtreg lnscience hotschool ncep gradrate black hispanic asian, fe
```

```
Fixed-effects (within) regression      Number of obs   =      268
Group variable: schoolname1           Number of groups =      67

R-sq:  within = 0.1419                 Obs per group:  min =      4
      between = 0.6701                      avg =     4.0
      overall  = 0.6462                      max =      4

                                         F(6,195)        =     5.37
corr(u_i, Xb) = 0.4945                 Prob > F        =     0.0000
```

lnscience	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
hotschool	-.0565477	.0379424	-1.49	0.138	-.1313778	.0182824
ncep	.0000151	3.89e-06	3.89	0.000	7.47e-06	.0000228
gradrate	.0012878	.0005423	2.37	0.019	.0002182	.0023574
black	-.0022315	.0008274	-2.70	0.008	-.0038634	-.0005997
hispanic	-.0024364	.0021571	-1.13	0.260	-.0066906	.0018178
asian	.0012044	.0007513	1.60	0.111	-.0002773	.0026861
_cons	4.090541	.0740631	55.23	0.000	3.944473	4.236609
sigma_u	.09808488					
sigma_e	.03268027					
rho	.90008084	(fraction of variance due to u_i)				

```
F test that all u_i=0:      F(66, 195) =    13.11          Prob > F = 0.0000
(est5 stored)
```