Does Studying the Arts Engender Creative Thinking? Evidence for Near but Not Far Transfer

ERIK MOGA, KRISTIN BURGER, LOIS HETLAND, and ELLEN WINNER

Viewing a great painting or listening to a profoundly moving piano concerto produces a sense of intellectual joy that is satisfying in and of itself. But, arguably, it also enhances and reinforces the conceptual processes so essential to innovation.

Alan Greenspan
Commencement Address, Harvard University, 1999.

[The arts] are the fuel for imagination.
Hillary Rodham Clinton
The University of Michigan, April 28, 1998.

The view that studying the arts makes people more creative and imaginative is part of our folklore. Arts education at its best includes open-ended inquiry, creative problem finding, and creative problem solving. It is reasonable to wonder, therefore, whether studying the arts helps develop creative thinking skills that can be deployed in other areas besides the arts.

This view has been put forth in qualified form by the psychologist David Perkins.¹ Perkins has argued that looking at art requires thinking and can be used to cultivate “thinking dispositions.” He argues that while any subject matter can be used to foster thinking skills, the arts are a particularly good vehicle for this. The arts are excellent vehicles for fostering thinking because they provide a sensory anchor (one can focus on a physical object as one thinks), they are instantly accessible (one can check one’s argument at any point by looking back at the work), they engage us and sustain our attention, and they encourage rich connections. However, he also points to evidence that thinking skills developed in one context will transfer to another context only when there is explicit teaching for transfer. Teachers need to encourage students to see the common principles that connect thinking in the arts to thinking in other domains.

What evidence do we have that learning in the arts leads to creative thinking skills? We carried out a comprehensive search for empirical studies investigating this question. We limited our search to studies assessing

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the impact of the visual arts or the impact of the visual arts along with other forms of arts. Thus, we did not investigate studies examining, for example, the link between creative thinking and training in a nonvisual form of art (e.g., music, drama, dance). We found only a few studies, all of which assessed thinking in terms of performance on paper-and-pencil creativity tests. Thus, all of the studies are constrained by the limits of such tests. Some of the studies we found were correlational; others were experimental; some assessed creativity through verbal measures; others through figural (visual) creativity tests.

In the three meta-analyses that follow, we examined the correlational studies separately from the experimental ones; and within the group of experimental studies, we looked separately at evidence for transfer from arts education to verbal vs. visual creative thinking. We hypothesized that the correlational studies would reveal a stronger connection than the experimental studies because creative students may self-select into the arts. We also hypothesized that transfer would be more likely to occur when the link was from the arts to a visual than to a verbal form of creativity test. This latter hypothesis was based on the fact that the bridge between the arts and visual creativity task performance may be a narrower one than that between the arts and verbal creativity task performance, since the arts (in the studies reviewed here) included the visual arts.

Method
A comprehensive search of seven electronic databases was conducted from their inception through 1999: Arts and Humanities Index (1988-1999), Dissertation Abstracts International (1950-1999), Educational Resource Information Clearinghouse (1950-1998), Language Linguistics Behavioral Abstracts (1973-1999), MedLine (1966-1999), PsychLit/PsychINFO (1984-1999), and Social Science Index (1988-1999). We used the search term art and combined this with the following search strings: (instruct or train) and (educate or learn or cognition or achieve or intelligence or IQ) and (measure or outcome or effect or evaluation) and (creative or creative thinking or critical thinking or higher-order thinking). The electronic search resulted in 2,713 studies, most of which were not relevant. In addition, we handsearched 41 journals from 1950-1998 (listed in Table 1 of the introductory paper in this issue) that publish articles in education, development, and the arts. We checked the bibliographies of all identified articles and sent requests to over 200 arts education researchers for unpublished data or manuscripts not yet published in order to avoid a publication bias.

We then applied a set of inclusion criteria. All studies had to be empirical studies assessing the relationship between studying the arts and performance on some measure of creative, critical, or higher-order thinking. We
Arts Education and Creativity

included only studies assessing the effects of visual arts alone or in combination with other arts disciplines. In addition, studies had to have a control group that did not receive exposure to arts study. After these inclusion criteria were applied, we were left with only eight studies, from which we ultimately calculated 10 effect sizes.

Coding Procedure:

Each study was coded in terms of the categories listed below by two independent judges. The judges disagreed on only six codings, and these disagreements were unambiguously resolved by rechecking the original text.

A brief description of each study appears in Table 1. A brief description of each creativity test used appears in Table 2.

Year of Publication. The year that each study was published was recorded.

Sample Size. Studies were coded for size of sample.

Effect Size. Effect sizes were calculated using one of the methods listed in Table 3 of the lead article in this issue by Winner and Cooper. We calculated one effect size for each study, with the exception of one study that reported results separately by sex. For this study, we had to calculate two separate effect sizes. We refer to each of these effect sizes as a separate study in what follows. Three of the studies used multiple measures of verbal or figural creativity or reported subtest results separately. For these studies we calculated an effect size for each measure or subtest and then averaged these into one composite effect size. Table 3 lists the effect size r associated with each study, along with the Z level associated with that effect size, and the significance level (p) associated with the Z.

Age or Grade Level of Participant. Grade level and age of subjects was recorded.

Participant Characteristics. Subjects were classified as average if they were not specified as having been selected for some special characteristic. If subjects were selected for a specific characteristic (e.g., high academic ability), this was recorded.

Duration. Studies were coded for the length of exposure to art study.

Outcome. The type of creativity measure used was recorded.

Publication Outlet. The publication outlet was recorded as a peer-reviewed journal, a non-peer-reviewed journal, a doctoral dissertation, or a technical report.

We performed three “mini” meta-analyses, one on the correlational studies (performed on four effect sizes), a second on experimental verbal creativity studies (performed on three effect sizes), and a third on experimental figural creativity studies (also performed on three effect sizes). Correlational studies assessed the creativity levels of students who had already taken arts courses and who may have self-selected into arts courses. Because no pre-test measures were given, there was no way to know whether students who
Table 1: Summary of Studies

<table>
<thead>
<tr>
<th>Correlational Studies</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burgart (1961)</td>
<td>Reports a correlation between amount of arts study in college and creativity as measured by 3 fluency tests: the Visual-Verbal Response Test, the Definitions Test, and the Relationships test. Type of arts study was not specified but it clearly included visual art; whether other art forms were included was not clear.</td>
</tr>
<tr>
<td>Burton, Horowitz, &amp; Abeles (1999)</td>
<td>Reports that the students (grades 4, 5, 7, 8) in arts rich schools with multiple forms of arts integrated into the curriculum score higher on the Torrance Tests of Creative Thinking — Thinking Creatively with Pictures than do students in arts poor schools.</td>
</tr>
<tr>
<td>Hamann, Bourassa, &amp; Aderman (1991)</td>
<td>Reports a correlation between amount of arts study (music, visual arts, theater) in high school and creativity as measured by the Consequences Test. Students in the top third of arts experience scored higher than those in the bottom third.</td>
</tr>
<tr>
<td>Howell (1990)</td>
<td>Reports a correlation between involvement in the arts (visual arts, music) in high school and scores on the Torrance Tests of Creative Thinking — Thinking Creatively with Pictures.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Experimental Studies</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dillard (1982)</td>
<td>Reports no effect of a 7 month arts program (drama, music, visual arts) on figural creativity scores (Torrance Test of Creative Thinking — Thinking Creatively with Pictures) of academically gifted children in grades 1-3.</td>
</tr>
<tr>
<td>Even (1963)</td>
<td>Reports that high school students given four one-day sessions of visual arts scored higher in creativity (on the verbal and figural forms of the Minnesota Tests of Creative Thinking) than students given four one-day sessions of science and than students given no treatment.</td>
</tr>
<tr>
<td>Luftig (1993)</td>
<td>Reports that students in grades 2, 4, and 5 who received an arts-integrated curriculum (visual arts, music, drama, dance, media arts) for a year scored higher in creativity (as measured by the Torrance Tests of Creative Thinking — Thinking Creatively with Pictures) than a group who received a cooperative learning curriculum as well as a group who received no treatment.</td>
</tr>
<tr>
<td>Skipper (1969)</td>
<td>Reports that 7th – 10th grade girls who enrolled voluntarily in an after-school arts program (visual arts, music, drama, dance, creative writing) scored higher than girls who did not enroll on one test (Things Category Test) but no higher on two other tests (Plot Titles Test, Apparatus Test). Boys who enrolled in the after-school arts programs scored higher than those who did not enroll on one test (Apparatus Test), but no higher on two other tests (Things Category Test, Plot Titles Test).</td>
</tr>
</tbody>
</table>
Table 2: Description of Creativity Tests Used

<table>
<thead>
<tr>
<th>Test</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apparatus Test</td>
<td>Verbal</td>
<td>Subject is asked to offer improvements on the design of given objects.</td>
</tr>
<tr>
<td>Consequences Form A-I</td>
<td>Verbal</td>
<td>Subject reads a brief story and is asked to state as many ramifications of the story as possible.</td>
</tr>
<tr>
<td>Definitions Test</td>
<td>Verbal</td>
<td>Subject is given a word and is asked to come up with as many definitions of that word as possible.</td>
</tr>
<tr>
<td>Minnesota Tests of Creative Thinking</td>
<td>Figural</td>
<td>Subjects complete an incomplete drawing; subjects transform a given shape into something; subjects make as many drawings as possible out of 42 one-inch circles.</td>
</tr>
<tr>
<td>Plot Titles Test</td>
<td>Verbal</td>
<td>Subject reads a passage and suggests as many appropriate titles as possible.</td>
</tr>
<tr>
<td>Relationships Test</td>
<td>Verbal</td>
<td>Subject is shown nine objects and is asked to select as many triads as possible that have something in common.</td>
</tr>
<tr>
<td>Things Categories Test</td>
<td>Verbal</td>
<td>Subjects list all things of a given color, then of a given shape, as quickly as possible in three minutes.</td>
</tr>
<tr>
<td>Torrance Tests of Creative Thinking</td>
<td>Figural and Verbal</td>
<td>A set of creativity tests containing one verbal test (Thinking Creatively with Words) and one figural test (Thinking Creatively with Pictures). For the figural test, subjects construct a picture “that no one else will think of” from a given shape and provide an “interesting” title; subjects create a picture from a series of lines and provide an “interesting” title; subjects make as many pictures as possible (in ten minutes) from a series of lines. For the verbal test, subjects are asked to complete a number of writing exercises that are accompanied by an illustration. These writing exercises involve generating lists. For example, subjects are instructed to list as many ways they can think of to make a particular product (e.g., a stuffed bunny) more fun for children.</td>
</tr>
<tr>
<td>Visual-Verbal Response Test</td>
<td>Verbal</td>
<td>Subject looks at a pattern of lines and generates as many ideas as possible about what the pattern means or suggests.</td>
</tr>
</tbody>
</table>
chose to take the arts were higher in creativity to begin with than students who did not choose to take the arts. Experimental studies assessed the creativity level of students before and after studying the arts. If students in the arts group gain more than those in the nonarts group, and if there are no other differences between groups besides amount of arts study, we can conclude that exposure to the arts was the factor that led to improvements in creative thinking.

**Meta-analysis 1: Correlational Studies**

A meta-analysis was first performed on the four correlational studies listed in the top third of Table 3.7

**Study Characteristics**

*Year of Publication.* The studies appeared between 1961 and 1999, with a median publication date of 1990.

*Age of Participants.* Ages of participants ranged from 4th grade to college age. One study examined college students, two examined high school students, and one examined 4th-8th grade students.

*Sample Size.* The total sample size was $n=1513$.

*Type of Participants.* Each of the studies assessed students who were not further categorized in any way (and therefore we coded these students as average).

*Duration.* The studies assessed the effects of art study lasting varying lengths of time. One study compared students who had participated in any artist residencies or arts experiences within the last four years to those who had participated in no arts for at least four years. One assessed the effects of more than one year of arts study. One compared students who had nine or more years of arts study to students with five year-long arts courses. We were unable to determine the amount of arts study in the remaining study.

*Outcome.* All studies used paper-and-pencil creativity tests as their outcome. Two studies used verbal measures, two used figural measures. The specific tests used are listed in Table 1 and defined in Table 2.

*Publication Outlet.* Two of the studies appeared in non-peer-reviewed journals. One study was a doctoral dissertation, and one was a technical report.

**Results**

A mean effect size of $r=.27$ was found (Stouffer's $Z = 8.91, p<.0001$; $t$-test of mean $Zr=3.75, p=.03$). When weighted by size of study, the mean effect size was $r=.28$, indicating that larger effect sizes were associated with larger sample sizes. The 95% confidence interval, from $r=.06$ to $r=.50$, did not span zero. Thus, the mean effect size of another set of four similar studies would
Table 3: Studies (Listed Alphabetically) Included in Meta-analysis 1: Correlational Studies

<table>
<thead>
<tr>
<th>Study/Year/ Outlet</th>
<th>N</th>
<th>r</th>
<th>Z (p)*</th>
<th>Age</th>
<th>Duration of Arts</th>
<th>Outcome</th>
<th>Effect Size Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burgart (1961)/ Non-peer Reviewed Journal</td>
<td>100</td>
<td>.43</td>
<td>4.25*</td>
<td>College</td>
<td>Avg.</td>
<td>Not reported</td>
<td>From the average of rs reported</td>
</tr>
<tr>
<td>Burton, Horowitz, &amp; Abeles (1999)/ Technical Report</td>
<td>1202</td>
<td>.29</td>
<td>10.20*</td>
<td>4th, 5th, 7th and 8th graders</td>
<td>Avg.</td>
<td>Over a year</td>
<td>Torrance — Thinking Creatively with Pictures</td>
</tr>
<tr>
<td>Hamann, Bourassa, &amp; Aderman (1991)/ Non-peer Reviewed Journal</td>
<td>76</td>
<td>.27</td>
<td>2.34 (p=.01)</td>
<td>High school</td>
<td>Avg.</td>
<td>Students who took 5 year-long arts courses were compared to students who took 9 years or more</td>
<td>Consequences Form A-1</td>
</tr>
<tr>
<td>Howell (1990)/ Doctoral Dissertation</td>
<td>135</td>
<td>.09</td>
<td>1.03 (p=.15)</td>
<td>High school</td>
<td>Avg.</td>
<td>Participation within the last 4 years was compared to no participation in the last 4 years</td>
<td>Torrance — Thinking Creatively with Pictures</td>
</tr>
</tbody>
</table>
Table 3 continued: Studies (Listed Alphabetically) Included in Meta-analysis 2: Experimental Studies with Verbal Outcomes

<table>
<thead>
<tr>
<th>Study/Year/Outlet</th>
<th>N</th>
<th>r</th>
<th>Z (p)</th>
<th>Age</th>
<th>Duration of Arts</th>
<th>Outcome</th>
<th>Effect Size Method</th>
<th>Method Used After Computing Paired t-test Using Raw Data Provided by Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>Even (1963)/Doctoral Dissertation</td>
<td>37</td>
<td>.16</td>
<td>0.95</td>
<td>11th</td>
<td>4 one-day sessions</td>
<td>Minnesota Tests of Creative Thinking</td>
<td>t method</td>
<td>t-test using raw data provided by author.</td>
</tr>
<tr>
<td>Skipper (1969)/Females/Technical Report</td>
<td>157</td>
<td>-.05</td>
<td>-0.68</td>
<td>Avg.</td>
<td>4 months</td>
<td>Things Categories Test; Plot Titles Test; Apparatus Test</td>
<td>F method</td>
<td></td>
</tr>
<tr>
<td>Skipper (1969)/Males/Technical Report</td>
<td>55</td>
<td>.05</td>
<td>0.33</td>
<td>Avg.</td>
<td>4 months</td>
<td>Things Categories Test; Plot Title Test; Apparatus Test</td>
<td>F method</td>
<td></td>
</tr>
</tbody>
</table>
Table 3 continued: Studies (Listed Alphabetically) Included in Meta-analysis 3: Experimental Studies with Figural Outcomes

<table>
<thead>
<tr>
<th>Study/Year/ Outlet</th>
<th>N</th>
<th>r</th>
<th>z (p)</th>
<th>Age Characteristics</th>
<th>Duration of Arts</th>
<th>Outcome</th>
<th>Effect Size Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dillard (1982)/ Doctoral Dissertation</td>
<td>97</td>
<td>.30</td>
<td>2.95</td>
<td>K, 1st, 2nd, and 3rd grade</td>
<td>High academic ability</td>
<td>7 months</td>
<td>Torrance — Thinking Creatively with Pictures</td>
</tr>
<tr>
<td>Even (1963)/ Doctoral Dissertation</td>
<td>37</td>
<td>.15</td>
<td>0.90</td>
<td>11th grade</td>
<td>High academic and low creative ability</td>
<td>4 one day sessions</td>
<td>Minnesota Tests for Creative Thinking</td>
</tr>
<tr>
<td>Luftig (1993)/ Technical Report</td>
<td>412b</td>
<td>.12</td>
<td>2.33</td>
<td>2nd and 4th graders</td>
<td>Avg.</td>
<td>1 year</td>
<td>Torrance — Thinking Creatively with Pictures</td>
</tr>
</tbody>
</table>

Notes:

a. * indicates p<.001.
b. N used to calculate r for Luftig does not include modified control group. It includes full control (n=198) plus SPECTRA+ (n=214).
be unlikely to be zero. A file drawer analysis indicates that we would have to discover 113 studies averaging null results \((p=.50)\) in order to reduce our significance level to the barely significant level of \(p=.05\). The standard deviation of the mean effect size was .14. Effect sizes were significantly heterogeneous, \(\chi^2(3)= 8.14, p=.04\), and ranged from \(r=.09\) to \(r=.43\).

These findings indicate that there is an association between studying the arts and performance on creativity measures. However, no causal conclusions can be drawn from these studies since they are correlational. We note that all but the study by Burton and her colleagues assessed the creativity of students who voluntarily chose to study the arts. Thus, one possible noncausal explanation is that students who self-select into the arts are creative thinkers to begin with. A possible noncausal explanation for the study by Burton and her colleagues is that students with more arts exposure attended better schools or had more creative teachers, and these factors might have led to greater creativity.

**Meta-analysis 2: Experimental Studies with Verbal Creativity Outcomes**

A meta-analysis was next performed on three effect sizes calculated from experimental studies with verbal creativity scores as their outcomes. These studies and their coded characteristics are listed in Table 3.

**Study Characteristics**

*Year of Publication.* The studies appeared between 1963 and 1969, with a median publication date of 1969.

*Age of Participants.* Ages of participants ranged from 7th grade to 11th grade. One study examined 11th graders, and two studies examined 7th, 8th, and 10th graders.

*Sample Size.* The total sample size was \(n=249\).

*Type of Participants.* Two studies assessed students not further categorized, and one study assessed students of high academic and low creative ability.

*Duration.* One study assessed the effects of a very brief, four-day arts treatment; two assessed the effects of four months of arts study.

*Outcome.* The creativity tests used in these three studies were recorded and are listed in Table 1 and defined in Table 2.

*Publication Outlet:* One study was a doctoral dissertation and two were technical reports.

**Results**

A mean effect size of \(r=.05\) was found. This effect size was not significant, as indicated both by the Stouffer’s \(Z=.35, p=.64\), and by the more conservative \(t\)-test of the mean \(Zr=.81, p=.50\). When weighted by size of study, the mean
effect size was reduced to $r = -0.003$, indicating that larger studies were associated with smaller effect sizes. In addition, the 95% confidence interval, from $r = -0.21$ to $r = 0.31$, spanned zero, indicating that another sample of similar studies might well produce a mean effect size of zero or below.

The standard deviation of the mean effect size was 0.11, but effect sizes were not significantly heterogeneous, $\chi^2 (2) = 1.40, p = .50$. They ranged from $r = -0.05$ to $r = 0.16$. These findings provide no support for a causal relationship between arts study and verbal creativity. However, perhaps the students in these studies were not exposed to the arts for a long enough time for an effect to have occurred.

Meta-analysis 3: Experimental Studies with Figural Creativity Outcomes

A third meta-analysis was performed on three effect sizes calculated from experimental studies looking at the effect of arts education on figural creativity scores. These studies and their coded characteristics are listed in the bottom third of Table 3.8

Study Characteristics

Year of Publication. The studies appeared between 1963 and 1993, with a median publication date of 1982.

Age of Participants. Ages of participants ranged from kindergarten to 11th grade. One study examined 11th graders and two studies examined elementary-aged children.

Sample Size. The total sample size was $n = 546$.

Type of Participants. One study assessed students not further categorized, one study assessed students of high academic and low creative ability, and one study assessed students with high academic ability.

Duration. Duration of arts study varied widely: four days, seven months, and one year.

Outcome. The creativity tests used were the Torrance Tests of Creative Thinking, Thinking Creatively with Pictures, and the Minnesota Tests of Creative Thinking.

Publication Outlet. One study was a technical report and two studies were doctoral dissertations.

Results

A mean effect size of $r = 0.19$ was found, along with a weighted mean effect size of $r = 0.15$. The mean effect size was significant as shown by the Stouffer's $Z = 3.57, p = .0002$. This latter result means that we can generalize our findings to other subjects who might have been selected for these studies. However, the more conservative $t$-test of the mean $Zr$ was not quite significant (yielding a value of 3.19, $p = .09$). This means that we cannot generalize our results to a
new set of similar studies. In addition, the 95% confidence interval spanned zero ($r=-.05$ to $r=.44$), and 11 more studies averaging null results would be needed to reduce the significance of the Stouffer's Z to $p=.05$. The standard deviation of the mean effect size was .10; effect sizes were not significantly heterogeneous, $\chi^2 (2)= 2.89$, $p=.24$. These results provide some support (though the support is equivocal) for the hypothesis that there is a causal relationship between studying the arts and performance on figural creativity tests.

Discussion

These results show that answering the question of whether there is an association between studying the arts and creative thinking depends on experimental design (correlational vs. true-experimental) and form of creativity measured (verbal vs. figural/visual).

Our first meta-analysis, based only on correlational studies, demonstrated a modest association between studying the arts and performance on creativity measures. In three of these studies, students self-selected into the arts. Hence, one possible explanation of the correlation found is that the kinds of students who choose to study the arts are creative thinkers to begin with.

The comparison between the two meta-analyses of experimental studies is striking. We found modest evidence for a causal relationship between arts study and creativity measures but only when the creativity measure was figural. When the measure was verbal/conceptual, no evidence for a causal relationship was found. Thus, we find some transfer when the bridge is narrow: from experience in the arts, which includes the visual arts, to performance on tests requiring drawing. We find no transfer when the bridge is wide: from experience in the arts to performance on tests requiring one to generate ideas, concepts, or words.

Conclusions are strongly limited by the dearth of experimental studies found. In addition, our conclusions are limited by the kinds of creativity measures used. It is possible that the tests used in these studies do not accurately detect the kind of creativity fostered by study in the arts. Perhaps more qualitative measures of creative thinking would reveal stronger transfer.

One general kind of creative thinking skills that might be fostered by the arts is an open-ended, problem-finding attitude. Problem finding was assessed by Getzels and Czikszentmihalyi in a task in which art students were asked to draw a still life.9 These researchers found that some students were not content to accept the problem as given, but challenged themselves to make the problem more interesting and difficult. These same students produced works judged higher in originality than did students low in problem finding. Perhaps studying the arts stimulates a problem-finding attitude
that can be used in nonarts areas. To test this hypothesis, researchers would need to develop measures of problem finding, first within an art form (to see whether this skill was learned in the arts form) and then in a nonart form (e.g., a science problem), to see whether problem finding generalized outside of the art. In short, researchers should not fall back on standardized tests just because they are readily available and easily scorable.

We conclude with several recommendations: First, we need more experimental studies if we are to test the causal hypothesis that studying the arts enhances creative thinking. Second, these studies should assess the impact of studying the arts for a nontrivial length of time (i.e., at least one year). It is not reasonable to expect arts study of a few weeks or months to produce effects powerful enough to transfer. Third, these studies should assess the impact of explicit teaching for transfer in arts classes. None of the studies we identified included programs in which the teacher taught for transfer by asking students to reflect on the skills used in arts classes and then to use these same skills in another arena. Fourth, researchers need to broaden the kinds of creativity measures used in their research.

NOTES

1. David Perkins, The Intelligent Eye: Learning to Think by Looking at Art (Santa Monica, Calif.: Getty Center for Education in the Arts, 1994).

2. All but two of the studies we identified specified that the arts education involved multiple forms of arts, and in all cases the visual arts were one of these forms of art. In one correlational study, the authors did not specify which art forms were involved but instead only mentioned that the students had "arts experience" (Herbert Burgart, "Art in Higher Education: The Relationship of Art Experience to Personality, General Creativity, and Aesthetic Performance," Studies in Art Education 2, no. 2 [1961]: 14-33). It was clear that these experiences included visual arts (because at one point the authors refer to "studio art"), but it is possible that visual art was the only art form. In one experimental figural study, only the visual arts were involved (Robert Even, "An Experimental Study of the Comparative Effect of Selected Art Experiences on the Creative Performance and Attitudes of Academically Superior Students" [Ph.D. diss., University of Minnesota, 1963]). Thus, all of our studies involved visual arts, and in all but two cases we can be sure that other forms of arts were involved as well. The search terms that we used to identify relevant studies were broad to increase the likelihood of identifying any studies that examined the link between visual arts education and creativity. Thus, the studies not included here were ones investigating the link between creativity and specific art forms besides visual arts.

3. We found three studies that could not be included for methodological reasons: Shirley Bolton, "An Introductory Study of Art as Creative Learning for the Rural Culturally Disadvantaged," Studies in Art Education 10, no. 2 (1969): 57-65; Carol Fineberg, Thinking through the Arts: A Comprehensive Arts in Education Program (New Rochelle, N.Y.: New Rochelle City School District, 1987); Steven Gibson, "A Comparison of Music and Multiple Arts Experiences in the Development of Creativity in Middle School Students" (Ed.D. diss., Washington University, 1988). All three studies reported improvement in creativity as a function of arts study. The study by Bolton could not be included because the arts and
control group were not matched and assessments were made only at posttest. The study by Fineberg could not be included because it lacked a control group. The study by Gibson could not be included because in this study the arts group was compared to a control group that received instruction in music. Hence, the control group in this study was not comparable to the no-arts control groups in the studies included in our meta-analyses.


6. To compute an average composite effect size, we first converted each effect size \( r \) to a Fisher's transformation, \( Z_r \). We then averaged these Fisher's \( Z_r \)s and converted the mean Fisher's \( Z_r \) back to an effect size \( r \). See Robert Rosenthal, *Meta-Analytic Procedure for Social Research* (Newbury Park, Calif.: Sage Publications, 1991).

7. Full references can be found in the list of studies included in the meta-analyses, below.

8. We were able to classify the study by Luftig as using a figural creativity outcome, thanks to information provided us by Jackie Quai, Director of SPECTRA+, personal communication, December 4, 1999.


**Studies Included in the Meta-analyses**


Dillard, Geneva, “The Effect of a Fine Arts Program on Intelligence, Achievement, Creativity, and Personality Test Scores of Young Gifted and Talented Students” (Doctoral diss., East Tennessee State University, 1982).


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