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Learning to Think Critically: A Visual Art Experiment

Daniel H. Bowen¹, Jay P. Greene¹, and Brian Kisida¹

This article examines whether exposure to the arts has an effect on the ability of students to engage in critical thinking. We conduct a randomized controlled trial involving 3,811 students who were assigned by lottery to participate in a School Visit Program at the newly opened Crystal Bridges Museum of American Art. Students who participated in the School Visit Program demonstrated significantly stronger critical thinking skills when analyzing a new painting. These effects were larger for students from more disadvantaged backgrounds. In light of recent declines in the availability of the arts for disadvantaged populations, our results have important policy implications for efforts to restore and expand access to the arts.

Keywords: arts education; critical thinking; experimental research; museum education

Introduction

The arts have a variety of potential benefits for students. Some view the study of the arts as a way to impart the rich history of human accomplishment to future generations. As Hetland and Winner (2001) put it, “the arts are a fundamentally important part of culture, and an education without them is an impoverished education leading to an impoverished society” (p. 5). For others, arts education is seen as beneficial because it helps develop self-expression, creativity, and empathy (Dewey, 1919; Heilig, Cole, & Aguilar, 2010). Finally, some argue that exposure to the arts is an effective way to enhance cognitive abilities (Eisner, 2002), which may foster critical thinking skills and improve academic achievement. These perceived benefits motivated a steady increase in student exposure to the arts throughout most of the 20th century (Rabkin & Hedberg, 2011).

Yet recent trends show that childhood exposure to the arts has decreased. The National Endowment for the Arts has documented the decline with their Survey of Public Participation in the Arts (SPPA). SPPA findings show that the rate of participation in childhood arts education has dropped since the mid-1980s. Particularly alarming is the fact that the declines are largely driven by the experiences of disadvantaged groups. In 2008, African American children were 49% less likely to receive arts education than they were in 1982, whereas Hispanic children were 40% less likely to receive arts education. For White students, however, exposure to arts education remained relatively unchanged from 1982 to 2008. Children whose parents have less than a high school education were nearly 77% less likely to have received arts education in 2008 than they were in 1982 (Rabkin & Hedberg, 2011).

Because schools provide the bulk of childhood arts experiences, a decline in overall arts exposure is explained primarily by cuts in school-based arts programs. The drop in school arts education has been particularly pronounced in schools with large concentrations of disadvantaged students (Chappell & Cahnmann-Taylor, 2013; President’s Committee on the Arts and the Humanities, 2011). A recent government analysis found that schools identified as needing improvement under No Child Left Behind and schools with higher percentages of minority students were more likely to report a reduction in time spent on the arts (Government Accounting Office, 2009). Additionally, over the past decade, students at schools in the highest quartile of free and reduced-price lunch (FRL) eligibility have seen a 13 percentage point decrease in the availability of visual arts instruction (Parsad & Spiegelman, 2012).

In addition to arts instruction in schools, an important component of arts exposure for children involves visits to museums and cultural institutions. Sometimes children have these experiences with their families, but quite often these experiences are provided by organized school tours. Cultural institutions spend more than \$2 billion a year on educational activities, and they receive more than 90 million student visits each year from K–12 school groups (National Humanities Alliance, 2012). Schools seeking to compensate for declining arts exposure in the classroom can draw upon cultural institutions to provide students with enriching and thought-provoking experiences.

¹Department of Education Reform, University of Arkansas, Fayetteville, AR

The Potential Benefits of Arts Exposure

With the increased emphasis on accountability testing on “core” subjects, many proponents of arts education have noted a decline in school-based arts exposure (Rabkin & Hedberg, 2011). Others have observed that the “era of high-stakes testing” is “likely to disadvantage the arts” (Gadsden, 2008, p. 33). Perhaps understandably then, arts advocates and researchers have attempted to strengthen the role of the arts in education through claims that arts exposure can lead to a variety of positive outcomes for students, including the potential for “transfer” effects to other academic subjects (e.g., Baker, 2012; Catterall, Dumais, & Hampden-Thompson, 2012; Deasy, 2002; Hetland & Winner, 2001). A notable problem with this work, however, has been a lack of research that clearly isolates the causal influence of arts exposure. As a research report by the RAND Corporation concluded, many of the existing studies on the benefits of arts exposure “do no more than establish correlations between arts involvement and the presence of certain effects in the study subjects. They do not demonstrate that arts experiences caused the effects” (McCarthy, Ondaatje, Zakaras, & Brooks, 2004, p. xiv). Additionally, Winner and Cooper (2000) conducted an extensive meta-analysis of studies claiming a link between the arts and student achievement. They found that only 31 of the 1,135 articles they reviewed met even minimal standards for making causal inferences: “We conclude that we have as yet no evidence that studying the arts has a causal effect on academic achievement” (p. 65).

Some have argued that the most direct effects of the arts on education are those “that pertain to the perception and comprehension of aesthetic features” (Eisner, 1999, p. 147). In *Studio Thinking: The Real Benefits of Arts Education*, Hetland, Winner, Veenema, and Sheridan (2007) identify the “habits of mind” instilled by studying art, which include observing, envisioning, innovating, reflecting, stretching and exploring, and engaging and persisting. Additional studies, like Korn’s (2007) quasi-experimental evaluation of the Solomon R. Guggenheim’s Literacy Through Art program, find strong correlations between student participation and “improved critical thinking and literacy skills in their discussion of both a work of art and a text selection” (p. xxxi). Other studies have looked at art and the relationship to student expressiveness and elaboration (Burton, Horowitz, & Abeles, 2000), creativity measures (Luftig, 1994), theory-building and reflecting (Heath, 1999), and critical thinking skills (Lampert, 2006).

Perhaps the most informative study on critical thinking and the arts comes from a federally funded evaluation of the School Partnership Program (SPP) at the Isabella Stewart Gardner Museum (ISGM) in Boston. In 2003, the ISGM, in partnership with the Institute for Learning Innovation, received a 3-year grant from the U.S. Department of Education to examine a program that involved multiple visits to an art museum. The study looked at the impact of Visual Thinking Strategies (VTS) as implemented by the ISGM’s SPP. VTS is a curriculum and teaching method developed by Visual Understanding in Education. As a major component of the evaluation, the study authors were charged with developing a valid rubric for measuring critical thinking skills (Luke, Stein, Foutz, & Adams, 2007).

Seven individual critical thinking skills comprised the final version of the rubric: observation, interpretation, evaluation, association, problem-finding, comparison, and flexible thinking.

In the final report, researchers found that treatment students generated significantly more instances of the critical thinking skills of observation, interpretation, association, comparison, flexible thinking, and evidence. In a separate report focusing on the eighth grade sample only, researchers found that treatment group students grew in their aesthetic and critical-thinking skills and that these skills transferred to their writing skills (Desantis, 2009). Museum educators involved in the program concluded that a move from a “content-driven program to one focused on the process of learning,” incorporated through multiple museum visits, were the keys to the success of the program (Burchenal & Grohe, 2007, p. 117).

We add to this growing body of research with a large-scale randomized controlled trial (RCT) involving 3,811 students assigned by lottery to participate in the School Visit Program at the newly opened Crystal Bridges Museum of American Art. There has never before been a study that utilizes this especially rigorous research design with enough observations to detect overall and subgroup effects. All students in our study completed a follow-up survey, which included a prompt to write essays in response to a work of art that was unfamiliar to them.

The essays from the treatment and control groups were coded blindly on a seven-item rubric to assess the students’ critical thinking skills. We find that students who were assigned by lottery to participate in the School Visit Program demonstrate significantly stronger critical thinking skills when analyzing a work of art they had not previously seen. The benefit of being randomly assigned to a school tour of an art museum was greater for students from more disadvantaged backgrounds. Specifically, the effects were greater for students from smaller towns, students attending schools with a higher proportion of FRL-eligible students, minority students, and students making their first visits to the Museum. In light of recent declines in the availability of the arts for these disadvantaged populations, our results have important policy implications for efforts to restore and expand access to the arts.

Sample and Data

The Crystal Bridges Museum of American Art opened in Bentonville, Arkansas in November of 2011. With a permanent endowment exceeding \$800 million, it is the first major museum dedicated to American art to open in 50 years (Vogel, 2011). In March of 2012, the Museum launched a School Visit Program. Because the opening of a major art museum in an area where one did not previously exist was a significant event, demand for school visits to the Museum far exceeded availability. Moreover, a generous portion of the endowment covers the cost of the School Visit Program, which allows school groups to visit the Museum at virtually no cost to the school or students. This endowment covers transportation, admission, substitute teachers, lunch at the museum, and pre/postvisit curricular materials. The museum received applications from 344 school groups representing 24,552 K–12 students during the first semester of the program. In order to allocate visits to the Museum in a fair

Table 1
Treatment/Control Balance of the Analytic Sample

Characteristic	Treatment (n = 1,801)	Control (n = 2,010)	Difference
Percent females	53.56	52.09	1.47
Percent Hispanic	19.93	19.55	0.38
Percent White	62.19	59.75	2.44
Percent Black	3.05	4.88	-1.82
Percent Other	14.82	15.82	-1.00
School % FRL	50.92	52.97	-1.92
Average grade	6.18	6.20	-0.02
Average miles from museum	36.44	37.74	-1.30

method, available slots in the School Visit Program were awarded through a lottery conducted by us in partnership with Crystal Bridges.

To achieve the most statistical power, we incorporated a stratified randomization procedure. The use of a stratified randomization procedure is justified and “can increase the balance between treatment and control groups without sacrificing the advantages of randomization” (Schneider, Carnoy, Kilpatrick, Schmidt, & Shavelson, 2007, p. 27). Given that we were especially interested in ensuring that the treatment and control groups had equal representation of important pretreatment characteristics, we first paired applicants with similar demographics (e.g., grade, region, and FRL) and performed separate randomizations within these pairings. The classrooms that won the lottery comprise the treatment group, and the corresponding matched applicants that did not win the lottery comprise the control group. As an incentive to participate in the study, applicant groups that did not win an immediate spot in the School Visit Program but participated in our data collection efforts (control group applicants) were guaranteed a spot for the following semester.

As a result of the lottery, 40 applicant groups with students in Grades 3–12 were randomly awarded a guided tour of the Museum in the Spring of 2012 (the treatment group), while another 40 Grade 3–12 applicant groups had their tours deferred to the Fall of 2012 (the control group). Applicant groups not selected to be in the treatment or control groups received apologetic letters informing them that they had not been selected to visit the Museum during this period and encouraging them to apply in future rounds.

Several weeks after treatment group applicants visited the Museum, trained members of the research team visited both treatment and control groups in their classrooms and administered surveys to the students that contained a critical thinking exercise. Ten school groups that were originally part of the lottery were excluded from the study because of tour cancellations or erroneous application information. In total, 70 applicant groups (35 treatment and 35 control) representing a total of 3,811 Grade 3–12 students completed the critical thinking exercise.

Because mere chance determined whether or not a group had been selected for the Museum visit, the treatment and control groups are largely identical except for whether they got to visit

the Museum on a school tour. As a result, any outcomes that differ between the treatment and control groups can confidently be attributed to participation in the School Visit Program. Comparisons between the treatment and control groups on key variables show that the stratified randomization procedure achieved the goal of producing comparable balance (Table 1).

The Treatment

Prior to their visit, teachers of treatment group students who were randomly awarded a Museum visit were sent a packet containing a 5-minute video orientation for teachers and students to watch. The video emphasized that the tours would be student-driven and emphasized that students would be encouraged to talk and that their ideas were important to the process. Teachers were also provided with a selection of three images that the students would see on their tour, information about the themes of the tour, and essential questions to ask their students before the visit. These questions were intended to familiarize students with the types of themes they would learn about on their tour and to familiarize them with the dialogue-driven nature of the tour. However, the Museum asked that the teachers not share any specific content information about the works of art. Postvisit materials included more complete factual information about the works of art and suggestions for classroom activities. Withholding most factual information until after the tour is consistent with the philosophy of the Museum’s education staff, which seeks to foster student-directed interpretations about the art.

The tours provided by Crystal Bridges were designed to be grade-level appropriate and tailored to align with Common Core Curriculum Standards. Tours were led by paid museum educators that had been trained to follow a constructivist-based learning approach. In a typical tour, students were split into groups of 10 to 15 that focused intensively on four or five paintings or sculptures in the Museum’s collection. This open-ended, student-centered approach, facilitated by museum educators, encouraged the group of students to think together, engage with each work of art on a deep level, and seek out their own unique interpretations of the work at hand. When appropriate, museum educators supplied historical and sociological contexts of the works in order to facilitate greater student understanding. The main goal of the Museum educator, however, was to guide student-driven discussion.



FIGURE 1. Bo Bartlett's *The Box*

Critical Thinking Assessment

We surveyed both the treatment group ($N = 1,801$) and its paired control group ($N = 2,010$) on average 2 weeks ($M = 13.5$ days, $SD = 6.1$) after the treatment group's visit to Crystal Bridges. The survey contained questions with regard to student demographics, attitudes toward cultural institutions, art consumption, art production, and knowledge of art. After answering all the survey items, students were asked to analyze an image they had not previously seen—a relatively unknown work of art that is not a part of the Museum's collection, Bo Bartlett's *The Box* (Figure 1). After piloting multiple images with student groups before data collection, this image was preferred because students showed greater interest and spent more time analyzing it than purely abstract images. It is likely that students identified with the younger subjects in the painting, and the ambiguous nature of the painting provided ample room for extended analysis. Moreover, the image has numerous instances of meaningful objects that lend themselves to interpretive discussion.

Students were given exactly five minutes to write as much as they wanted in response to the following two questions: (1) What is going on in this painting? (2) What do you see that makes you think that? These two questions are part of the VTS curriculum and are often used as prompts by educators when facilitating student-driven discussions about art images. The first question asks students to engage in storytelling, while the second prompt "subtly asks the viewer to supply evidence to back up his answer to the first question" (Housen, 2001, p. 7).

Essays ranged from purely observational to essays that incorporated deeper interpretations of the complex painting. For example, the following essay from a fourth grade girl illustrates a purely observational response to the prompt:

I see a girl and a boy, the girl is standing, the boy is sitting. I also see the flag (only the stars). I also see a toy. I see a picture with a lady inside of it. I see a couch and a lamp, and a chair. I also see that they are in a house, there is a rug, and a tub or a bucket and a window, a picture frame in the corner, a little table to hold the lamp, and I also see a glass it has red liquid and there is also a log thing on the basket and on the left a horn or something.

Other essays, while still making observations, provided more interpretations and imposed an overall narrative to the painting. The following essay, from an eighth grade boy, illustrates an attempt by the student to interpret various components of the painting:

I think that the young boy and girl were actual old people who became young again in this painting. The reason I think this is because the boy and the girl are wearing loose fitting clothes. Maybe they were an old married couple that opened a box of childhood memories and they remembered when they were children.

In this passage, from a 10th grade girl, the student provides deep interpretations of the objects placed throughout the painting and integrates some preexisting knowledge of these symbols (i.e., associations) to create a narrative:

I believe the children are reminiscing on the loss of their father. The look on the children's faces is very mournful. In the open bucket you can see things that would be sent home if a loved one was lost in war. The Popeye doll seems like he would represent the father's strength. There is a wedding photo, probably for remembrance and what looks like communion, which represents religion that maybe the family was close to. Also, to me, the empty chair in the foreground shows where the father would be sitting if he were present.

In this passage, from an 11th grade girl, the student displays empathy with the painting's subjects and provides interpretations of their emotions from subtle cues:

The children's father was killed during the war and so was their mother, the little girl is wearing her mother's dress and the boy is wearing his father's clothes. They have to learn to be grown up now, the boy's eyes are averted from the camera because he is hiding his emotions and the girl is the strongest of the two and has to take her mother's place and her responsibilities.

Using Luke et al.'s (2007) critical-thinking skills checklist, two researchers independently coded each student's written response and then tallied the total number of observations, interpretations, evaluations, associations, instances of problem finding, comparisons, and instances of flexible thinking. In order to limit coder bias, coders were kept unaware of students' characteristics, including the student's grade level and whether he or she was in the treatment or control group. To assess interrater reliability, the coders graded an overlapping set of 750 essays. Descriptive statistics for the full sample, as well as Cohen's weighted kappa for the overlapping items (Cohen, 1968), are provided in Table 2.

The composite score of all seven items, which is the dependent variable used in our outcome analyses, displays a high rate of reliability between coders (weighted kappa = 0.84). When looking at the critical thinking scale items separately, most of the seven items also exhibit high levels of intercoder reliability. The item "problem finding" is an exception, which is explained by the fact that instances of this item were particularly rare in student essays.

Table 2
Descriptive Statistics and Intercooder Reliability for Critical Thinking Items

Item	Average (SD)	Percent Agreement	Weighted Kappa
Composite (sum of 7)	8.16 (3.85)	99.4	0.84
Observation: what something is; identifying something; what is happening; how it looks; locations; counts	3.97 (2.40)	99.4	0.78
Interpretation: characteristics or feelings related to object; identity and relationships	3.90 (2.35)	98.7	0.56
Evaluation: comments about personal preference and perceived merits of work or artist	0.02 (0.18)	99.6	0.40
Association: linking with prior experience or knowledge; making connections to experience	0.06 (0.25)	96.8	0.37
Problem finding: notes or requests information; identifies information needed to form a conclusion/opinion	0.01 (0.12)	99.7	0.13
Comparison: similarities or differences; noticing relationships; noticing patterns	0.02 (0.15)	99.1	0.69
Flexible thinking: seeing things from different perspectives; revising thinking	0.17 (0.43)	98.7	0.84

Empirical Strategy

Because the RCT approach has the important feature of generating comparable treatment and control groups, we can use a straightforward set of analytic techniques to estimate the impact of a school tour to an art museum on critical thinking skills. In its most simple form, this technique could estimate simple mean differences using the following equation for outcome CTS_i , the critical thinking composite score, of student i in matched pair m :

$$CTS_{im} = \alpha + \beta_1 Treat_i + \beta_2 Match_{im} + \epsilon_{im} \quad (1)$$

The binary variable $Treat_i$ is equal to 1 if the student is in the treatment group that was randomly assigned to visit the museum for a school tour and is equal to 0 otherwise. Because the groups were created using a stratified randomization procedure within matched applicant group pairs, $Match_{im}$ is also included in the model as a vector of dummy variables that have the statistical effect of estimating within, as opposed to across, matched pairs. Finally, ϵ_{im} is a stochastic error term clustered at the applicant group level to take into account the spatial correlation from students nested within applicant groups.

Proper randomization generates experimental groups that are comparable but not necessarily identical. The basic regression model can, therefore, be improved by adding controls for observable characteristics to increase the reliability of the estimated impact by accounting for minor differences and improving the precision of the overall statistical model. This yields the following equation to be estimated:

$$CTS_{im} = \alpha + \beta_1 Treat_i + \beta_2 Match_{im} + \beta_3 Gender_i + \beta_4 Grade_i + \epsilon_{im} \quad (2)$$

where $Gender_i$ is a dummy variable equal to 1 if the student is a female and 0 otherwise, and $Grade_i$ is a vector of dummy

variables indicating the grade level of student i . In this model, β_1 is the parameter of interest and represents the effect of a school tour for students in the treatment group. Equation 2 is our preferred model for estimating overall impacts.

In addition to estimating overall impacts, we are interested in the possibility of heterogeneous effects on particular subgroups of students. Subgroup effects are estimated by augmenting the basic analytic equation with indicator variables and an interaction term where S_i indicates that a student is a member of a particular subgroup:

$$CTS_{im} = \alpha + \beta_1 Treat_i + \beta_2 Match_{im} + \beta_3 Gender_i + \beta_4 Grade_i + \beta_5 S_i + \beta_6 S_i * Treat_i + \epsilon_{im} \quad (3)$$

These models are used to estimate impacts on the separate components of the subgroups (e.g., impacts on minority and nonminority students separately) and test for the difference in impacts between the two groups. In our analyses we examine the subgroup effects for students in schools that have higher (>50%) or lower ($\leq 50\%$) proportions of students who are FRL-eligible; students attending schools located in smaller towns (<10,000 population) and students in larger towns ($\geq 10,000$ population); White and non-White students; students in Grades 3–8 and students in high school; and students making their first visits to the Museum. When examining the impact of a first visit, we restrict our dataset to students in the treatment group who had only visited the Museum once (i.e., on the school visit) and students in the control group who had never visited the Museum. This excludes students who had been to Crystal Bridges outside of the School Visit Program prior to being surveyed.

Results

Table 3 shows our main results. All impacts on the treatment group are presented in terms of standard deviation effect sizes.

Table 3
Impact of Treatment on Student Critical Thinking About Art

Group	Effect Size (SE)	Group	Effect Size (SE)
Full sample	+0.09** (0.04)	—	—
High FRL	+0.18*** (0.06)	Low FRL	−0.02 (0.75)
Town <10,000	+0.33*** (0.12)	Town >10,000	+0.03 (0.05)
Non-White	+0.18*** (0.06)	White	+0.03 (0.04)
Grades 3–8	+0.18*** (0.03)	Grades 9–12	+0.05 (0.13)
First visit	+0.17*** (0.04)	—	—

Note. Estimates are obtained from regression models that control for student gender, grade, and matched pair, with robust standard errors clustered by applicant group. Effect sizes are in terms of standard deviation units.

** $p < .05$. *** $p < .01$ (two-tailed).

For the entire sample, students who went on a school visit to an art museum perform 9% of a standard deviation higher on the critical thinking measure (p value = 0.03). The impacts are greater for students who were in groups that are more disadvantaged and may have been less likely to have had such an experience absent the treatment. Specifically, when estimating effects for students at schools where a majority of the students are FRL-eligible, the impact of the treatment is 18% of a standard deviation relative to similar students in the control group (p value < 0.01). The benefit of a school tour for non-White students in the treatment group is 18% of a standard deviation (p value < 0.01). Rural students, who we identify as those living in towns with fewer than 10,000 people, receive the biggest impact of the treatment. These rural students are 33% of a standard deviation better in their critical thinking skills than rural students who did not win the lottery to go to the Museum (p value < 0.01). The benefit of the school tour is also concentrated among younger students. Treatment group students in Grades 3–8 demonstrate critical thinking skills that are 11% of a standard deviation higher than control group students in those grades (p value < 0.01). Finally, for students in the treatment group who indicated that this was their first visit to the Museum, the benefit of a school visit is 17% of a standard deviation compared to students in the control group who had not yet visited (p value < 0.01). For students from lower-FRL schools, larger towns, White students, and high school students, we find no statistically significant impacts of a school visit.

Discussion

The intervention the students in the treatment group received was modest: their teachers briefly exposed them to pre/postvisit curricular materials, they spent roughly half of a day at a world class art museum, and as part of their visit they were guided by professional museum educators to think critically about four or five specific works of art for about an hour. Yet even this minimal intervention produced significantly positive and meaningful benefits for their ability to think critically about a work of art they had not seen previously. Because these results are derived from an RCT, we can be especially confident that the arts exposure received by the treatment group caused the positive impacts on the critical thinking assessment. No prior research has

established the causal connection between an arts experience and critical thinking skills with this level of rigor.

Although we can demonstrate these critical thinking benefits with high confidence, we cannot be as certain about how much these benefits extend to critical thinking in other academic contexts. Data limitations prevent us from directly testing to determine if there are spillover effects in other academic subjects. Winner and Cooper (2000), however, suggest that the improvements in critical thinking produced by arts experiences are not limited to the arts: “Some cognitive structures developed by learning in the arts might be the same as some needed to do well in academics” (p. 12). They note that skills such as observation, critical and independent thinking, and problem solving could be transferred to other academic disciplines.

Attempting to justify the arts in terms of their effect on other educational outcomes, however, may be unrealistic. It is possible that by setting such high expectations for arts exposure, the arts are being set up to fail. Noting this, some argue that the value of the arts should be “based upon their inherent merit” (Hetland & Winner, 2001, p. 3). Adding to this dilemma is the fact that although claims of the positive spillover effects of the arts are abundant, there is a lack of empirical research substantiating these claims (Winner & Cooper, 2000). Future research should further explore whether the benefits of thinking critically about the arts transfers to other educational subjects, such as social studies, science, or language arts. At the same time, it is important to temper expectations and consider the inherent benefits of arts exposure as valuable in their own right.

Although this study finds significant benefits from a modest intervention, future research could examine the potential effects of more intensive arts-based experiences. In addition, this study is able to confirm that gains in critical thinking skills could be observed several weeks following school tours of an art museum. Future research could evaluate whether these benefits endure for a longer period. This research also does not establish which components of the school tour of an art museum were essential for producing gains in critical thinking skills. For example, we do not know whether similar benefits could be observed from exposure to the arts without a tour of a museum or whether the entire tour experience was necessary. Although pre- and postcurricular materials were sent to teachers who went on a tour, our survey of teachers suggests that these materials received modest attention—most

teachers indicated that they spent only 1 to 2 hours using these materials. Still, most students did receive exposure to the materials from their teachers. Only 10% of the teachers reported that they did not use the previsit materials, whereas 13% reported that they did not use the postvisit materials. Future research could attempt to unbundle the experience of school tours of art museums to see if similar benefits could be produced by school-based experiences.

This research not only establishes the causal connection between an arts experience and critical thinking skills; it also makes clear that the benefits of school tours are particularly large for more disadvantaged groups of students. The pivotal role of schools in providing arts exposure to disadvantaged students may help explain why we observe much larger benefits for these students. If schools fail to provide those experiences, advantaged students may be in a position to substitute by receiving exposure to the arts and cultural institutions from their families. But disadvantaged families may be less able to substitute if their schools do not provide exposure to the arts. Because disadvantaged students face challenges in receiving arts experiences outside of school, public education plays an essential role in providing those students with exposure to the arts. If schools do not do it, it is unlikely to happen.

There are strong policy implications of our findings. First, we establish that students benefit in their critical thinking skills from school tours of an art museum. Schools have to decide how often they send their students on field trips and where those trips should go. Sending students for school tours of art museums has proven benefits that other field trip experiences may not.

Second, policymakers and educators have to make decisions about how to allocate funds among schools. Given the greater benefits for disadvantaged students from school tours of an art museum, concentrating school tour resources in schools with more disadvantaged students may have the greatest return on those resources.

Third, we have established that an arts experience can have a significant impact on critical thinking skills. This suggests that there are real, negative consequences to efforts to reduce the arts in schools. It is ironic that the cuts in arts education have most affected disadvantaged students, as this research demonstrates that those are precisely the students who could benefit the most from school-provided arts experiences.

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AUTHORS

DANIEL H. BOWEN, PhD, is a postdoctoral fellow at Rice University's Houston Education Research Consortium at 6100 Main

St., MS-28, Houston, TX, 77005; daniel.h.bowen@rice.edu. His research focuses on nontraditional outcome measures in education policy, noncore school subject areas, and teacher quality issues.

JAY P. GREENE, PhD, is a professor of education reform at the University of Arkansas, 200 Graduate Education Building, Fayetteville, AR 72701; jpg@uark.edu. His research focuses on the educational effects of cultural institutions, like art museums and theaters, as well as the effects of school choice.

BRIAN KISIDA is a senior research associate in the Department of Education Reform at the University of Arkansas, 201 Graduate Education Building, Fayetteville, AR 72701; bkisida@uark.edu. His research includes the rigorous study of informal learning environments, arts education and cultural policy, traditional and nontraditional learning outcomes, school integration, and school choice.

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