

ARTS + STEM = LEARNING



Research shows arts integration leads to

HIGHER
math achievement¹

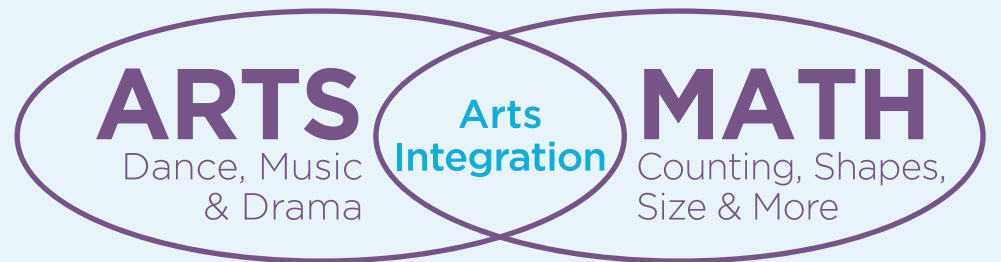
EARLY MATH SKILLS
are the strongest predictor
of later academic achievement³

ARTS WORK!

Wolf Trap's model program led to **26+ days** of math learning²

WHY

CHILDREN LEARN BEST BY DOING
the arts and STEM are
natural partners



RHYTHMS/PATTERNS=PRE-ALGEBRA

HOW

Each teacher received up to **101 HOURS** of PROFESSIONAL DEVELOPMENT

Teacher
+ Wolf Trap Teaching Artist
+ Wolf Trap Professional Development

BETTER MATH KNOWLEDGE

Wolf Trap teachers scored **62% HIGHER** on overall arts integration measures, and **150% HIGHER** in linking arts with math⁴

The Wolf Trap APPROACH

WOLF TRAP
teaching artists
COLLABORATE
with teachers
in the classroom



INSTRUCTIONAL
content aligned
**TO NATIONAL AND
STATE STANDARDS**



28
STATES
INCLUDING **17**
AFFILIATE SITES



WOLF TRAP

FOUNDATION FOR THE PERFORMING ARTS

SOURCES

1. Interpretations derived from results of a four-year study of Wolf Trap's Early Childhood STEM Learning Through the Arts: An experimental application of Wolf Trap's arts education program model. Ludwig, M. and Song, M., (2014). "Final Report: Findings from the Evaluation of the Wolf Trap Arts in Education Model Development and Dissemination Grant." American Institutes for Research.
2. Song, M., Ludwig M., and Marklein M.B., (2016). "Arts Integration: A Promising Approach to Improving Early Learning." American Institutes for Research.
3. Duncan, G. J., Dowsett, C.J., Classens, A., Magnuson, K., Huston, A.C., Klebanov, P., et al. (2007). School readiness and later achievement. *Developmental Psychology*, 43, 1428-1446.
4. Ludwig and Song, opt cit, pg. 16, Exhibit 9.



KEY RESEARCH FINDINGS ON THE EFFICACY OF WOLF TRAP'S EARLY CHILDHOOD STEM LEARNING THROUGH THE ARTS

Overview Since 1981, Wolf Trap Foundation for the Performing Arts has been a leader in early childhood learning through the arts, offering educators the tools to implement outcomes-based, arts-integrated lessons in their classrooms for the purpose of enhancing student achievement. In 2010, Wolf Trap received a major grant from the U.S. Department of Education to implement and study a professional development (PD) model that enables teachers to infuse performing arts strategies in kindergarten and pre-k classrooms in an effort to improve math outcomes. The program, Early Childhood STEM Learning Through the Arts (Early STEM/Arts), provides arts-integrated content, which included in-class residencies, multi-day focused art/math trainings, peer-sharing of instructional strategies and one-to-one mentoring and coaching with a Wolf Trap teaching artist.

Independent Research To implement the study, Wolf Trap partnered with Fairfax County (Virginia) Public Schools to execute a randomized, controlled study of Early STEM/Arts. Conducted by American Institutes for Research (AIR), an independent, third-party research firm, the study took place over four years (2010 – 2014).

Key Research Findings

1. *Wolf Trap's Early STEM/Arts program had a statistically significant, positive impact on students' math achievement.* Wolf Trap students outperformed peers in the control schools on the Early Math Diagnostic Assessment (EMDA), a standard math assessment for young children.
2. *Students in the classrooms of teachers trained in the Early STEM/Arts program gained the equivalent of more than a month of additional learning in math.* The first-year impact translates to 1.3 additional months of learning, or 26 additional days, for students whose teachers participated in program. In the second year, AIR found a sustained impact amounting to 1.7 additional months of learning, or 34 additional days, even though not all students in the second year continued in classrooms with teachers participating in the program.
3. *Wolf Trap's Early STEM/Arts program demonstrates features of effective, high quality PD.* In measuring Wolf Trap's model against standards of effective PD, research confirms that Wolf Trap provides high quality PD by thoroughly integrating: form, duration, collective participation, content, active learning, and coherence.

Elements of Early STEM/Arts that may have contributed to positive results:

- **Reaching children early and improved classroom interaction.** For many students, this was their first introduction to school and the first opportunity to learn English. Teachers said the use of music, movement, and dramatizing concepts was beneficial for all students, but in particular students who were shy, who had never been to school, or who spoke another language. Additionally, an increased focus on student participation, ongoing teacher feedback, and improved classroom structure may have contributed to student learning.
- **Giving a boost to teachers' math instruction.** The use of performing arts strategies linked to mathematics concepts may have provided an instructional boost, making abstract math concepts seem more real and accessible through the new strategies applied by the teacher and the teaching artist.
- **Teacher enthusiasm for the arts in the classroom.** It may be that the teachers in the treatment schools were highly receptive to the PD and eager to implement new strategies that could result in improved math performance.