



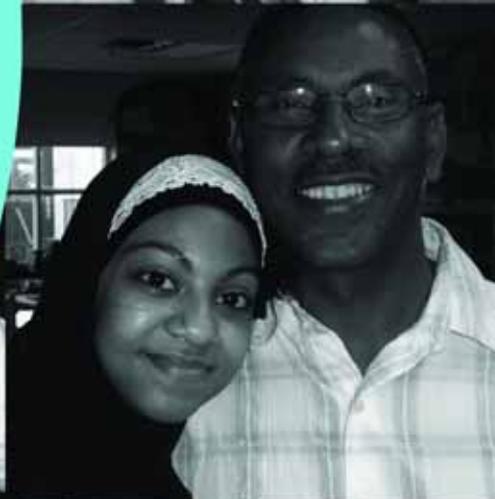
A Guide to Creating and Sustaining an
Art2STEM Club

Art2STEM is a collaborative initiative of Alignment Nashville

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ABOUT ALIGNMENT NASHVILLE

Alignment Nashville is a unique and scalable framework for developing community schools. The mission is to bring community organizations and resources into alignment so that their coordinated support of Nashville's youth has a positive impact on public school success, children's health, and the success of our community as a whole.

In the past, over 175 nonprofit organizations worked in the schools and community individually, without direction or coordination. While each organization provided much-needed services, the problems facing public education and our children are far too complex for any single organization to address in isolation.

Alignment Nashville has developed processes for collaboration that align the resources of these organizations to the Metro Nashville Public Schools strategic plan and to community strategic plans, aligning the city's resources toward common goals.

AN was developed to ensure all the services children need are provided to them in an effective and efficient way that complements their education, health and well-being, as well as the goals of the public schools. Through community-wide collaboration among schools, non-profits, businesses, and the public sector, AN creates the synergy

necessary for sustained improvement in public education and children's health. This collaboration provides the following advantages:

- **Greater returns on investment**—by working together toward common goals, resources are leveraged, duplication is avoided, and efficiency is greatly increased.
- **Higher-quality services**—utilizing expertise from multiple organizations guarantees a broader perspective and a wiser approach.
- **Enhanced capacity**—very few organizations have the capacity to have community-wide impact. A collective effort enhances the impact of each of organization, while generating a much greater overall impact.
- **Leverage of local funding**—AN programs have demonstrated they can attract large national funding, increasing the impact of the local funding that played a role in building the pilot programs.



www.alignmentnashville.org



Welcome to the Art2STEM Replication Guide. In our Art2STEM clubs, seventh- and eighth-grade girls are discovering that creativity is an important part of the world of Science, Technology, Engineering, and Mathematics (STEM). Through this discovery experience, the partners and leaders of Art2STEM hope the girls will develop a vision for their own future and careers.

This book is for teachers, school administrators, community organizations, business partners and anyone who is interested in learning about ways to help young girls discover a meaningful future. We hope you find the guide useful in creating your own Art2STEM club. Thank you for your interest in our work.

- Sydney Rogers, Principal Investigator

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[GET INVOLVED]

To become a partner business or organization, or to volunteer with Art2STEM, please contact Sandra Harris, Art2STEM Program Manager, at sandra@alignmentnashville.org.

The chronicle of Art2STEM is a narrative of innovation set in the rich fabric of the Nashville educational, business and nonprofit communities and their focus on student success. The leading characters come from all walks of life – inter-generational, multi-cultural, educationally and economically diverse – all united in their commitment to learning and improving the future.

Art2STEM was proposed at a time of renewed focus on Metro Nashville Public Schools (MNPS), a time of concerted effort to improve the graduation rate but more importantly, to prepare graduates for post-secondary study and careers through an increased emphasis on rigor, relevance, and relationships in the high school experience.

To achieve those goals, MNPS converted all 12 comprehensive high schools to include a wide variety of thematic or career-oriented academies reflecting student interest and workforce projections. Because many high-demand careers are in science, technology, engineering and mathematics (STEM), each school includes at least one STEM-related Academy as an option.

However, a recent survey of MNPS ninth-graders mirrored the national trend of very low student interest in STEM, particularly among girls. Because MNPS students self-select a Career Academy as they enter 10th grade, it was critically important to transform girls' perceptions and help them understand the opportunities and rewards offered by STEM-related occupations.

Art2STEM was designed to spark that transformation in Nashville. Beginning with girls in grades 7-8, the project builds on their interests in art and other, more traditional careers to guide them through carefully planned activities that create a new awareness of how those interests converge with STEM. The result: For the first time, girls can see themselves as valuable contributors to a better tomorrow through new, previously unimagined STEM careers.

While Art2STEM was a response to education innovation at a particular juncture for Nashville and MNPS, the practices can be adopted by other communities

and adapted to meet their unique situations. This guide will be invaluable to convey lessons learned, essential practices to adopt, pitfalls to avoid and successes to celebrate.

Art2STEM has flourished with the support of key organizations like Alignment Nashville, PENCIL Foundation and Adventure Science Center, along with significant contributions from businesses, colleges and dedicated teachers. Other communities can replicate this accomplishment by aligning their resources to improve student success and the economic well-being of their community.

Elements of Art2STEM

- Community agencies, colleges, and businesses supply day-to-day operational management, technical training, volunteers, and site visits.
- Middle school teachers are paired with a high school teacher for each club. The teams attend professional development sessions and plan club meetings, field trips, and special events, with each teacher receiving a modest stipend.
- Business professionals and other volunteers are selected as mentors to work with each club.
- Middle school girls are recruited for the clubs that meet twice a month.
- Every club takes two field trips in the fall and two field trips in the spring semester to participating businesses and colleges.
- Special events include an all-clubs Family Night in the fall semester, an all-clubs sleepover at the end of the school year, and individual Family Night celebrations for each club during the spring semester.
- Club members can attend a week-long summer camp, with their coaches, to explore new STEM activities while networking and making new friends.

[Elements of Success: Business Involvement]

“The women in our office have enjoyed getting to know the girls and really passing down the knowledge that they’ve gained over the years.”

– Tara Myers, Architect, Earl Swensson Associates

Art2STEM is a natural connection for local STEM-related businesses with a vested interest in ensuring they have access to a well-educated workforce for future employees. By establishing connections with students early in their academic journey, these businesses can help young people understand how their scholastic lives will fit into real-world STEM careers.

Several Art2STEM businesses allowed employees to serve as mentors on the club leadership teams, and many companies opened their doors to students by hosting business-site visits where students could actually see their mentors at work. Such opportunities allow students to make connections between their afterschool activities and the workforce that transcend any textbook example.

The generous Nashville companies that participate in Art2STEM have also found an extra benefit in the increased enthusiasm among their current employees who volunteer with Art2STEM clubs.

The opportunity to encourage students, especially girls, has been particularly important to Susan Lewis, an engineer from the Nashville branch of Deloitte, an international firm specializing in audit, financial advisory, tax and consulting services. Despite her passion for math and science – her favorite subjects in middle school – Lewis had never seen a female engineer and never dreamed a girl like her could become an engineer.

It was only through the encouragement and intervention of a perceptive algebra teacher that Lewis was able to envision a new future where she could use her academic prowess in a career she loves.

“I’ve often wondered,” Lewis said, “back in eighth grade, if my algebra teacher hadn’t said anything to me, would I have even thought about an engineering career? So, when the opportunity came for us to partner with Adventure Science Center and become involved in Art2STEM, it spoke to me personally.

“And I said, this is something Deloitte needs to do because we’re very dedicated to getting involved with women, young women, and broadening their minds to careers in today’s technology,” recalled Lewis, who became a mentor at Oliver Middle School in 2009. “It has been amazing to see the girls’ transformation over this last year-and-a-half about what they’ve learned, what they see, what they realize they can be – how it’s broadened their horizons and their perspectives.”



A2S campers creating their designs

[Elements of Success: Community Engagement]

“The contributions of community agencies, all aligned to support a single goal, are the bedrock of Art2STEM.”

– Sandra Harris, Art2STEM Program Manager

The innovative plans for Art2STEM that earned a \$1.3 million grant from the National Science Foundation were hammered out among a consortium of community agencies:

- Alignment Nashville convenes diverse organizations to align their resources in support of strategic initiatives carefully selected and vetted by 20 committees focused on education and youth health.
- Girl Scouts of Middle Tennessee is devoted to developing the character and skills of girls.
- Adventure Science Center ignites the scientific curiosity of 50,000 students per year.
- Tennessee Tech University supports the Middle Tennessee Region's P-16 STEM Education through its Oakley Millard STEM Center and three state-funded Centers of Excellence.
- PENCIL Foundation connects the community with schools through business-school partnerships and volunteers.

Each of the contributors considers Art2STEM as a

part of their mission to serve young people. “Coordinating business engagement for the clubs is a natural extension of our coordination role in the schools,” said Connie Williams, executive director of PENCIL. “A2S provides our network of business partners with high-value engagement opportunities with middle school and freshmen girls.”

During implementation, the community partners assume different roles: Adventure Science Center oversees the day-to-day operations; Tennessee Tech provides technical workshops for teachers and students; and PENCIL identifies field trips, guest speakers, and business professionals as coaches for club meetings.

“These activities and experiences bring the girls in contact with women architects, engineers, scientists, and project managers,” Williams said. “Through interactions with female STEM professionals, the girls broaden their visions of who they can become. They see STEM workplaces and learn first-hand about STEM careers. They gain a real-world context for what they are learning in school and in the clubs, and they build relationships with positive adult role models who can help shape their futures.”

Art2STEM coaches experience "Making Stuff" at Adventure Science Center



[Elements of Success: Transformed Teaching & Learning]

“You can give the kids the tools and just minimal instruction, and then step back and they will be curious and they will learn and they will explore.”

– John Marshall, Overton High, Academy of Environmental Engineering

The role of dedicated teachers cannot be underestimated in Art2STEM, both for their personal influence in recruiting students and for their careful guidance as they introduce STEM to their club members. Previous STEM skills are not necessary because Art2STEM teachers participate in extensive professional development, and through the informal learning environment, each club member – students, teachers, and volunteer mentors – becomes an active learner. For the adults, some of the best aspects of Art2STEM are the “ah-ha” moments they experience as they explore new horizons with their clubs.

“My favorite A2S club meeting was when we visited Street Dixon Rick Architecture because I saw the girls just light up,” said Lee Tydus, a sixth-grade language arts teacher at Apollo Middle. “The lady engineer was working with them on how to put together a gingerbread house. They had to do all the measurements and they were just into it. They were asking questions, they were answering, they were doing the math and they just blossomed.”

All of A2S business visits are carefully planned to create this kind of success. Before the field trip, employees from Street Dixon Rick came to a club meeting to give an interactive presentation and help the

girls practice software applications.

“After the girls finished a tour of the building, they got to work a little with SketchUp,” Tydus said. “They asked a lot of questions, and that

made me know that these girls liked what they were doing – and I can see them in the future definitely being scientists, engineers, mathematicians, and working with technology.”

The Tools of Art2STEM

Three software programs are the focus of a comprehensive set of professional development opportunities for the teachers and volunteers who serve as Art2STEM coaches:

- SPORE Creature Creator (www.spore.com) is the first design experience for A2S middle school clubs. Students quickly navigate the simple drag-and-drop interface of this powerful tool with laptops and three-button mice to design unique “creatures” that are emailed to A2S partner, Tennessee Tech, to confirm production viability. From there, the creatures are sent to ZCorp to be produced as three-dimensional figurines through the rapid-prototype process, and the items are then mailed to each A2S club. The tangible evidence of a successful design process is a powerful stage for subsequent club experiences.
- Alice (www.alice.org) is an introduction to computer programming that makes it easy to create short, animated “movies.” Girls begin by writing a short story about a topic of interest, and then draw their stories (storyboarding) on a series of panels much like a comic book. That storyboard is the reference for the Alice program, where girls manipulate their characters within a virtual world by “telling” (basic programming) each figure what to do and when to do it. The result is a one- to two-minute animation that students share with fellow club members.
- Google SketchUp (www.sketchup.google.com) is a free computer-aided design (CAD) program to create the conceptual phases of architectural and engineering design in 3D. Art2STEM students create models of such items as pencil holders, paper weights, and jewelry with the easy-to-learn tool that can be used to design anything from houses to spaceships. The girls begin their design with pencil and paper, “build” the item on the computer, and when designs are complete, they are prototyped in the same process as their SPORE creatures.

[Evidence of Success: New Skills, New Possibilities]

“When we get started, we get awesome.”
 – Eighth-grade club member at Croft Middle



A2S Team Joelton preparing for Family Night

Art2STEM is about engaging and empowering young people – girls in particular – by helping them understand that art and STEM skills in science, technology, engineering, and math are inextricably intertwined. In fact, a natural attraction to the creativity inherent in art makes these students ideal candidates for STEM careers, something they may not have considered before participating in Art2STEM.

One of the regular club activities is a timeline that girls create to show the events in their future. Designed as an evaluation tool, it’s also revelatory for the students.

“I’m glad I joined Art2STEM because it’s actually influenced what I want to be when I grow up,” said an

eighth-grade club member at DuPont-Tyler Middle. “I did a timeline for what I want to be,” she explained as she pointed to the classes she has planned for every grade and her freshman year in college. “Next year, I’ll take biology and geometry, English 1, world history, and fundamental foundation of technology, which is a seminar for my future career.”

That kind of positive impact is a hallmark of the A2S program. “We’ve built bridges and we designed creatures on the computer,” said a seventh-grade club member at Croft Middle. “It shows that girls can do engineering, and it shows you that you can learn. And, it shows that girls can do a lot more than what other girls think.”

[What Research and Experience Tell Us]

Art2STEM was originally funded by a grant from the National Science Foundation (NSF) through ITEST (Innovative Technological Experiences for Students and Teachers). ITEST responds to current concerns about the growing demand for STEM professionals in the U.S. and seeks solutions to ensure the breadth and depth of an emerging STEM workforce.

Under this program, a variety of possible approaches have been implemented and studied to support the future STEM workforce and to build students' capacity to participate. All of these are focused on engaging students in learning STEM content and 21st century skills.

Art2STEM was shaped by two fundamental questions addressed by ITEST: How do students acquire the knowledge, skills, and disposition to participate productively in the changing STEM workforce? How can we assess and predict students' inclination to participate in the STEM fields?

Art2STEM addresses these fundamental issues by incorporating insights and successful practices from the study of *How People Learn* (Bransford, et al., National Academy Press, 2000) and specific experiences and expertise of the Nashville educational community. As a result, Art2STEM:

- Provides meaningful student experiences that are rigorous, explore the relationship between art and STEM, and are relevant to the skills of successful STEM professionals.
- Connects girls' creative interest to STEM-related activities and projects, and subsequently to opportunities in the STEM workforce where they can make a difference.
- Integrates multiple approaches rather than relying on a single event or strategy to impact the girls' perception of STEM and STEM-related careers and professionals.
- Allows girls to observe, develop, and practice 21st century skills.

- Creates awareness of pathways leading to STEM-related careers and a vision of achieving that goal.



A2S camper displays strawberry DNA evidence

[Values and Perspectives of Middle School Girls]

"Art2STEM carefully builds experiences for girls that take them from their personal knowledge and interests to an exploration of how that relates to science, technology, engineering, and math."

- Sydney Rogers, PI for Art2STEM

Given the traditional stereotype of male STEM professionals, there is little wonder that girls generally do not perceive themselves as potentially successful in STEM education nor see themselves in STEM careers.

The underlying factors discouraging female participation in STEM, particularly in engineering and technology classes, are well-known.

- For most girls, there is little encouragement to pursue STEM disciplines. Sometimes this is based on cultural norms, popular media images, or perceptions of what are "achievable" or "acceptable" careers for girls. Such misperceptions are reinforced when there is a lack of visible role models.
- The resulting lack of critical mass of girls in STEM-related courses can result in a feeling of isolation or being "different," with a limited number of friends in the same or similar academic disciplines.
- There are often misperceptions about STEM-related careers because girls don't have enough information about these careers. For example, many don't know what engineers really do, and how STEM-related careers might actually be consistent with their strengths and values.

Art2STEM addresses all three issues by offering a supportive club environment for girls and by involving female mentors and role models at club meetings, business trips and college visits. Evaluation instruments such as "Draw an Engineer" and "My Life Timeline" are used to document the girls' perceptions of STEM professionals and to assess their career awareness and personal plans for the future.

Beyond creating a girl-friendly environment for Art2STEM participants, the program seeks to apply what

is known about girls and how they learn:

- Context tends to be more important for girls than for boys.
- Girls' language skills are often more developed at this stage, so they are better engaged by narrative and storytelling to provide context for their work.
- Girls tend to be more excited by how a technology will be used versus interest in the technology itself.
- In general, girls value making a positive contribution to society, and they prefer collaboration to competition.

Art2STEM activities are designed to be contextualized and project-based, and their focus is on the use of technology instead of learning technology skills. Much of the work is team-based and focused on collaboration and consensus-building, and Art2STEM business visits help girls understand how STEM-related careers can make a difference for the world.



"The engineer is looking at the machine and trying to figure out what it does. She will take it apart and put it back together to find out."

- Seventh-grade club member, Croft Middle School

[Multiple, Evidence-Based Approaches]

Art2STEM uses a comprehensive set of evidence-based approaches to influence girls' perceptions of STEM and STEM-related careers and professionals.

Meaningful Experiences - Art2STEM activities and projects develop a deeper understanding of the connections among creativity, design, inventiveness and innovation, and how those factors relate to STEM disciplines and STEM-related careers.

Informal Learning - Beyond formal learning in a classroom, girls can also learn in informal settings through hands-on activities, problem-based projects and social interaction. For example, informal STEM learning can take place in science centers, zoos, and planetariums; educational programs such as summer camps and after-school programs; or workplace environments through visits to business and industry. Art2STEM offers a variety of informal learning environments, which also provide a different way for the girls to relate to their teachers outside of the day-to-day classroom.

Capstone Experiences and Projects - Art2STEM summer camps and capstone projects allow girls who participated during the school year to "put it all together" during a week-long experience. This week of camp deepens and builds on the technical learning they have shared over the past year, and it also develops relationships and relevance that should help them make decisions on their classes and career in the years to come.

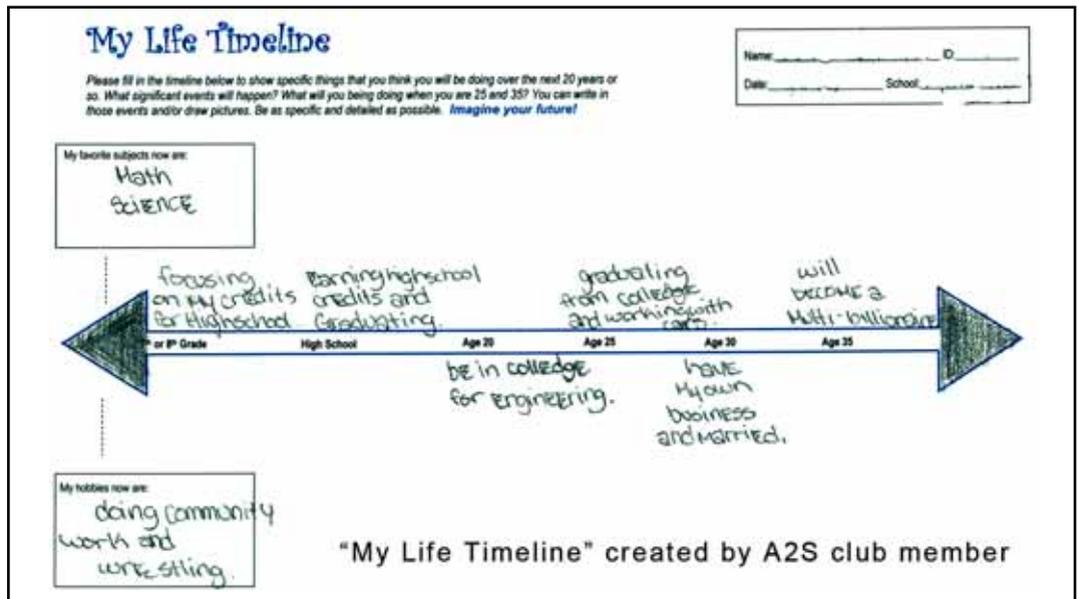
Professional Development for Coaches and Mentors -

A team of dedicated coaches and mentors is at the heart of any successful Art2STEM Club. These teachers and STEM professionals effectively engage the girls in informal learning environments and are genuinely interested in

the girls' future success. A comprehensive professional development program is required to prepare the coaches and mentors for their important roles, including:

- Training in project-based and other forms of experiential learning.
- Learning technical skills, such as STEM-related software applications.
- Developing broad awareness of STEM-related programs of study, postsecondary opportunities leading to STEM careers, and the nature of STEM-related businesses and careers.
- Working together to implement the Art2STEM program, effectively modeling the teamwork and collaboration expected among the girls.

Parent Awareness and Education - Many Art2STEM girls have no tradition of postsecondary education in their families. Parents can exert a significant influence on their daughter's career choices, so it's important for Art2STEM to offer opportunities for the girls, their parents and extended family members to learn more about STEM possibilities and postsecondary options that are both available and achievable. Parents get valuable insight during the Parent Night events held at each middle school club and at program-wide events hosted by community partners such as Adventure Science Center.



My Life Timeline

Please fill in the timeline below to show specific things that you think you will be doing over the next 20 years or so. What significant events will happen? What will you be doing when you are 25 and 35? You can write in those events and/or draw pictures. Be as specific and detailed as possible. *Imagine your future!*

Name: _____ ID: _____
Date: _____ School: _____

My favorite subjects now are:
Math
Science

My hobbies now are:
doing community work and writing.

Timeline markers: 8th Grade, High School, Age 20, Age 25, Age 30, Age 35

Timeline events:
- focusing on my credits and for Highschool Graduating (between 8th and High School)
- Earning highschool credits and Graduating (between High School and Age 20)
- graduating from college and working with cars (between Age 20 and Age 25)
- be in college for engineering (between Age 25 and Age 30)
- will become a Multi-billionaire (between Age 30 and Age 35)

"My Life Timeline" created by A2S club member



[21st Century Skills and Art2STEM]

The knowledge and skills necessary for today's students to succeed in college and their chosen occupations define a powerful vision for education in the 21st century. Art2STEM is designed to help students acquire these skills, preparing them to be lifelong learners in a rapidly changing, diverse, information-rich, and technology-driven world, especially the world of STEM-related careers.

Critical Thinking and Problem-Solving: Students work with open-ended problems and projects that require them to analyze information and situations, explore solutions, make reasoned judgments, and evaluate results.

Teamwork and Collaboration: Students work in teams to negotiate agreements, conduct projects and communicate results, taking on a variety of roles as they work together within their teams.

Communication: Students communicate effectively by using verbal, written, and multimedia materials for a variety of purposes and audiences.

Creativity and Innovation: Students think creatively in response to a wide variety of challenges by developing, trying out, and revising designs and solutions.

[Lessons Learned and Successful Practices]

"Take time to learn how to make the concepts and tools useful for the clubs. A retreat for all coaches helps ensure everyone is on the same page from the beginning."

- Tocarra Cecil, Art2STEM Coach, Overton High School

The first-year focus of Art2STEM evaluation included collection of efficacy and impact data in the following areas:

- Recruitment, retention and role of coaches
- Program professional development and orientation
- Programmatic offerings
- Student attendance, engagement and retention
- Parent engagement

Findings from the first three topics were especially valuable in crafting real-time modifications to the professional learning community created by teacher-coaches and volunteer-mentors, who blended their varied experiences and expertise from the worlds of education and business. These adjustments became obviously necessary after high attrition of coaches during the first year. Based on the evaluation data, Year 2 modifications included:

- Additional attention was paid to orientation and explicit expectations for coaches and other adult staff.
- First-year professional development sessions focused on project orientation, pedagogical frameworks and software tools. The sessions were enhanced and more consistently attended after an improved focus on and alignment with the needs of the individual school programs and the support and encouragement of returning coaches.
- Professional development, practice, and coaching in

software tools became more ongoing (rather than free-standing, isolated events), diminishing the reservations of some coaches about under-preparation to guide students' computer-based activities. These changes were based on evaluator observations showing most coaches did not interact with the girls during Alice and SolidWorks activities, and students also stated they experienced frustration and were under-supported by coaches during these activities.

- Whenever possible, more opportunities were available for the teacher-coaches and volunteer-mentors to train together, as well as to work together in the afterschool sessions. Evaluation showed the A2S clubs benefited from the ongoing collaboration in curricular resources, technology tools, consensus building, peer advising and technical expertise - with the combined perspective enriching both the students' and adults' experience. These shared experiences also developed the community sense of project ownership that is vital for the long-term growth and sustainability of the program.
- New opportunities were developed to leverage the tie between middle schools and high schools. The concept of Career Academies and career pathways has become an integral part of the MNPS high school

culture, so including a high school representative on the A2S team became increasingly imperative. Evaluation showed this is an important strategy in influencing A2S participants' selection of a STEM-related Academy in high school.

Ongoing evaluation continues to influence the creation of successful Art2STEM practices. After the end of the most recent school year, A2S coaches offered these suggestions:

- Professional development needs to include "basic training" for new coaches - everything from recruiting tips to modeling how to run a club meeting.
- Review basic policies so the clubs are consistent in student-related procedures. For example, what happens if a girl misses club meetings because she's suspended, and then asks to continue in A2S upon returning to school?
- Coaches should post details of their lesson plans on their Google calendar entries so that all teams can view, collaborate, and exchange ideas on successful practices.
- End-of-year evaluation needs to happen slightly sooner in the school year because the end-of-school at the middle school level is an unbelievable flurry of activity. In addition, standardized testing occurs at this time. It is hard to arrange meetings with the girls because they have so many extra things to do.

- Host an end-of-year celebratory luncheon recognizing the hard work and accomplishments of the A2S coaches. This gesture, along with a certificate of appreciation, fosters communication and collaboration with fellow teacher-coaches and goes a long way toward sustaining morale and encouraging continued engagement in A2S.

Art2STEM Statement of Expectations for Coaches

The guidelines below will provide you with a better understanding of what is expected of Art2STEM Coaches. Based on the Middle School model, these guidelines also apply to high school clubs meeting once monthly.

For Art2STEM to be successful, Coaches need to: *

- 1. Conduct after school meetings, twice per month throughout the MNPS calendar year:** This means roughly 14 club meetings per school year. A minimum of 10 of these sessions will meet the after school guidelines of Art2STEM. This allows you the flexibility of making up to 4 exceptions in your sessions - i.e., school functions such as science fairs or art fairs that can double as an Art2STEM session. Club meetings and Art2STEM events should be added to your school's calendar - in addition to the Google master calendar - to help prevent conflicts. Additionally, we understand that all Coaches may not be able to participate in all club meetings. In these cases, when at least 2 members of the Coaching team can be present, club meetings should proceed as scheduled. We ask that at least 1 MNPS teacher accompanies your club on any field trip. And we do hope each of you will join the girls on field trips when possible.
- 2. Have approval for supplemental expenditures:** Should you need supplemental resources (i.e., photo paper, plates, food, napkins) for a special Art2STEM event, please get authorization from your Community Agency for any extra costs.
- 3. Hold planning meetings:** In order for club sessions to run efficiently, there will be a minimum of two face-to-face planning meetings per semester (one, for high school clubs) - in addition to regular club meetings. Your Community Agency and Implementation Team are available to help with planning, if needed. Please let us know when you hold your planning meetings and post these meetings on the Google master calendar. We would like to join you occasionally.
- 4. Make sure data collection information is complete:** To be compliant with evaluation guidelines, girls wishing to participate in Art2STEM will complete and submit the necessary consent forms (i.e., Enrollment, Parent Consent, Parent Commitment, Photo/Video Permission) before the first club meeting. Those who do not complete and submit their forms by the first club meeting will not be able to participate in Art2STEM. Clubs need to allow time to complete evaluation within two weeks of the first club meeting, and again at the end of the school year. The evaluation team will collaborate with Program Manager and each club to complete the necessary evaluations.
- 5. Inform Community Agency, as well as members of your Coaching team - in a timely manner - when there is a change in schedule:** We ask that a one-week notice be given to the girls and their families, as well as all members of a given Coaching Team so that alternate plans can be made for transportation and schedules can be adjusted. Please post any changes to the Google master calendar. The only exceptions are inclement weather (MNPS snow days) or security concerns.
- 6. Select a makeup date for cancelled sessions:** There are a lot of experiences we wish to expose the girls to in Art2STEM. With such limited time to spend with the girls, we will commit to meeting for 14 sessions (per item 1). This means setting makeup dates for missed sessions and letting the girls and their families - as well as your Community Agency - know your new session dates. Please post any changes to the Google master calendar.
- 7. Participate in all relevant professional development training:** Professional development opportunities are required unless otherwise noted. These training sessions will be posted on the Google master calendar. To be respectful of your time, we will give you at least two weeks notice for professional development training.
- 8. Manage and maintain project resources:** We ask that Coaches exercise proper care and maintenance of resources (i.e., Flip cameras, flash drives, laptops, etc.). Should there be any issues with resources - i.e., an item is lost, stolen, or damaged - we ask that you immediately notify your Community Agency, and fill out and submit (via fax) an incident report to Alignment Nashville (attn: Sandra Harris, fax: 615.254.6748).
- 9. Feel encouraged to take part in additional Art2STEM Events:** We thank you for your commitment to Art2STEM and we want to show our appreciation from time to time. We are fortunate to have an incredible community agency in Adventure Science Center. Through their hard work, last semester's "Dell Family Science Night," was a big success. We hope you will attend the family-focused Art2STEM events we are planning this year.

**Should expectations consistently go unmet, Coaching Teams will be restructured to provide the greatest benefit to the girls and to achieve the desired outcomes set by Art2STEM.*

Signature: _____ Date: _____

Your signature means you understand and commit to the Art2STEM expectations above. Please fax the completed form to Sandra Harris, at: 615.254.6748

All forms available at www.alignmentnashville.org. Click the "Resources" tab, and then click "Art2STEM."

[So You Want to Host an Art2STEM Club]

"Art2STEM is really fun, even if you're not a math and science person, and especially if you get your other friends involved. It's really the time of your life!"

- Eighth-grade club member, Oliver Middle School

Like any new endeavor, a new Art2STEM Club requires a bit of juggling to manage the interconnecting puzzle pieces in a timely manner. But with good communication and teamwork, a new club can begin with a minimum of glitches. Note: Everything listed below assumes that the administration of the local school system has agreed to partner with the Art2STEM initiative and that one or more prospective schools have been jointly identified.

Implementation Team

A strong Implementation Team is essential to assess progress, address issues and update plans for the program. The Art2STEM Implementation Team includes representatives from each partner organization and meets on a weekly basis to ensure the program remains goal-focused and that successful practices and lessons learned are incorporated into future plans and activities. The current team includes:

- Principal Investigator for the NSF Art2STEM grant (Sydney Rogers) who serves as Chair and adviser on community engagement and leveraging the resources of Alignment Nashville.
- Adviser on business engagement (Connie Williams) who leverages the resources of PENCIL Foundation.
- Principal community agency (Jeri Hasselbring, Adventure Science Center) for Art2STEM support.
- Program Manager (Sandra Harris) who oversees administrative, financial and staffing functions.
- Operations Coordinator (John Hawkins, Adventure Science Center) who supports participants in the day-to-day operations of clubs and events.
- Technology adviser (Ismail Fidan, Tennessee Tech University) who coordinates technologies employed in the program.

- Liaison with Metro Nashville Public Schools (David McNeel) who also consults on curriculum and professional development.
- Evaluation (Carol Nixon) who serves as principal contact for services through Edvantia.

Promotional Materials

These are indispensable but not high-tech or expensive. Develop an attractive one-page flier in adult-friendly language that clearly explains the purpose of your club, the participating schools, the general structure of the club sessions, and the business partners already recruited as partners.

The second flier is written less formally to reflect the excitement of Art2STEM and spark the imagination of girls and their families. Be sure to include an interest section where families can list their contact information. All forms are available at www.alignmentnashville.org. Click the "Resources" tab, and then click "Art2STEM."

Create an eye-catching poster to be displayed on an easel at informational meetings; an inexpensive retractable pop-up banner is even more convenient and can be used on multiple occasions. Finally, a distinctive logo is useful to build brand-identity and program awareness.

Recruitment

Teacher recruitment begins by speaking with the principals at each targeted school to introduce the A2S concept, answer principals' questions (e.g. "Why would our school want to participate?"), and confirm the school's capacity to host an afterschool club. As administrators, principals will recommend teachers who are best suited for leading an A2S club. After individual or group meetings to

learn about the program, teachers apply to volunteer as an A2S club leader; applicants are reviewed and selected by the A2S Leadership Team. In the Art2STEM world, teachers are referred to as Coaches to reflect their roles as co-learners in the process.

Business and community recruitment is a key component for networking and sustainability. Art2STEM partners with PENCIL Foundation to recruit businesses interested in connecting with and nurturing the future workforce by providing volunteer mentors, hosting a business site visit, or providing guest speakers. Adventure Science Center serves as the A2S community agency to further leverage professional connections to such organizations as WiTT (Women in Technology of Tennessee), and TWISTER (Tennessee Women In Science, Technology, Engineering, and Research).

Mentors are recruited from local businesses, colleges

and organizations to volunteer with the A2S club of their choice. Because A2S clubs are hosted in Nashville public schools, all volunteer mentors must complete an application and pass a background check. Note: While university students are tremendous assets, experience shows that they are often unable to make the commitment required to support an A2S club for the entire year.

"I was very happy when I went to the Open House Night for the parents and heard about Art2STEM. And I was very, very happy when my daughter walked up to that table and decided to sign up. Art2STEM has really gotten her involved in her career; in science, technology, engineering, and math. It's just been the best thing that could ever happen for my daughter. Thank you so much."

- Deborah S., parent of club member,
DuPont-Tyler Middle



A2S launches Year 2 at Adventure Science Center

Student recruitment begins with A2S coaches who can make school announcements, distribute the student-interest fliers and extend personal invitations to students they feel would thrive by participating in A2S. The first school-wide recruitment opportunity usually occurs at each school's open-house event. Successful recruitment strategies include setting up an eye-catching A2S table/booth and encouraging students and their families to learn about A2S.

Common questions from parents and caregivers include the expectations of families, the club meeting schedule, attendance and behavioral expectations of participants, the types of activities during club meetings, field trip procedures, and special events. Parents can fill out the registration forms before leaving, or the forms can be taken home, completed and returned to school by the student.

Finally, don't overlook the power of word-of-mouth as girls invite their friends to participate in A2S.

Family Involvement

Successful A2S clubs need strong support from parents and caregivers. Before the first club meeting, an informational session helps parents and families feel they are a part of the process, which encourages sustained engagement. Held at each school site, the session allows parents to get more in-depth answers to their questions and understand the commitments they must make, such as picking up their child after each club meeting.

Families are encouraged to learn A2S concepts during the year by asking about club meetings and reviewing the materials brought home by their daughters. The end-of-semester or end-of-year Family Nights provide an ideal setting for families to celebrate the achievements of the club members. And, parents or caregivers who work in STEM professions are welcome to volunteer their time as guest speakers for A2S clubs.



A2S dad and daughter

Themes, Modules, Projects and Activities

The teams of Art2STEM coaches and mentors usually want the creativity and flexibility to design their individual clubs' session plans within the parameters of A2S guidelines. During summer professional development, coaches collaborate to create an outline for the school year - while the complementary creative activities can vary at each school, all the girls experience the essential elements of art, animation software, computer-aided design, and the manufacturing process. Typical modules are listed below:

Design & Manufacturing

- Symmetry/ Golden Triangle
- Science of Sculpture (playdough models)
- SPORE Creature Creator

Trip: Tennessee Technological University

Architecture

- Hand-sketch designs/Engineering Cycle
- Intro to Google SketchUp
- Translate hand-drawn designs to SketchUp

Trip: Architecture firm

Materials Science

- Interior Design
- "Making Stuff"

Trip: Interior design firm; Nashville Police; Architecture firm

Animation

- Storyboard
- Stop-motion

Trip: College/university editing/production dept.; Video production company

Invention

- Introduction and Inspiration: "Wallace & Gromit - The Wrong Trousers"
- After video, create invention ideas to improve life
- Ford PAS Module 1: From Concept to Consumer

Trip: Manufacturing company using computer-aided design (CAD)



Robotics experience at Tennessee State University

Sample Timeline for A2S Clubs

Fall Semester

- Open House at the school: Staff an Art2STEM booth or table for promotion and questions.
- Information Night for parents/caregivers: Held two-three weeks prior to first official club meeting.
- Planning: Coach-Mentor Teams need a minimum of two face-to-face meetings per semester.
- First club meeting: Held after Labor Day with snacks and icebreakers. Collect enrollment/registration documents, review the schedule and rules, and begin the baseline evaluation.
- Business/university visit: Collaborate with community agency to schedule your field trip; prepare and debrief club members.
- Guest speaker(s): Tie-in with business visit or session plan.

- A2S Family Night: All clubs celebrate together at one location; the community agency coordinates and schedules this event based on the schools' calendars.

Milestones

- Girls can describe the concept and process of design, identify aspects of design in creating art, and relate the creation of art to its technological analog.
- Girls begin to understand real-world connections from guest speakers and business/college visits.
- Girls practice regular reflection on each new experience.
- Ongoing evaluation consistently occurs.
- Family Night is celebratory event.



Field trip to College of Engineering at Tennessee Tech University

Successful Field Trips

Field trips complement the A2S club meetings by helping students understand the connection between their afterschool sessions and real-world STEM-focused professional experiences. Coaches and mentors review their club schedules and collaborate with their community agency to select a business or college site based on relevance to a specific theme. For example, A2S clubs working on SPORE Creature Creator might take a field trip to Tennessee Tech University where they experience a rapid prototyping (RP) lab. The RP lab uses the same process that will create the 3D SPORE creatures, so students connect their club experience to a real-world manufacturing process.

Scheduling an A2S field trip

- Coaches and mentors work with A2S manager to determine host.
- Collaborate with community agency and site to select time and date. Most A2S trips are held on weekdays when school is not in session (e.g. faculty in-service day) or on Saturday if that's possible for the business or college. If the trip is during a regular school day, be sure to follow the school's travel protocol.
- Collaborate with business/college (using checklist - see "Forms") and set agenda.
- Notify club members and distribute permission slips.
- Collect signed permission slips from parents/caregivers.
- Submit headcount to community agency.
- Community agency arranges transportation and meal.
- Travel, return and reflect.
- Leaders complete visit checklist and submit to program manager.

Reflection and Assessment

It's important to help the girls connect the dots by reflecting on club experiences as a part of the learning process. At the end of each A2S session, students and coaches reflect on the day's experience to build 21st century skills and assist in evaluation and impact-assessment. Club leaders also allow time for evaluation and assessments during the first two (baseline) sessions and the final two (impact) club meetings of the year.

Coach/Mentor Professional Development

Coaches are supported through professional development opportunities in the summer as well as during the school year. The most successful PD involves hands-on, practical applications of the inquiry model of teaching and learning as the coaches share successful practices. These sessions are also helpful for mentors because they are eager for success in a "teaching" role with students. In addition, mentors are a tremendous PD asset because they can share their professional expertise. Well-designed professional development offers a rich exchange of ideas between coaches and business professionals while they explore the necessary tools for an A2S club.

Art2STEM Events

Remember to celebrate students' hard work and accomplishments. Special events can include:

- A2S Family Night: A program-wide annual event held near the end of the first semester at a community venue. Clubs send invitations to their principals, businesses/colleges visited during field trips, and students' immediate families. Each club displays and shares their individual and group achievements.
- Year-End Celebration: Each club hosts a Family Night at their school.
- A2S Camp-In & Focus Group: A program-wide annual event with a twist - it's a slumber party for students! Held at a community venue, all A2S club members gather to celebrate the success of the A2S year. Time is set aside for small teams of students to participate in evaluation focus groups to provide feedback on their A2S experiences.



Dr. Ismail Fidan assists A2S Coach Michelle Little with Google SketchUp

Logistics, Nuts and Bolts

It is the responsibility of the coaches to manage their club's meeting schedule, anticipate the need for materials and supplies, and submit requests to the community agency, which handles materials, supplies, snacks, and transportation. Requests for support must be made in writing via email, and in a timely manner (we suggest one-week minimum).

- Coaches need both electronic and hard-copy files of important contact information, including phone numbers (work and cell) and email addresses of each coach, the A2S program manager and coordinator, and the parents/caregivers of A2S students.
- Program-wide information (e.g. the date for A2S Family Night) is best disseminated via e-newsletter or email blast list.
- Club-specific information is best disseminated via personalized emails tailored to each group.
- Coaches need to have electronic files of the important A2S forms for students, including Enrollment and Registration, Parent Commitment, Parent Consent,

Photo/Video Release, and Field Trip Permission.

- Coaches need to have electronic files of the important A2S forms for leaders, including Statement of Expectations for A2S Coaches, and A2S Informational Flier.
- Coaches are responsible for taking attendance at the beginning of each club meeting. Attendance data is recorded in a shared spreadsheet accessible by club coaches, A2S manager, coordinator and evaluator.
- Coaches are responsible for setting aside 10 minutes at the end of each club meeting for students to complete an activity rating card related to the day's session. Coaches collect the cards as students leave and submit the cards to A2S manager or coordinator.
- A2S uses a central calendar (e.g. Google) that is shared and maintained by all clubs (you may need a training session to ensure all coaches are familiar with the process). Coaches are responsible for accurately posting club meeting schedules. The A2S manager or coordinator administers the calendar and relies on its accuracy to support each club.

"It's particularly rewarding to work with girls and to help them feel confident and empowered."

- Carol Mosow, math teacher, Hillsboro High School

A successful Art2STEM club leverages 21st century skills in the informal learning environment of afterschool club meetings and creates engaging, real-world experiences for

the participants. To demonstrate the tremendous impact of A2S, our coaches and participants collaborated to tell the personal stories of their clubs.

[A2S Team Apollo]

"The A2S club at Apollo Middle School is a great example of what A2S hopes to achieve. The girls celebrate each others' accomplishments and tell about what they're doing with many of the terms you'd want to hear: rapid prototyping, reverse engineering, programming, etc. Thank you for allowing me to participate.

It was moving, inspirational, and fun."

- Sue Perkins, MEG Lab Program Manager, Girl Scouts of Middle Tennessee

What makes our Art2STEM club awesome? Mainly, it's the girls; we are surprised each year by their dedication and excitement.

So many students who claim to not like math or science classes are in this program and they love it. Some may not be the highest-achieving students, and they get a chance to really begin to think critically and make a connection between what they enjoy doing and a more scientific/technical world. The real-world connections are what make them interested and they realize that these subjects don't just come from textbooks.

We've seen so many girls mature and change. One girl in particular was a "troublemaker," but everyone saw a different side of her during our meetings and trips. She became a "go-to" person for a lot of the girls because she was a natural leader - and was leading others in the right direction. She truly loved the program and admitted that it made her a better student and person. Last year, another girl confided in us that no one in her family had ever gone to college and she never really thought she would go either. However, after being in the program for a year, she really wanted to be the first in her family to attend college and attributed that attitude to Art2STEM.

The SPORE creatures seem to be the biggest hit every year. The girls love using their artistic and creative sides while getting to use new technology and software to implement their creativity beyond a paper/pencil activity. The trip to Tennessee Tech University each year really solidifies the experience for the girls. Just seeing the rapid prototyping machine that will make their creatures, and learning how it works, makes the whole design and prototyping concept come to life. Most of the girls still rave about this experience at the end of the year.

The biggest challenge is a typical "after-school activity" problem. The girls who are involved in the club are the same girls who are involved in other activities.





While participation teaches them to balance their time, it's sometimes difficult to get activities completed and everyone on the same page. The other challenge is the time commitment for the adults involved. They truly must care about the program and the students to make it the best it can be.

But it's worth it. Not only do the girls love to participate, it becomes a little family each year. The girls become very close and begin to trust each other, and they take more risks when being creative and learning new

things. That feeling of security is something every teacher strives for in his/her classroom, because the best learning occurs when students feel safe to take risks in their learning.

Also, we don't have many afterschool clubs that have an educational focus. Although the students would never admit it, they yearn for that. It offers an outlet for our girls to be "smart" without any ridicule, and gives them an opportunity to get to know other people who share their interests. Art2STEM allows them to grow as students and people like no other program.

[A2S Team Bailey]

"The girls don't have many doors opened for them. They see that there are a lot of things they can pursue, and they might not have considered them without Art2STEM."

- Melynda Sutton, eighth-grade teacher, Bailey Middle

Art2STEM opened our eyes to the lack of women in STEM careers. The girls didn't know what career paths were available, and in the first activity, they were basically clueless about what an engineer is. Throughout the year, the Art2STEM activities made them more aware of what's out there for them. It shows them that they can be more than what they thought they could be.

Art2STEM gives them so many opportunities with experiences like visiting Triumph Aerostructures, Nissan, and Tennessee Tech. At Tech, they were really excited walking past the dorms and making the connection with the SPORE program. They could see how the figures were prototyped, how to work with the computers and how their creatures were going to be made. That got them excited about the thought of going to college and staying on a college campus.

We appreciated our mentors from Deloitte, and we're thankful that the business allowed its employees to come work with our young ladies. Our mentors showed the girls what they do every day, and they learned if you keep your eyes on the prize, then you can actually accomplish it yourself. The opportunity to see women in action saying "I did it; you can do it, too," was really empowering. We would love to see our girls work alongside women of that caliber.

Next year, we're going to have a stronger club because we have a lot of returning seventh-graders, and we're going to have these rising eighth-graders do some recruitment. We're looking for eager girls who want to learn more or who would like to be an artist, and give them the opportunity to see what it's like to be an engineer, what they could be, and what it takes to get there.



[A2S Team Croft]

"Art2STEM has allowed the girls to explore career paths and stay more focused on the academic track rather than trying to be popular. They are continuing to strive academically and to achieve."

- John Marshall, teacher, Overton High Academy of Environmental Engineering



Art2STEM builds a conduit for girls who are excited to participate in an engineering program when they get to high school. Traditionally, it has been very difficult to get girls to enter into any engineering or drafting programs, although they are much needed.

In A2S, we allow the girls to work with equipment, resources and other things outside the normal school day. We allow them to explore, to fashion, to shape, to design things that spring from their curiosity - and turn those things loose on the computer. It's just that imagination, that curiosity we all had when we were little kids.

We had a young lady last year working on Alice, which is a 3D environment where you actually learn to write computer code. You can make figure skaters spin or the lunch lady push the tray across the table. So this one girl was doing a wonderful job, and the girls came from all around the room and looked and patted her on the back. She was encouraged, and she taught some of the other girls things she had learned. So that girl became an expert,

and she helped other girls gain a bit of confidence and develop little cartoons and things like that on their own.

These young ladies are incredible learners. One girl does lovely artwork and she is very confident about that, but she was able to understand that you can build a bridge and the bridge can be artwork, or that you can build a building and the building can be artwork. She understands art doesn't have to be just a paintbrush in an art classroom; it can be something a whole lot bigger than that.

One of the challenges is getting the girls to come out of their shell, to answer questions and build rapport. Once they feel safe and comfortable, they're excited to share concepts and ideas. Another challenge is finding adults who have time to make the commitment. We have to understand how Google SketchUp and other software works, and we've spent a lot of time and effort in preparing different lessons. There's a lot of flexibility, which is wonderful, but A2S is a big commitment.

[A2S Team DuPont - Tyler]

"We went to LP [Building Products] and they recycle everything they can. We learned that their floors are wood chippings from when construction was done on their building. It was so much fun!"

Seventh-grade club member, DuPont-Tyler Middle

The Art2STEM curriculum has really opened the minds of our young ladies to a whole new world of science and engineering they knew very little about. From the Ford PAS modules to the computer software we explored, the girls really became aware of the science,



math, and engineering involved in just about everything.

Our club combined art with science, technology, engineering, and math in an engaging module called "stained glass." The girls created a work of art using poster board and tissue paper, and they had to draw, accurately measure, cut, and assemble materials into "stained glass windows" that represented their desired career path.

Field trips were very popular with the girls. The impact of business engagement is evident before, during, and after each trip, and it's rewarding to hear what the girls take away from their visits. A trip to LP Building Products introduced our girls to the concept of repurposing materials that may have been discarded in the past.

Another successful activity was Google SketchUp. It's user-friendly and really gives the girls lots of room for creativity and problem-solving. They really have to think through their designs and figure out a way to make them work within the program.

Art2STEM is the curriculum of the future - a student-centered, project-based approach that develops students' skills to think critically and problem-solve. They experience STEM hands-on and can visualize themselves working in STEM fields and making a difference.

[A2S Team Joelton]

"STEM is important, and we are proud to have Art2STEM at Joelton Middle School."

- Patti Spann, Joelton principal

Joelton is extremely excited to be a part of this dynamic program, and we have active seventh- and eighth-grade young ladies who are eager to become more knowledgeable about science, technology, engineering,

and math.

As educators, we are very happy to see young ladies strengthen their skills and expand their horizons with critical thinking and problem-solving. A2S gives girls the

opportunity to do things they normally associate as "guy things" and opens their minds to possible career choices. Each JMS student said they had a lot of fun - as shown in this group photo at Nashville Electric Service - and would encourage other girls to participate in A2S.

Art2STEM is definitely an invaluable program.



[A2S Team Oliver]

"Art2STEM allows girls to explore STEM activities and careers before they are in high school and shows them that STEM careers can be creative, engaging, and FUN!"

- Emily Medlock, eighth-grade teacher, Oliver Middle

Art2STEM opens an opportunity for girls to use their creativity and communication skills to connect with other young women in a non-threatening learning environment that is interactive, cooperative and collaborative - a real-life preparation for the global society of the 21st century.

Our core group of about 30 girls is very engaged.

They realized how art is used in STEM fields and they learned to relate A2S to other areas, so they've really applied themselves more in math and science. Two of them were even accepted into a prestigious program where they study college-level math and science one day per week at Vanderbilt University.

A2S also gives ideas that can be used in the classroom as well. Art2STEM uses research-based strategies and project-based learning, and teachers can be innovative and creative. One of the fundamental elements is that the teachers are not answering questions: They're posing questions, and that's very valuable. We would love to implement some of the A2S ideas in the classroom with our students.

The field trip to the Deloitte facility was a huge hit, and the volunteers got to show them what they could work on if they stick in the math and science arena. It was amazing to see their eyes pop when they found out that when you delete something from your laptop, it's really not gone. It's still there. That was one of the most beneficial parts this year.



[A2S Team Thurgood Marshall]

*"Art2STEM is a program where you can feel safe asking questions and learning at your own pace.
It's not like school."*

-Eighth-grade club member, Thurgood Marshall Middle



Art2STEM is about empowering girls to go into fields that they never imagined. That's the whole point. It has exposed them to what college is like, and how art is used in science, math, technology, and engineering. It has changed what the girls think about engineers. Field trips to different businesses, being exposed to campus life, and meeting women who work in different STEM fields - all of that is of great value.

Our girls were so enthusiastic that we decided to let some of them tell the story of our club:

- "Art2STEM has made me more confident and it's made me see lots of different career options."
- "A2S has really helped me reinforce what I wanted to be, because we actually went on a field trip to a place that does what I want to do. I want to be a forensic scientist, and we went to Aegis Labs where they do pretty much the same things a forensic scientist does. They process urine samples and sometimes they do

blood tests and fibers and things like that. It also helped me figure out what I needed to do in order to make it in that field."

- "Everyone had more of a chance to ask questions. I liked both years; they've both been interesting and very informative."
- "My favorite experience was the summer camp. It was just amazing. It pushed us to our limits and then even further than that, and I really like that. For future kids who are going to join - you learn, you have fun, and it's about you."
- "I would encourage more girls to join. Art2STEM is really fun and you get to learn with your friends and you don't have to worry about being laughed at for any questions you ask. There's no pressure or anything. It's really exciting."
- "Art2STEM is a fun experience. It helps you learn, and you'll like it."

[A2S Team West End]

"My daughter loves art, so that colorful brochure had us drawn in like moths to a light bulb."
 - Melinda McDonald, A2S coach, West End Middle

We traveled to Tennessee Tech on a field trip and learned about how a design becomes a creation. We also had a business visit to Nashville Electric Service where we met three women engineers, a map engineer, a communications engineer and an electrical engineer. We learned all about how the light company does business, and how they keep up with all the electricity of the city. It was amazing. We now look at everything differently, and we realize creativity is part of problem-solving.

As for the reaction of the girls, here's what a visitor to our club had to say:

"I arrived half-expecting a quiet room filled with calculators, protractors and students somberly reciting from the Periodic Table of Elements. What I discovered, however, was a room fragranced with pepperoni pizza

and buzzing with excitement.

"The students were eager to get started on their project - designing their own pencil box - and their eagerness was surpassed only by that of their own adult leaders. I was amazed at how invested the teachers and volunteers were in the club members and it was evident in the students' design. Some of the pieces were beyond impressive.

"I had an opportunity to chat with some of the students and sensed, even amid all the fun, how serious this was to them. It felt as if the students realized that they were doing more than just creating a vessel for pens and paperclips - they believed they were leaving their mark on the world around them. Thanks to Art2STEM, that is exactly what they were doing."



[A2S Team Cane Ridge/Antioch]

"A2S has offered these young ladies a chance to see that they can be a part of STEM, and be female too. You don't have to lose your creative and nurturing side if you're in a predominantly male career field."

- Denise Armstrong, pre-calculus teacher, Cane Ridge High



Art2STEM shows that there continues to be a need for women to be represented in the STEM fields. Some of us had assumed this dynamic had changed, but it really hasn't.

Determining which students to select for the program is challenging for the first year. In the future, this will be much easier because we'll have a pool of girls coming up from the eighth-grade feeder schools. The growing pains will subside, and A2S will develop into a cohesive unit that opens up doors for the young ladies, opportunities that for some, are once in a lifetime. We really need to introduce students to worlds outside their own.

[A2S Team McGavock]

"Some female teenagers don't have a clue what is available in this world for women.

But those who participate in the Art2STEM program will."

- Michelle Little, math teacher, McGavock High

From the girls:

- "I had a chance to do hands-on activities in Art2STEM and I enjoyed those the most. I got to see how robots work, and I learned what the people in Aegis do and how things work there."
- "The part of Art2STEM that interests me the most are the field trips to the different companies. I had the chance to tour the Parthenon, and I learned that many females do not go into STEM even though they often get first pick with the jobs."
- "I learned a lot of important information about STEM from the guest speakers who came to speak with us. I enjoyed the field trips the most, and learned many new things. I might consider signing up for a STEM Academy because it opens more doors for females."
- "Art2STEM is helping females become engineers because it is a great field for women. I will consider signing up for the Academy of Aviation/Transportation because this academy has certain fields that interest me."

- "When I saw the ECO Cars and learned how they were operated, that was very cool. Going on field trips to different business partners were most interesting because I learned new stuff from these companies. I will consider signing up for a STEM Academy because it's fun and I learned things that I had never learned before."
- "Art2STEM gave me the opportunity to see things that other students have not seen, like inventions and machinery. I especially liked the trip to Aegis because I got to see their machinery up close and how it is operated. I would consider the Academy of Aviation/Transportation because it would be different and you will be doing hands-on work that is fun."
- "On the Aegis field trip, I learned how they separated water and urine to determine if a patient is abusing drugs. I also learned there is a high demand for females. I will consider changing my schedule to the Aviation/Transportation Academy; it is really exciting."



[A2S Team Overton]

*"I did not think about connecting Art to STEM but now I have a better understanding of the relationship."
- Mary Lou Snyder, science teacher, Overton High*

Our Art2STEM students have definitely become more inquisitive when it comes to certain scientific concepts. Our field trip to Fisk University included both the Georgia



O'Keefe art exhibit and observation of experiments in the physics department. It opened their eyes to many different career opportunities and options available to them if they study within the STEM disciplines, and we have learned that the smallest experience for students can make a huge difference in the decisions that they make for their lives. Life can be beautiful when one appreciates art and the beauty around us as well as having a meaningful and rewarding career.

Art2STEM has taught us to look outside the box when it comes to careers in the STEM disciplines. It is evident that we need more females in the STEM sciences, so if we can use anything to spark a child's interest, educators need to provide that for them. Art in any form is a great way to get the girls' attention, and once we have their attention, then the real work can begin. In the end, it will prove successful as students are able to connect to science in a non-traditional way.

"I participate in the program because I wish someone had told me that I could have been an architect, an engineer, a designer. It might have changed my life to have been involved in a program like this, and I hope it changes many girls' lives for the positive."

- Beth Grubb, A2S Volunteer Mentor, iPractice Group

"I chose to volunteer with Art2STEM to influence girls' choices in school and their careers. Girls may not think of technology as a career choice, and I want to help them realize that any career in STEM can be very rewarding and exciting."

- Kim Chenault, A2S Volunteer Mentor, Deloitte

The collective impact of businesses, community organizations and colleges is at the heart of Art2STEM success. Some of the adults from these Art2STEM partners volunteer as Mentors who work with the Coaches at each club meeting. Others are liaisons and hosts for the field trips that make the real-world connection from STEM to career.

PENCIL Foundation has three decades' experience in connecting businesses to public schools, so A2S leveraged that asset by creating a master list of STEM-related organizations in Nashville.

As the community agency, Adventure Science Center also used their connections to suggest possible business partners. After the A2S Implementation Team collaborated to create a focused contact list, the Art2STEM program manager contacted the businesses and explained the project framework, including:

- The importance of STEM in a well-prepared workforce and the region's ongoing economic vitality.
- Real-life examples to demonstrate the importance of 21st century skills in career success.
- Reaching the untapped potential of non-traditional, under-represented populations for STEM professionals.
- Early student involvement at an age when they can make different decisions for future success.

When a business decided it had the commitment and resources to join as an Art2STEM partner, the program manager facilitated the relationship with A2S clubs to arrange field trip locations and dates. The program coordinator arranged the field trip logistics, and of course, the manager and A2S coaches followed up with sincere thank-you notes for the great experiences.

The partnerships were clearly a success, with eight of

nine surveyed field trip hosts eager for the girls to come again - and the ninth had to reluctantly decline only because of changes in corporate policy. And, while the girls reaped huge benefits from the real-world connections, their hosts were equally influenced in the very best way. Here's a sample of their comments that provides a glimpse into the motivation, activities, and impact of the field trips.

***DeeGee Lester**, Education Director, The Parthenon: "We learned of Art2STEM through my involvement as the co-chair of the Developing Community Leaders Committee of Alignment Nashville. The Greeks influenced the foundations of math and science, and it's rewarding to see the light go on as students learn about all of the exciting interplay between math and architecture as well as the realization of the exciting career possibilities that await them."*

***Elizabeth Casey**, Regional Sales Director for Security Solutions, Dell: "Great experience. The girls were quiet upon arrival, but as soon as we got into the workshops, they were really engaged and excited about learning."*

***Sybil McLain**, Marketing Manager, Street Dixon Rick Architecture: "We created tailor-made, design-related work projects for the A2S students. One was the design and creation of gingerbread homes, and another was fairly elaborate bird houses. In both instances, students had to apply math and physics concepts. The A2S girls were very engaged in the architectural activity, and they came up with designs that were clever, surprising and innovative."*

Tara Myers, Architect, Earl Swensson Associates:

"We begin by welcoming the girls and introducing several women who work in our office. Each gives an overview of our history and what we do, presents a brief summary of what our firm does, and explains about some of the ways we use math and science in our daily jobs. Throughout the visit, girls are encouraged to ask questions. We also try to incorporate a hands-on experience, usually tied to architectural drawing. We end the trip with a tour of our office where the girls get to talk with additional people in the firm and see how we work.

"We've now had three or four different groups come to the firm, and all of our employees who have helped have volunteered to do it a second time. For me, the most impactful moments are when the girls ask a lot of questions and you can tell that they are excited about what they are seeing and hearing. We were told by school faculty after the last visit that several of the girls in the program now want to be architects or interior designers, which was a nice thing to hear."

Lisa Baugh, Creative Coordinator, Film House, Inc.: *"Everyone who participated in the A2S field trip spoke positively about the experience. We liked the questions that the girls asked and found them to be very insightful. We believe in a hands-on approach and that it is never too early to learn."*

Sheila Wells, Engineer, Nashville Electric Service:

"The Art2STEM program provides young women a great opportunity to learn more about their career options. The youth in this program are eager to learn and show great interest in finding out information about their career path. I truly enjoyed meeting them and wish them the best."

Jason Ramsey, Prosthetist/Orthotist, Hanger Orthotics and Prosthetics Services: *"The A2S program manager told me about the objectives of A2S, and we both thought a student field trip to the Hanger office would be the best fit. Our goal is to introduce teen girls to a career in a scientific/technical field such as prosthetics and orthotics, and provide exposure to the CAD-CAM technology that practitioners at our office use every day. The A2S field trips are a great way to do this because we understand that students need to see the real-world connection between art and STEM. We also demonstrated clinical and technical aspects of prosthetic and orthotic care during the visit. The students were excited about the demonstration of our CAD laser scanner, and they were especially engaged when I used the laser to acquire a cranial scan of one teacher's head."*

Heather Brown, major in Concrete Industry Management, MTSU: "I was told I would be good in math and science at a very early age and it empowered me. So I want to do the same for girls. When I presented a talk about concrete, all the girls seemed genuinely interested and a couple of girls took brochures about the major."

BeBe Holland, Human Resources Generalist, Triumph Aerostructures: *"Triumph has a company-wide program - WINGs - where each site is involved with community involvement projects or events. The A2S field trips are overwhelmingly positive; our employees have been impressed with the level of interest from the students. We look forward to welcoming more A2S clubs because it's very positive to see young women interested in entering fields that the majority of females have avoided in the past."*

Dr. Ismail Fidan, Professor, Tennessee Tech University: "When A2S students visit the TTU campus every fall, the Dean or Associate Dean welcomes the girls and coaches to our campus. Our engineering faculty organizes three or four different activities for the students, who are divided into four teams. The teams visit the cutting-edge rapid prototyping (RP) lab

for a hands-on experience when each girl grabs a 3D model of a human hand from the RP material vat. Students then clean the 3D model, use markers to design it the way they like, and then get to take the models home. Seeing the girls learn more about STEM brings great satisfaction."



A2S Team Apollo visits BioTN



These adults and many others went the extra mile for Art2STEM, and we extend a sincere thank-you to all the businesses, community organizations and colleges that provided invaluable assistance to the project.

ACE Mentor Program	Girl Scouts of Middle Tennessee	Nashville State Community College
Adventure Science Center	Hanger Orthotics and Prosthetics	Nissan North America
Adventure Works	Lee Company	Parthenon
Aegis Labs, Inc.	Lipscomb University	Street Dixon Rick Architecture
AMEC	LP Building Products	Tennessee Repertory Theatre Company
Belmont University	Metro Water Services	Tennessee State University
BioTN	Middle Tennessee State University	Tennessee Tech University
Deloitte	Nashville Display	Tennessee Performing Arts Center
Earl Swensson Associates	Nashville Electric Service	Triumph Aerostructures
Film House	Nashville International Airport	ZCorp
Fisk University	Nashville Public Television	
Frist Center for the Visual Arts	Nashville Shores	

"Adventure Science Center has lived its mission to ignite curiosity and inspire the lifelong discovery of science. Our participation in A2S provides the opportunity to connect with schools, teachers and the business community in new and innovative ways to engage girls in STEM."

- Jeri Hasselbring, Director of Education, Adventure Science Center

Thank You!

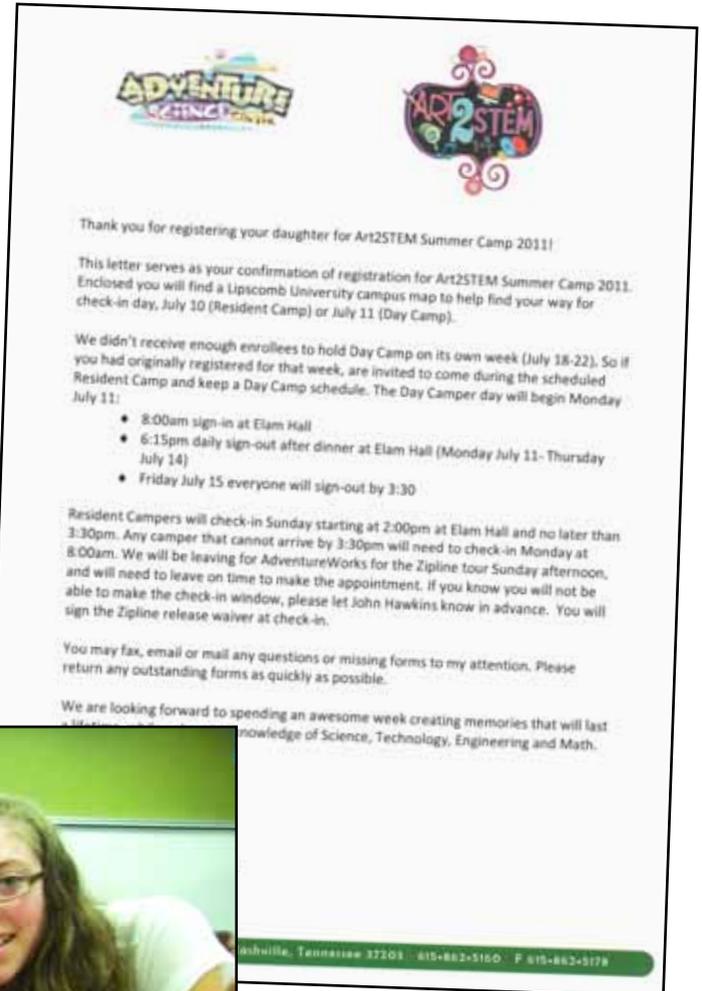
Art2STEM recognizes the teachers and business professionals serving as coaches with our afterschool clubs. These leaders have committed themselves to positively impacting girls' lives. We appreciate your dedication and hard work.

Lee Tydus	Apollo Middle	Denise Armstrong	Cane Ridge High
Jodi Graham	Apollo Middle	Melinda McDonald	West End Middle
Cecily Wiseman	Tennessee State University	Carol Mosow	Hillsboro High
Melynda Sutton	Bailey Middle	Jessica Bruce	Deloitte
Marcus Davis	Bailey Middle	Beth Grubb	Belmont University
Pam England	Deloitte	Janet McFarland	Antioch High
Leslie Knapp	Deloitte	Harold Cunningham	Cane Ridge High
Mary Kindt	Croft Middle	Lisa Bonelli	McGavock High
John Marshall	Overton High	Mary Lou Snyder	Overton High
Nicole Jimenez	DuPont-Tyler Middle	Tocarra Cecil	Overton High
Michelle Little	McGavock High	Lance Olivas	Overton High
Peter Ortner	McGavock High	Bianca Edwards	Belmont University
Marilou Pampo	Blue River I.T.	Erica Todd	Belmont University
Lakeshia Wright	Joelton Middle	Sally Spear	Croft Middle
Edward Rakus	Joelton Middle	Patrick Carr	Croft Middle
Christina Carlisle	Deloitte	Kim Chenault	Deloitte
Emily Medlock	Oliver Middle	Taryn Bell	Joelton Middle
Millie Norwood	Oliver Middle	Linda Polk	Joelton Middle
Frank Lane	Overton High	Rachel Amescu	Hillsboro High
Karen Wabby	InfoSystems, Inc.	Avis Ortiz	Tennessee State University
Susan Lewis	Deloitte	Kevina Bland	Tennessee State University
Jan Maddox	Deloitte	Amber Tydus	Nashville State Comm. College
Deborah Smith	Thurgood Marshall Middle	Syrita Murray	Tennessee State University
Kimberly Vaughan	Thurgood Marshall Middle	Amy McConnell-Flatt	West End Middle

*"My daughter really looked forward to Art2STEM camp.
She absolutely loved it and was so excited. She didn't even want to leave."*

- Parent of Art2STEM camper, Joelton Middle

After a long school year, the perfect reward for Art2STEM middle school students is a week-long residential summer camp. Camp is a great way to nurture the educational seeds that have been planted throughout the year, and it's also an excellent opportunity to reinforce responsibility and other character values necessary for school and career. For example, A2S campers are expected to stay on schedule, maintain a clean room and keep up with their own meal tickets. And, if a family is not comfortable with their daughter staying overnight, parents can provide transportation on a day-camp schedule.



A2S campers present their 3D models

All forms available at www.alignmentnashville.org. Click the "Resources" tab, and then click "Art2STEM."

[Nuts and Bolts of Camp]

Safety and Security: Parents and caregivers must be assured that appropriate safety and security precautions are taken, including:

- Camp counselors are CPR and first-aid certified
- Exits are monitored at all times
- Students travel in groups of three when necessary to be apart from counselors
- Access to social media will be strictly limited
- Emergency procedures are in place

Staffing: It's hard to have too many caring adults at Art2STEM camp. In addition to coaches and program staff, A2S mentors and volunteers are welcome to help the girls.

- Coaches are notified as soon as camp dates are set.
- Coaches and staff collaborate to set the agenda, and coaches facilitate the activities.
- Counselors are support staff provided by the coordinating agency (Adventure Science Center) who shepherd students from location to location to ensure safety. Counselors are hired at a 1:12 counselor-student ratio.

Timeline: Book your camp location and date early in the first semester so the reward incentive process will help with registration numbers and general planning.

The best strategy is to get ahead of the curve by discussing camp with the girls' parents as early as possible, because many parents begin to make summer plans in January. Obviously, parents will not know if their child can qualify at this time, but the more they know earlier, the better the odds that their child will be a consistent club member for the rest of the year. Waiting too long before introducing the camp to your parents may mean that some students will already be committed to another conflicting summer program.

Schedule your camp date for several weeks after the last day of school. Typically, families make their travel plans for soon after the end of the school year. Prime camp enrollment usually happens after Independence Day when parents realize their daughter has hit a point of boredom and most summer travel plans have been completed.

Locations: Students love the idea of living the college life. Offering your Art2STEM summer camp on a college campus provides a nice selling point for registrations. A college campus also provides all the necessary resources such as meal planning, housing, security, classrooms and play space. The more you can incorporate "one-stop shopping," the easier the planning process will go.

Enrollment: We suggest that a fully refundable deposit be submitted at time of camp registration - nothing that will break the bank of your families but a small fee that symbolizes the commitment. This helps for wise use of A2S resources and reduces casual cancellations that cause last-minute planning problems. Informational meetings will give parents a chance to ask any questions they may have about camp, and the sessions are also a good way to ensure that registration forms make it home.

Dear Art2STEM Participant,

Adventure Science Center is so excited that you are attending Art2STEM camp on the beautiful campus of Lipscomb University! This unique resident camp will be fun, will increase your knowledge of science, technology, engineering and math, help you develop new leadership skills, make new friends, check out what college life is like, and see your Art2STEM coaches in a whole new light! This letter will help you and your parents know what to expect at camp and also includes a packing list, directions, campus map, and reminders about the necessary forms to complete.

We start the camp with a wacky cool zip line adventure on Sunday evening. For this special activity please have your parents fill out and sign the waiver and bring it with you to camp. Make sure you are wearing your Art2STEM t-shirt.

WHAT:	Art 2 STEM Camp
WHEN:	Resident week July 10 - 15, 2011
TIMES:	Check-in: Sunday July 10, 2 p.m. Check-out: Friday July 15, parent presentation at 2 p.m., check-out about 3:30
	• A parent or guardian is required to be present at check-in and out of camp unless prior written permission has been given for carpooling. ID will be required.
WHERE:	Lipscomb University is located at One University Park Dr., Nashville, TN 37204. Visit Lipscomb's web site for directions to campus at www.lipscomb.edu .
DEADLINE:	Your health form signed by a doctor or nurse and insurance card copy must be complete and on file by July 28. You may email, email or fax it in advance to the Art2STEM Coordinator (John).
	John Hawkins, Art2STEM Coordinator John@lipscomb.edu 800 Fort Negley Blvd. Nashville, TN 37203 Fax: 615.862.5178

Bring your Zip Line waiver with you to camp. And wear your A2S t-shirt.

OVERNIGHT ACCOMMODATIONS

- We will be staying in a dorm on the Lipscomb University campus. Two girls will share a room. Two rooms comprise a suite with a shared bathroom between. We will do our best to put girls together with an indicated friend, but can not guarantee you will be with your best Art2STEM friend. If you would like to request a roommate, please call the Art2STEM Coordinator (John) at 615.401.5065. Please understand that this is also a great opportunity to make new friends and not all requests can be filled.
- Please review the packing list carefully and note what items you will need to bring.

Page 1 of 6

Health forms: Have each student submit a health form permitting the use of common over-the-counter medications, basic first-aid treatment and professional medical help in the event a guardian cannot be reached. This form should allow parents to provide emergency contact information and list any special needs that their daughter may have. Having each student complete a physical is also suggested to ensure that all bases are covered.

**Adventure Science Center
Art2STEM CAMPER HEALTH HISTORY FORM**

To be filled out by parent/guardian then reviewed & signed by doctor or nurse practitioner.
A copy - front & back - of camper's health insurance card must accompany this form. PLEASE PRINT.

Camper's Name (First, Middle, Last) _____ Parent/Guardian Full Name _____ Phone _____
 Address _____ City, State, Zip _____ Camper's Birth Date _____
 Emergency Contact _____ Relationship to Camper _____ (Pages 1 and 2)

HEALTH HISTORY - check all that apply to camper

<input type="checkbox"/> Fainting/lazy spells <input type="checkbox"/> Indigestion/low acid? <input type="checkbox"/> Sleep disturbances <input type="checkbox"/> Constipation/Diarrhea <input type="checkbox"/> Irritability/changes in regulation <input type="checkbox"/> Nosebleeds <input type="checkbox"/> Headaches/Migraines <input type="checkbox"/> Bleeding disorders <input type="checkbox"/> Phobias <input type="checkbox"/> Emotions <input type="checkbox"/> Rare fevers	<input type="checkbox"/> Diabetes <input type="checkbox"/> Heart problems <input type="checkbox"/> Mononucleosis <input type="checkbox"/> Asthma/Respiratory problems <input type="checkbox"/> Ear infections <input type="checkbox"/> Seizures <input type="checkbox"/> High/Low Blood Pressure <input type="checkbox"/> Musculoskeletal disorders <input type="checkbox"/> ADD or ADHD <input type="checkbox"/> Eating disorder <input type="checkbox"/> Emotional/Social disorders* *Explain in attached document	AS NEEDED MEDICATIONS Camp Health Care Supervisor may administer the following to the camper on an as needed basis: <input type="checkbox"/> Tylenol/Acetaminophen <input type="checkbox"/> Advil/Ibuprofen <input type="checkbox"/> Sudafed/Decongestant <input type="checkbox"/> Benadryl/Antihistamine <input type="checkbox"/> Robitussin/Expectorant <input type="checkbox"/> Pepto Bismol <input type="checkbox"/> Tums/Antacid <input type="checkbox"/> Calamine Lotion <input type="checkbox"/> Antibiotic Cream <input type="checkbox"/> Swimmer's Ear Solution
--	---	--

Check of above: _____
 Allergies? Yes No (If No, has she been prepared for this? Yes No)
 No known Allergies _____
 Food: Medicine Environment (insect stings, hay fever, etc) Other _____
 Eats a regular diet Eats a regular vegetarian diet Has special dietary needs _____
 Comments: Please explain how these may affect camper's experience while at camp on back of page.
HEALTH AUTHORIZATION FOR HEALTHCARE
 This form has permission to participate in all camp activities, except as noted by me and/or their doctor.
 I understand that the camp is not responsible for medical treatment related to the health of my child for both routine health
 conditions and for the camp to order x-rays, routine tests, and treatment related to the health of my child for both routine health
 conditions. If the contact listed above cannot be reached in case of an emergency, I give my permission to the doctor to hospitalize,
 and/or order injections, anesthesia, or surgery for this camper. I understand the information on this form may be shared with camp
 staff. I give permission to copy this form. Camp has permission to obtain my child's health records from health care providers
 who will treat them.
 _____ Date _____

**ART2STEM
Student Enrollment Form**

Parents, please provide the information about your child that is requested below.

Student's Name: _____
 Mailing Address: _____
 Home Phone: _____ Alternate Phone: _____
 Parent Name: _____
 Address (if different): _____
 Parent's Email Address: _____
 School: _____
 Student's Grade: _____ Student's Date of Birth: ____/____/____

Ethnicity:

<input type="radio"/> Caucasian	<input type="radio"/> Asian
<input type="radio"/> African American	<input type="radio"/> Arabic
<input type="radio"/> Hispanic	<input type="radio"/> Bi-racial
<input type="radio"/> American Indian	<input type="radio"/> Other

Lives With:

<input type="radio"/> Both parents
<input type="radio"/> One parent only
<input type="radio"/> Parent & step-parent
<input type="radio"/> Grandparent
<input type="radio"/> Other relative
<input type="radio"/> Foster family
<input type="radio"/> Other

Do you have a computer in the home?
 No
 Yes

If yes, do you have internet access?
 No
 Yes

All forms available at
www.alignmentnashville.org.
 Click the "Resources" tab, and then
 click "Art2STEM."



[The Who and What of Camp]

Summer camp provides a platform to engage your most committed club members in higher-level programming, and creates an outlet for coaches to explore new lessons and activities that can be adapted and used in a more traditional learning environment. The best way to

generate an intellectually rewarding camp experience is to focus your programming on a progressive project. This project should take a week to complete, with experiences building on previous afterschool and camp activities.

A2S Resident Camp Schedule: Lipscomb University						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
7:00- 8:00		Breakfast	Breakfast	Breakfast	Breakfast	Breakfast
8:00- 9:00		Clean Room	Clean Room	Clean Room	Clean Room	Clean Room
9:15- 10:15		Off Site Field Trip: Lighthouse Chrstrn	Water Treatment & Flood Study	Sculpture & Science Lesson	Interior Design Lesson	Clean Room
10:30- 11:30			Water Test Lesson	Museum Art & Exhibit Design	Interior Design Lesson	Finish Projects
11:45- 12:30		Lunch (Off Site)	Lunch	Lunch	Lunch	Lunch
12:45- 1:45		Off Site Field Trip: Opryland Hotel	Levee Build Activity	Museum Art & Exhibit Design	Focus Groups	Finish Projects
2:00- 2:30	Check- In		Break	Break	Break	Closing Campfire
2:45- 3:45	Check- In	Progressive Project	Progressive Project	Progressive Project	Progressive Project	Check Out
4:00- 5:00	Evening Program	Progressive Project	Progressive Project	Progressive Project	Progressive Project	
5:15- 6:15	Evening Program	Dinner	Dinner	Pizza Dinner	Dinner	
6:30- 8:00	Evening Program	Evening Program	Evening Program	Evening Program	Evening Program	
10:00	Lights Out	Lights Out	Lights Out	Lights Out	Lights Out	

Middle School Art2STEM Camp: Building on personal experiences from the 2010 flood in Nashville, the most recent A2S camp featured the theme, "Reimagining and Rebuilding Nashville After the Flood."

The week opened with trips to Opryland Hotel and Lighthouse Christian School, two sites most severely damaged and now undergoing significant rebuilding. Then, the first half of each day was dedicated to activities such as flood water control, levees, sculpture, and interior design. Working in teams of five, the girls were randomly assigned an important Nashville site such as the Grand Ole Opry, Riverfront Park, Farmers Market, the Frist Center for the Visual Arts, or LP Field where the Tennessee Titans play football. Their task was to redesign the landscape and/or building, with a focus on ease of use, functional layout, budget, and impact on environmental, ecological, social and civic aspects.

Each team began by drafting design ideas with paper and pencil. When the group had combined thoughts and hand-sketched a consensus design, they recreated it

digitally on Google SketchUp, the drafting program they had used earlier in the year. The girls were free to change the aesthetic details of their model, but the primary concern was redesigning the structural features of the building or site to better withstand natural disasters such as floods.

After the digital design was complete, the girls used the engineering design cycle as they recreated a scale model just like the prototypes produced by architects - which meant only glue was allowed instead of the easier method of using transparent tape. The project married important aspects of both art and STEM while showing the girls how their skills could be used to create a better world.

While designing the activities for the week, be intentional about including plenty of time to practice such 21st century skills as communication, critical thinking, problem-solving and teamwork. And, be conscious of the middle-school attention span by providing breaks and a varied pace to maintain concentration and interest.

High School Art2STEM Camp: Nashville Shores is one of the region's popular water parks, and like all recreational attractions, enticing both new and repeat visitors depends on keeping the park fresh and competitive.

All of the high school camp activities were constructed to answer this driving question: What kind of attraction will increase both new and repeat visitors to Nashville Shores? The context for the problem-based activity included this description: "The management of Nashville Shores has decided it needs a new cutting-edge, state-of-the-art attraction that will bring new and repeat visitors to the park and is requesting proposals for that new attraction. Such an attraction must involve water and offer thrills and excitement to the visitors. The winning proposal will also be judged based upon its viability and compatibility with existing features of the park."

Camp begins with an introductory ice-breaker, the formation of teams, and initial team consensus on what constitutes appealing architecture. Continuing the consensus theme, the individual teams collaborate on

design ideas for their proposed attraction by working with volunteers from the ACE Mentoring Program. The ACE mentors help them develop and document selected engineering features and a construction plan for their proposed attraction.

Each team is also responsible for creating a group presentation to explain and defend their projects during a peer review.

The camp culminates with a walking tour of key buildings in downtown Nashville to help students recognize aspects of art, design, architecture, construction and engineering that were highlighted during camp week. The students then tour Nashville Shores with an emphasis on the design, architecture, engineering and construction of principle park features. Finally, each team showcases its proposal with presentations and interactive sessions led by ACE mentors and representatives from Nashville Shores. After assessment of each project, the winning proposal is selected.

A2S High School Capstone Schedule

ACE = Architecture, Construction, Engineering

	Tuesday (6/7)	Wednesday (6/8)	Thursday (6/9)	Friday (6/10)
8:30- 9:30	Frist Intro & Icebreaker	ACE Engineering "Beam Strength"	Field Trip	Nashville Shores tour
9:30- 10:30	Nashville Shores Challenge	ACE Engineering "Beam Strength"		
10:30- 11:30	Brainstorming and 1st sketch	Water flow and slope activity		LUNCH (off-site)
11:30- 12:00	LUNCH	LUNCH	LUNCH (off-site)	Parent Presentation
12:00- 1:00	ACE Architecture	ACE Construction		Parent Presentation
1:00- 2:00	"School Entrance" activity	Construction cont.	Finish Models	Back to Shores
2:00- 3:00	Final sketch	Construction cont.	Finish Models	
3:00	DISMISSAL	DISMISSAL	DISMISSAL	DISMISSAL

[Registration and Enrollment Forms]

"You need a clear, designated place to pick up and drop off forms for Art2STEM in your school. I use the front office and I keep them informed on everything I am doing."
- Melinda McDonald, Art2STEM Coach, West End Middle School

During professional development, teachers receive electronic and hard-copies of the required forms for students and are responsible for dissemination at their school. Documents may be distributed during open-house events, as well as during the school day.

Forms should be sent home before the first meeting for parents/caregivers to read and sign so that participants can turn in all registration and enrollment documents when they arrive at the first club meeting.



A2S Annual Spring Camp-In at Adventure Science Center

[Field Trip Planning and Assessment]

"The visit checklist allows businesses to understand the purpose of our visit and what we hope to accomplish while we're there."

- Millie Norwood, Art2STEM Coach, Oliver Middle

A2S provides a Business Visit Checklist to guide the field trip planning process. This document outlines A2S concepts that are important to business engagement - for example, one question asks, "To what extent are female engineers visible?" To answer this question, coaches need to collaborate with their host and build an agenda that addresses this concept. After the field trip, coaches complete the checklist and submit the form to the evaluation team for analysis.

And don't forget: No field trip is successful for the girls who don't get to participate, and for this age, it's important to distribute permission forms early and follow up consistently to collect signed forms so that every student gets to go.

All forms available at www.alignmentnashville.org. Click the "Resources" tab, and then click "Art2STEM."

Art to STEM Business Visit Checklist

Business Name: _____ Business Type: _____

School: _____ Date: _____ Rater: _____

To what extent was each of the following steps of the engineering design cycle evident on the tour?

Step	Not at All	A Little	Somewhat	A Good Bit	A Great Deal
Problem identification, definition	<input type="radio"/>				
Brainstorming, consideration of many options	<input type="radio"/>				
Design (solution)	<input type="radio"/>				
Prototyping	<input type="radio"/>				
Test	<input type="radio"/>				
Build	<input type="radio"/>				
Evaluate	<input type="radio"/>				
Improve	<input type="radio"/>				

To what extent was each of the following characteristics evident on the tour?

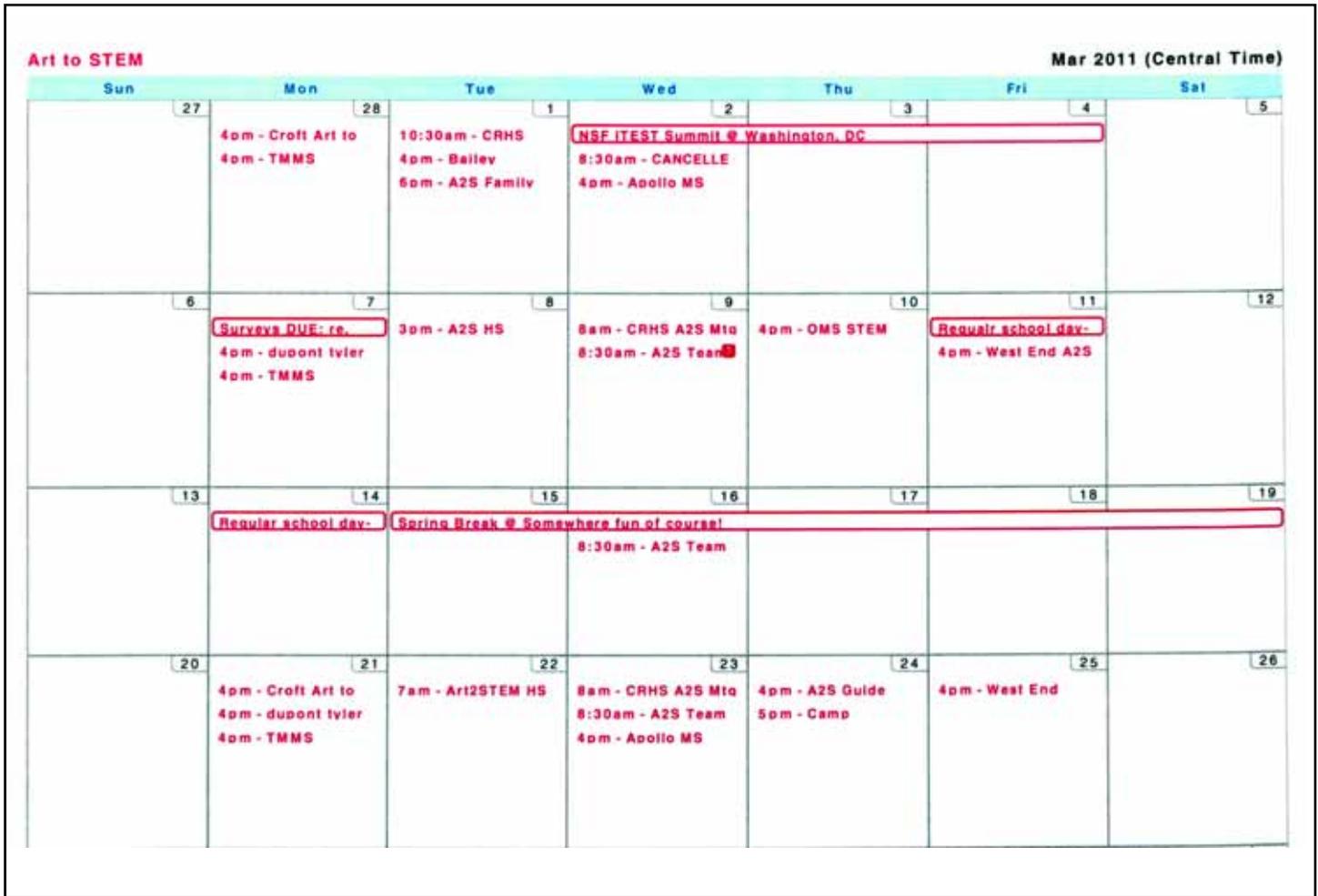
Characteristic	Not at All	A Little	Some-what	A Good Bit	A Great Deal
To what extent were women engineers visible?	<input type="radio"/>				
To what extent was teamwork and a culture of collaboration demonstrated?	<input type="radio"/>				
How evident and multidimensional was the use of technology ? (How high tech?)	<input type="radio"/>				
To what extent was the use of or need for creativity evident?	<input type="radio"/>				
To what extent was art integral to the product or service? That is, are aesthetics key for the product/service?	<input type="radio"/>				
To what extent did the tour highlight the contribution of the product/service to quality of life (helping others)?	<input type="radio"/>				
How interactive were the employees with the girls (i.e., talking with, asking questions, engaging)?	<input type="radio"/>				
Overall, how engaged did the majority of the girls appear?	<input type="radio"/>				

Please feel free make notes on the back detailing more specific observations.



[Google Calendars and Documents]

"Learning to use the Google calendar and documents is fairly easy. I hadn't really used either before becoming an A2S coach, but they are both user-friendly."
 - Denise Armstrong, Art2STEM Coach, Cane Ridge High



A project-wide shared space such as Google calendar and Google documents is essential to effectively manage multiple A2S club schedules because it allows coaches and staff to see all meeting schedules and attendance data in a central location. Coaches are responsible for maintaining their club calendars, and A2S staff relies on their accuracy

to plan resources and schedule events for all sites.

Note: Some A2S clubs faced challenges when trying to connect with Google docs because of school filters or system incompatibility. Those coaches solved the problem by creating Gmail accounts.

[Using the Art2STEM Website: www.art2stem.org]

"Our club uses the website to inform parents and students about what's happening in A2S. It is also an efficient place to find the forms we need like the enrollment packet, phone numbers, and links to important tools."

- Melinda McDonald, Art2STEM Coach, West End Middle

An Art2STEM website provides a central location for all clubs to show their school pride, and for coaches and parents to keep up with A2S events. It's also a repository where coaches can access all required forms and link to the project's shared space on Google. Each

coaching team is responsible for maintaining their club's web page, and an A2S staff member serves as overall website manager. You may need to use part of your professional development to help coaches navigate the process.

A professionally created graphic or logo is an effective investment of resources. Each club and community partner has the flexibility to be creative as they incorporate the A2S icon into their customized recruitment and promotional materials. In addition, general information fliers and posters that can be used by all participants will be very helpful throughout the year.

All forms available at www.alignmentnashville.org. Click the "Resources" tab, and then click "Art2STEM."



Who are we?

Art2STEM, in partnership with Metropolitan Nashville Public Schools (MNPS) is designed specifically for girls in grades seven through nine to engage their interests, skills and abilities in science, technology, engineering and math (STEM). The program introduces girls to STEM-related studies they can pursue in high school through career academies and college. Our partners include MNPS, PENCIL Foundation, Adventure Science Center, Tennessee Tech University, and Edvantia. Funding of \$1.3 million to support the project over three years has been provided to Alignment Nashville by the National Science Foundation.

Which schools are engaged?

Approximately 280 students enrolled in *Art2STEM* for the 2010/2011 school year. One of the long-term goals of *Art2STEM* is to increase the likelihood that the participating girls will enroll in STEM-focused academies in high school. After-school clubs are located in eight middle schools: Apollo, Bailey, Croft, DuPont Tyler, Joelton, Oliver, Thurgood Marshall, and West End. In the fall of 2010, the program expanded to include Antioch, Cane Ridge, McGavock, and Overton high schools.

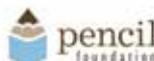
The Details

Research shows that only about 3% of 9th grade girls expressed interest in enrolling in a STEM-related career as their first choice. The most common interest was in arts and entertainment. We believe that all students, but especially girls and minority students, simply are not aware of the many career opportunities in STEM fields and how relevant they are to their own talents as well as real-world issues.

The sessions take place in informal settings and are facilitated by teams of "coaches" that consist of middle and high school teachers as well as mentors who are recruited by Adventure Science Center from local colleges and businesses. Activities are grounded within an authentic, local context through partnerships with local businesses. PENCIL Foundation serves as the business engagement partner (as well as the fiscal agent) for *Art2STEM*. Through business engagement, students are able to visit several local companies, including: Aegis Labs, Nashville Display, NES, Dell, Earl Swensson Associates, Triumph Aerostructures, Npt, Nissan, Deloitte, LP Building Products, the Parthenon, and Frist Center for the Visual Arts.

The year in *Art2STEM* culminates with a one-week summer camp. The summer camp experience is a fun way for Coaches and club members to dig deeper in previous activities as well as to explore a range of new STEM activities while networking and making new friends.

For more information on *Art2STEM*, contact Sandra Harris at 615.585.8713, or email: sandra@alignmentnashville.org



A collaborative initiative of Alignment Nashville



Partial funding provided by: National Science Foundation

ART2STEM

www.art2stem.org



Art2STEM

Art2STEM is a collaborative initiative of Alignment Nashville (AN). The project supports after-school activities that promote the interests, skills, and concerning education in science, technology, engineering and math (STEM) among middle school girls attending Metro Nashville Public Schools (MNPS).

Currently in year two, the Art2STEM Partners include MNPS, PENCIL Foundation, Adventure Science Center, Tennessee Tech University, and Edvantia. After school clubs are located in eight middle schools including Apollo, Bailey, Croft, Dalton, Tyler, Jackson, Oliver, Thegood Marshall, and West End. The project has expanded to include students from four MNPS high schools in the 2010/2011 school year: Annock, Cane Ridge, McGowick, and Overton. Approximately 270 girls enrolled in Art2STEM for the 2010/2011 school year.

BACKGROUND

One of the long-term goals of Art2STEM is to increase the likelihood that the participating girls will enroll in STEM career academics in high school. This effort supports the NSF program's primary aim to expand the "pipeline" so that more individuals enter STEM jobs, especially from underrepresented groups.

In 2006, only about 3% of 9th grade girls expressed interest in enrolling in a STEM related career as their first choice. The most common interest was in arts and entertainment. Art2STEM believes that all students but especially girls and minority students, simply are not aware of the many career opportunities in STEM fields and how relevant they are to their own talents as well as real-world issues.



BUSINESS & INDUSTRY ENGAGEMENT

Art2STEM activities are grounded within an authentic, local context ensured through partnerships with local business and industry. These partnerships provide role models and help the girls understand the relevance of what they are learning.

The girls have visited several local industries to see the design and prototyping processes firsthand including Triumph Aerostructures, Nashville Electric Service, Nissan North America, Argis Labs, LP Building Products, and Earl Swenson Associates (architecture).

Year two began with an introduction to CAD and rapid prototyping through the creation of SPORE creatures. With technical support provided by staff at TTU, the girls designed figures, saved them to flash drives, and those files were then emailed to TTU, then sent to Z-corp for rapid prototyping.

From there, the 3D models were produced and sent to the girls at their schools, via standard mail. A great year to a successful year. Art2STEM culminates with a week-long summer camp. Students will have a choice of attending a residential camp or a day camp. The summer camp experience is a fun way for girls to dig deeper into previous activities as well as to explore a range of new STEM activities while networking and making new friends.

EVALUATION: DRAW AN ENGINEER

Evaluation activities assess changes in the girls' attitudes and beliefs related to STEM as well as their understanding of what engineers do at work. For example, the Draw an Engineer Test qualitatively assesses changes in knowledge and understanding.

The girls most often drew pictures of female engineers at summer camp than they did in drawings in the fall or spring.

RESULTS

Results from student focus groups and open-ended survey items suggested that A2S participation contributed to mostly positive shifts in the girls' attitudes and knowledge related to STEM. Feedback from two open-ended survey items suggested five inter-related themes: STEM topics are not boring; STEM topics are important and widespread; STEM careers are accessible; STEM careers are appealing; and STEM is still or now unappealing (for a subject of the girls). Results from the focus groups suggested that for more girls, A2S participation increased their interest in science and engineering, improved their understanding and appreciation of engineering, science, and math; and increased their likelihood of considering STEM education and careers. Their feedback also suggested changes that A2S might consider to make the program more appealing, including increasing emphasis on math and science, adding more hands-on activities, and reducing data collection.

Student survey findings suggest that the most apparent change over time related to the girls' understanding of what engineers and scientists do. The students in both samples, core students and summer campers, demonstrated statistically significant increases in understanding that were consistent across items. The data suggest more favorable attitudes towards science, engineering, and math than technology. The girls reported greater interest in pursuing careers in science and engineering in the spring and summer relative to fall.

WHY THESE RESULTS?

- An Emphasis on Creative Arts and STEM
- Intentional After-School and Summer Camp Activities
- Authentic Contexts
- Mentors, Role Models, and Community Infrastructure



[Final Words]



For many middle school students, the transition to high school has never been more challenging and the consequences of their choices have never been so important. For those from under-represented populations in STEM education, especially girls,

this transition to ninth grade and subsequently into a STEM-related Academy is one that is often not successfully navigated.

Art2STEM offers an opportunity for middle school girls to develop the confidence and sense of purpose to negotiate this transition, and then to pursue successfully a STEM-related program of study and ultimately enter a satisfying and rewarding career in one of the many STEM-related businesses and industries in our area.

In addition to helping further develop the 21st century skills and competencies that will serve them in their educational and career pursuits, Art2STEM provides an environment of informal learning where relationships with peers, teachers and mentors from the Nashville community can be built and nurtured. In short, the learning that occurs in Art2STEM is both rigorous and relevant; the relationships and readiness for future success can be life-changing.

I heartily endorse this program and commend it both as an important part of the MNPS STEM initiative as well as a model for other school districts in their efforts to improve student success in STEM.

Lora P. Hall, Ed.D.

*Associate Superintendent of Middle Schools
Leadership & Learning
Metropolitan Nashville Public Schools*



Art2STEM Campers on the steps of Elam Hall at Lipscomb University



About AdventureScience Center...



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Adventure Science Center (ASC) ignites curiosity and inspires the lifelong discovery of science in visitors of all ages. Last year, more than 275,000 visitors, including nearly 50,000 school children, learned, explored, interacted and enjoyed programs and exhibits at the Center. Its world class Sudekum Planetarium provided a diverse menu of full dome video programming that awed audiences by sending them on a unique journey into space.

On-site curriculum-based programming includes engaging demonstrations, hands-on labs, inquiry – based teacher professional development and Science Sleepovers. CampQUEST offers children an exciting summer and school break experience. Nearly 1,000 children attend CampQUEST each year.

In addition to on-site programming, ASC delivers educational outreach at community centers, churches, libraries, as well as schools. Outreach programming includes Electronic Education - virtual field trips by videoconferencing.

Its premier outreach endeavor is serving as the Community Partner for Art2STEM (A2S), an afterschool club located in eight MNPS middle schools. A2S introduces middle school girls to STEM career paths by tapping into their natural attraction to art. A2S includes professional development for teachers and offers the students a summer camp opportunity at a local university setting where the girls continue to interact with scientists, engineers and other STEM professionals.

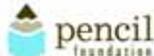
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