

Learning improved by arts training

SIR — It has been suggested^{1,2} that musical experience or training can temporarily strengthen visuospatial reasoning. We report here further data on the relationship between arts training and some broader aspects of learning.

In its first year, our study included 96 pupils (aged 5–7 years) in eight first-grade public-school classrooms. Four 'test arts' classrooms (two each in two schools) participated in a music and visual-arts curriculum which emphasized sequenced skill development³. Two other control, 'standard arts' classrooms in each school received the system's standard visual arts and musical training. Curricula in all classrooms were otherwise identical.

After seven months, the schools gave all students standardized First-Grade Metropolitan Achievement Tests, and in the 83% of pupils for whom the details

were already on file, we compared the results with kindergarten achievement scores. Classroom teachers also evaluated each student on attitude and behaviour (on Likert-scale questionnaires) four times during the study.

We found that, in the 83% of students with kindergarten scores on file, those in the test arts classes started behind the control children in having kindergarten tests at least at the national average grade level (38% compared with 47%; $P < 0.05$, χ^2), but after seven months, they had caught up to statistical equality on reading and were now ahead on learning mathematics (77% compared with 55% were now at grade level or above; $P < 0.05$, χ^2).

In the full first-grade sample, pupils in the test group were again equal to those in the control group on reading, but ahead on maths (75% compared with 53% at or above grade level; $P < 0.05$, χ^2). This maths advantage did not depend on school, or on whether students entered after poor, average or good kindergarten performance (see figure). The results of the

achievement tests were also above grade level: in the full sample, for example, the percentage increment of test arts pupils over controls fell only gradually over levels above the 50th percentile, and were still present to a small degree even at the 90th percentile, whereas in reading, the percentages between the groups remained roughly equal over higher percentiles.

Classroom attitude and behaviour ratings of test students began significantly behind those of controls, possibly reflecting their poorer kindergarten start, but reached statistical equality by achievement testing time. This might explain the equality between the groups on reading, but not fully the improvement in maths.

We continued the study the following year in four test and five control second-grade classrooms at the same schools, all students again taking achievement tests after seven months. We found that test and control arts pupils were again equal on reading, and that test arts pupils were again ahead on maths (73% compared with 55% at or above grade level on comprehension, $P < 0.05$, χ^2 ; 71% compared with 63% on problem-solving). The percentage of students at or above grade level in second-grade maths was highest in those with two years of test arts, less in those with only one year and lowest in those with no test arts (on maths comprehension; $P < 0.01$, CMH statistics).

We believe our data show that when students discover that participation in arts activities is pleasurable, they become motivated to acquire skills in the arts on which our programme focuses, with two types of result. First, from realizing that they can learn such challenging but desirable skills, students' general attitude towards learning and school can improve. Second, learning arts skills forces mental 'stretching' useful to other areas of learning: the maths learning advantage in our data could, for example, reflect the development of mental skills such as ordering, and other elements of thinking on which mathematical learning at this age also depends⁴.

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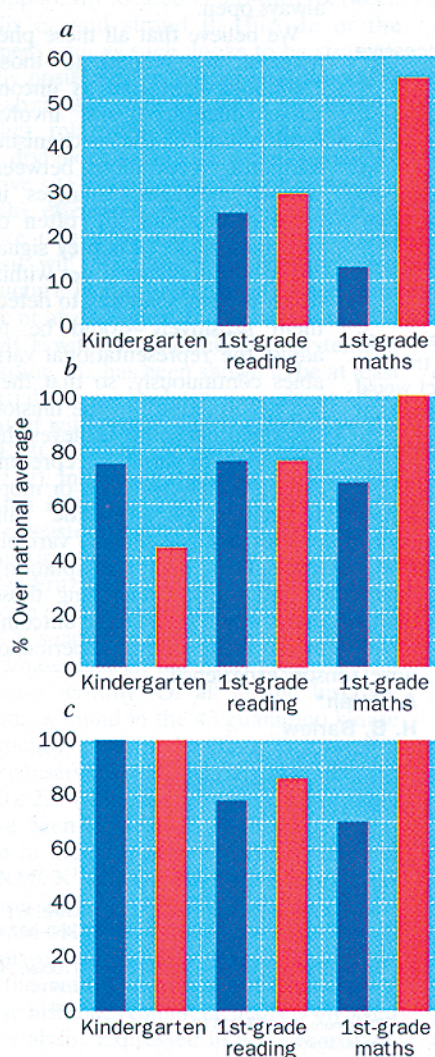
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First-grade achievement test performance by previous kindergarten performance. *a*, Scores below 34th national percentile; kindergarten scores not available. *b*, Kindergarten scores between 34th and 66th national percentile. *c*, Kindergarten scores above 66th national percentile. Blue bars, standard arts; red bars, test arts.

METHODS. The 80 students in the first-grade sample for whom kindergarten achievement test scores were also available were divided into three subgroups, *a*, *b* or *c*, as defined above. For each subgroup, the per cent of test and control arts students at national average (grade level) or above (that is, at 50th national percentile or above) were calculated and compared for kindergarten, first-grade reading and first-grade maths achievement tests. In *a*, some students could raise performance to grade level or above in reading by the end of the first grade, roughly 25% in control and test arts groups, but in maths a significantly higher percentage of test arts students do so ($P < 0.05$, χ^2). In *b*, although more test students are below grade average at kindergarten level, after first grade they are equal to controls on reading and ahead on maths ($P < 0.06$, χ^2). Even with the best kindergarten test students (*c*), there is improved learning in maths in test arts students ($P < 0.03$, χ^2). Such uniformity of the test versus control difference across strata adds to the statistical significance of test versus control difference in the full combined strata ($P < 0.01$, CMH statistics). (In the classes studied, students receiving remedial teaching for limited proficiency in English, and those entering from a transitional year, repeating the first grade or not present for the full year, were analysed separately, and are not included in the present results.) Full details of methodology and other results described here are available directly from the authors (mgardi1140@aol.com).