

Executive Summary

In the fifth year (2013–2014) of partnership with the Air Force Academy High School (AFAHS), the Adler Planetarium is pleased to report the school has become increasingly independent in its ability to sustain the programs developed for it, while the museum has greatly expanded its expertise and footprint in teen initiatives.

In 2014, the museum helped AFAHS teachers successfully transition into leadership roles for previously Adler-led programs such as the Robotics Club, Adler Chem—a co-developed chemistry curriculum—and the freshmen culminating event. In taking more ownership, AFAHS is on a path to sustaining these initiatives in the future. The museum welcomed AFAHS' second senior class into the Adler community, and offered new opportunities to students.

Program Growth and Impact

With the philanthropy of the S&C Foundation, the Adler/AFAHS partnership began as a way to bring science, technology, engineering, and math (STEM) skills and career exposure to a pool of at-risk students. The collaboration ultimately fostered development of a broad suite of Adler youth programs, which now reach across other Chicago Public Schools (CPS)—enabling the Adler to establish a thriving community of teen volunteers, interns, leaders, and mentoring STEM professionals. New partnerships with youth organizations throughout the city are another result of the Adler's intensive work with AFAHS, and the generosity of the S&C Foundation. This deep focus on directly exposing teens to STEM opportunities and encouraging them to develop hands-on skills is unique in the Chicago museum community.

During this five year program, the Adler has reached, taught, or collaborated with:

- 536 Air Force Academy students
- 344 teen Facebook group members
- 150 Hack Day students
- 114 teen volunteers
- 85 AFAHS Robotics Club students
- 71 teen interns
- 60 Near Space After-School Club members
- 24 Youth Leadership Council members
- 20 CPS high schools
- 14 nonprofit youth organizations

The museum has hosted or led:

- 150 AFAHS Robotics Club meetings
- 25 AFAHS freshman field trips
- 12 Web-Making Workshops
- 9 CPS ChicagoQuest middle school field trips
- 7 AFAHS Robotics competitions
- 3 Far Horizons High School High-Altitude Ballooning programs
- 2 sophomore class Far Horizons balloon launches

Year Five Evaluation Findings

The Adler/AFAHS Partnership is a STEM pipeline program, intended to move students along interest-driven pathways toward future careers as STEM professionals. The partnership encompasses a full suite of programs, serving different segments of the school's population according to their needs and readiness. The goals of the partnership and the Year Five report findings are:

Goal 1: Reinforce positive attitudes toward museums and STEM subjects in all programs.

Findings:

- The students with the greatest involvement with the Adler experienced the greatest positive attitudinal impact.
- Much of students' positive attitudes were the results of encountering diverse experiences and feeling challenged.

- Exposure to the Adler positively affected attitudes about museums and STEM for the student body in general, even those experiencing lower levels of involvement.

Goal 2: Build students' STEM related skills and content knowledge in astronomy and aerospace in all programs.

Findings:

- Students demonstrated significant gains in STEM-related skills and museum related-content knowledge.

Goal 3: Provide students with an understanding of the workplace environment and foster essential life and job skills such as public speaking, personal confidence, collaboration, punctuality, and professional appearance through volunteer and internship opportunities, as preparation for success in college and future careers.

Findings:

- Adler paid and unpaid internship experiences teach valuable life skills that many participants might otherwise not have.
- Unexpected role changes can be learning experiences.

Goal 4: Develop a suite of programs that allows for multiple entry points to engender a sense of belonging within the scientific and museum community.

Findings:

- The partnership programs were able to engage a diverse community of AFAHS students and other under-represented teens.
- Programs that empowered youth to contribute made them feel highly valued.
- The diverse suite of programs provided opportunities successful in gaining student engagement beyond what was mandatory.

Year Five Adler Learning

1. Relationship-Building is Critical to Program Health

The value of building strong relationships between all stakeholders—students, teachers, and Adler staff—became apparent early in the partnership. Initial year-end reports from 2010 and 2011 reference efforts to improve this relationship-building by reducing the number of students on field trips and increasing Adler staff time at the school. However, it often was not the STEM content or experiences that got students hooked into the partnership, it was a personal connection with a specific Adler staff person.

2. Program Diversity Creates Greater Opportunities for Student Engagement

Implementing a wide range of programs has proven essential in attracting a broader base of youth who are non-traditional museum participants. The variety of programs attracted students of varying interests and created diversity in skill-sets. As a teen community, youth are able to learn from each other and collaborate, and with more opportunities from which to choose, it is more likely they can find a place within the museum where they feel comfortable and confident. The data suggest this approach can change how teens view the museum and their relationship with STEM fields.

3. Designing to Empower Youth Increases Program Impact

Feedback from students indicates they value the opportunity to create their own experiences at the Adler. AFAHS students who felt the greatest impact from the partnership often ended up as YLC members, summer interns, or Far Horizons volunteers. These opportunities called on youth to be active members of the Adler community by creating and facilitating their own programs, and managing youth-facing programs from the Adler perspective.

4. To Successfully Engage Underrepresented Youth, It Is Imperative to Remove Access Barriers

During the course of the partnership, the museum learned from AFAHS students and teachers about the number of barriers they face in accessing Adler resources, including the museum’s location, difficulty of transportation, admission fees, and a lack of familiarity with the culture of museums. The Adler will continue to explore ways to bring the museum experience directly to the community.

5. Financial Incentives Improve Low-Income Youth Recruitment

The target audience for the Adler is now largely made up of youth from low-income areas, and partnership programs would benefit from compensation or incentives for its participants, even at minimal levels. Offering additional paid internships and stipend-based

programs would enable these teens to feel more financially secure, and make Adler programs more competitive with part-time job opportunities and other paid programs around the city.

A Teen Community Beyond AFAHS

In Year Five of the partnership, while the Adler continued to build an internal, fully-integrated youth community at the museum, the programs developed for and traditionally available only to AFAHS students were opened to other Chicago-area schools—further expanding the Adler’s reach and positive impact on the city’s youth. In the five years since the partnership began, the museum has moved from offering very few teen-targeted programs to engaging more than 600 teens from 20 Chicago-area high schools as participants or active Adler-community contributors.

Adler Youth Program Engagement Numbers, 2009 – 2014*

Program	Year 1	Year 2	Year 3	Year 4	Year 5
Freshman Field Trips	110	110	110	110	96
Operation Airlift	-	110	110	50	41
Volunteers	-	20	20	20	54
Summer Interns	-	12	12	16	16
Astrojournalists	-	-	7	10	10
YLC	-	-	-	7	17
AdlerChem	-	-	-	12	16
Balloon Launch	-	-	-	100	128
Hack Days	-	-	-	-	16
Web-Making Workshops	-	-	-	12	48
Near Space Explorers	-	-	-	-	-
Astronomy Course	-	95	95	-	-
Robotics Team	25	15	15	15	15
TOTALS	135	362	369	352	457

*Does not include attendance at annual Youth Community Bash and Recruitment Events

Today these students choose from multiple experiences ranging from one-time programs designed to increase interest in STEM to extended engagements that build specific STEM skills.

Conclusion: Impact Today and for the Future

The S&C Foundation's generous philanthropy played an essential role in the Adler Planetarium's ability to launch and build a vibrant teen community over the past five years. Today this teen network includes more than 500 youth engaged in STEM and workforce readiness training, and another 150 reached through teen-led programs such as recruitment events and an annual community bash. With the foundation's resources, the museum was able to pilot, learn from, enhance, and expand multiple successful teen initiatives with program components that will continue to positively impact students at AFAHS and other Chicago area high schools.

In the partnership's fifth and final year, the museum continued to grow AFAHS teachers' and students' confidence and independence, while also dramatically shaping the future of the Adler's youth programs. With a robust STEM-pipeline that extends from middle school through undergraduate studies, the museum is building a sustainable model for attracting, engaging, and challenging youth across CPS. The Adler has become a pioneering leader in helping at-risk youth build affinity for STEM careers through the teen initiatives inspired by its Adler/AFAHS Partnership.

At the close of Year Five, AFAHS cadets have become an integrated part of the Adler family, and a large cohort of 2014 matriculating seniors who have been involved with the museum will be attending four-year colleges, many with full scholarships. (See *Appendix III*). The partnership has positioned the museum as a

leader in teen STEM engagement, and had a profound and lasting impact on students who have become full members of the Adler community. 2013 AFAHS graduate Jocelyn Vega wrote in an email to the museum:

"I miss the Adler culture so much! Everyone is great to work with, and I love how involved it is with Chicago's youth...My involvement with the Adler has truly impacted my perspectives and growth outside of the classroom."

-Jocelyn Vega, Cornell University Freshman

The S&C Foundation's support has been vital to the museum's ability to deeply engage a growing youth community in critical STEM enrichment opportunities. It is the Adler Planetarium's plan to continue to expand and deepen its impact on teens through these pioneering programs.

Year Five Detailed Program Evaluation

Evaluation Executive Summary

For the final Year Five evaluation, the Adler worked closely with an external, guest evaluator Kristen Vogt to employ a research methodology and instruments that would best convey the program's impact in achieving its intended goals. Kristen has expertise in museum education and research, and is the manager of education at the International Museum of Surgical Science in Chicago. (See Appendix II.) The Adler also reviewed and analyzed findings from previous program years in developing this final evaluation.

The Adler Planetarium is pleased to report it made significant progress in achieving the AFAHS Partnership goals.

Goal 1: Reinforce positive attitudes towards museums and STEM subjects in all programs;

Goal 2: Build students' STEM-related skills and content knowledge in astronomy and aerospace in all programs;

Goal 3: Provide students with an understanding of the workplace environment and foster essential life and job skills such as public speaking, personal confidence, collaboration, punctuality, and professional appearance through volunteer and internship opportunities, as preparation for success in college and future careers;

Goal 4: Develop a suite of programs that allows for multiple entry points to engender a sense of belonging within the scientific and museum community.

The Adler made progress against all four goals. AFAHS students reported increases in positive attitudes towards museums and STEM, and students who engaged in multiple programs showed more dramatic increases (Goal 1). Students' content knowledge increased through their hands-on experiences with real science in multiple program components and they acquired many new skills (Goal 2).

Over 200 students took part in internships and volunteering opportunities, with reported increases in workplace and life skills, helping prepare the vast majority of AFAHS students who will continue on to post-secondary education (Goal 3). Finally, the Adler has implemented a suite of programs with documented findings that support success in building a strong teen network that feels a part of the scientific and museum communities—achieving the aims of Goal 4.

Additionally, during the course of the partnership, the Adler gained a deeper understanding of the challenges and opportunities with youth programming that targets non-traditional museum audiences. As the customized programs grew, five critical elements for program success emerged. This learning resulted from challenges encountered through programs and through qualitative and quantitative evaluation data:

- The necessity of building relationships across Adler staff, teen participants, and teachers;
- The value of offering a diverse menu of programs with multiple entry points to attract students with different interests and skill sets;
- The impact of including programs that give youth participants autonomy and a direct voice and influence on the museum community;
- The need to recognize and remove barriers encountered by youth, teachers, and schools for accessing Adler resources;
- The importance of offering compensation for youth participants in order to attract teens from a target demographic of non-traditional museum visitors.

Evaluation Methodology

Previous evaluations have already demonstrated positive movement in the Adler/AFAHS Partnership's outcomes, so the Year Five evaluation focuses on assessing the cumulative progress toward each of the four stated goals, and offers a closing discussion on the lessons learned for sustaining the Adler's expanding teen experiences in the future.

Along with analysis of data from the previous four years, this evaluation includes additional qualitative data to support prior findings regarding the impact of the partnership. The data presented in this evaluation is a representative sample of all data collected over the five years of the Adler/AFAHS Partnership. New evaluation data for Year Five includes:

- First-time reporting of focus group data from students of all grade levels, reflecting on their experience with the Adler during high school;
- First-time reporting of focus group data from AFAHS teachers reflecting on their experience with the Adler/AFAHS Partnership.

The Adler was able to assess its progress toward achieving the program's goals and measuring its impact using these data.

Evaluation Instruments

During the Adler/AFAHS Partnership program, the Adler has consistently conducted evaluation for all program components in order to assess student outcomes. All programs incorporated a mix of surveys and interviews at the point of entry, mid-course, or at their conclusion, as was appropriate to the program duration.

Key evaluation instruments used during the five-year partnership include a combination of qualitative and quantitative tools:

#1: Partnership Program Component Surveys, Interviews and Artifacts (Year One—Year Five):

- a. Administered to or collected from all Adler Teen Program participants
- b. Surveys and interviews conducted throughout all program stages
- c. Assess learning and skill development from artifacts submitted by participants

#2: Yearly Post-Survey (Year One—Year Five):

- a. Administered to all AFAHS students at the end of the school year
- b. Assesses student attitudes and engagement with museums and STEM activity

#3: Freshman Pre-Survey (Year Two—Year Five):

- a. Administered to incoming freshman prior to their first visit to the Adler
- b. Assesses student attitudes and engagement with museums and STEM activity

#4: Senior Exit Survey (Year Four):

- a. Administered to all seniors regardless of matriculation or college/career status
- b. Assesses student attitudes and engagement with museums and STEM activity
- c. Assesses student perceptions of the value of the Adler Partnership

#5: Senior Focus Group (Year Four):

- a. Administered to self-selected seniors regardless of matriculation or college/career status
- b. Assesses targeted, open-ended feedback on senior exit survey questions

#6: Teacher Exit Survey (Year Four):

- a. Administered to a sample of all teachers and administrators engaged in the AFAHS/Adler partnership, regardless of current employment status
- b. Assesses teacher engagement in Adler programs and attitudes on program efficacy, reach, relevancy, and outcomes

#7: Student Focus Groups (Year Five):

- a. Administered to self-selected students regardless of academic status
- b. Assesses targeted, open-ended feedback on overall experiences with the Adler

#8: Teacher Focus Group (Year Five)

- a. Administered to a sample of all teachers and administrators engaged in the AFAHS/Adler Partnership, regardless of current employment status
- b. Assesses teacher engagement in Adler programs and attitudes on program efficacy, reach, relevancy and outcomes

The assigned numbers indicate the instruments used for quotes, figures, and tables throughout the report. For example, “Summer Paid Teen Internships (Instrument 7)” indicates these findings are from the Student Focus Groups.

Notes on Evaluation Instruments:

Student and Program Participant Surveys—Surveys continued to be administered throughout the year, including at the beginning and end of the school year, and at the start and end of all Adler youth programs. Surveys were developed and collected through SurveyMonkey and administered either online or on paper. Analysis was conducted using SurveyMonkey.

Program Participant Artifacts—During Adler programs, students frequently produced digital and physical products that represented content or skills gained during the experience. Digital artifacts and photos of physical products can be found at the following websites:

- **Digital Artifacts from Teen Programs:**
<http://teens.adlerplanetarium.org>
- **Adler Teen Instagram:**
<http://instagram.com/adlerteens>

- **Astrojournalist Intern Blog:**

<http://adlerastrojournalists.wordpress.com>

- **Teen-Curated Tumblr:**

<http://adlerplanetarium.tumblr.com>

- **Operation Airlift Photos:**

<http://adlerplanetarium.smugmug.com/Other/Operation-Airlift-2014>

- **Operation Airlift Website:**

<http://operationairlift.weebly.com>

Self-Reported Statements—In the outcomes and measures below, self-reported student statements come from a selection of surveys and interviews that collect open-ended feedback relating to satisfaction level and feelings about the overall partnership program, as well as specific program components such as Teen Internships, Field Trips, and Workshops.

Year Five Student and Teacher Focus Groups—Focus groups were conducted in May and June 2014 by the external evaluator who was unfamiliar with individual students. The evaluator interviewed two groups of eight students and one group of seven teachers across three separate dates. The evaluator conducted the interviews at AFAHS after classes finished for the day, using a Dell laptop to take notes, an iPhone to record the sessions, and NVivo to analyze the interviews.

Student interviewees ranged from sophomores to seniors. Students represented varied ethnic backgrounds and had different levels of experience with the Adler. All students interviewed had participated in the freshmen field trip sequence at the museum at the beginning of their high school career. Students were offered a gift certificate for participation in the focus group.

As valued partners and supporters to the program, the evaluator also interviewed AFAHS teachers who had participated in at least one component of the freshmen field trip program. Teachers came from multi-

Based on five years of evaluation and program implementation, the Adler has identified a number of key components as elements critical to making progress towards the four partnership goals, and for future teen initiatives.

1) Relationship-Building is Critical to Program Health

The value of building strong relationships between all stakeholders—students, teachers, and Adler staff—became apparent early in the partnership. Initial year-end reports from 2010 and 2011 reference efforts to improve this relationship-building by reducing the number of students on field trips and increasing Adler staff time at the school. However, it often was not the STEM content or experiences that got students hooked into the partnership, it was a personal connection with a specific Adler staff person:

“I wasn’t really into science until Dr. Friedman started talking about all these different things. It got my attention when he was talking about all the jobs related to science and engineering and the things people can do, the things they could build.” –Final report, 2011

In the final years of the partnership, interviews with students and teachers continued to demonstrate that staff relationships play a large role in helping students to feel a sense of belonging within the Adler community.

As new schools are brought into the partnerships with the Adler, the museum will integrate relationship building components with key stakeholders such as teachers, administrators, and even student peers. The Adler started allowing teens to bring friends to end-of-year celebration events for interns and volunteers, potentially drawing new participants who already feel a sense of familiarity.

2) Program Diversity Creates Better Opportunities for Student Engagement

Implementing a wide range of programs has proven essential in attracting a broader base of youth who are non-traditional museum participants. This can be seen in the students’ narratives of their experiences at the Adler and AFAHS, as they reference multiple entry points for Adler engagements. Despite whole class experiences, students that had more engagements with the Adler (3+ programs) tended to refer to other programs such as Summer Internships or volunteering as the ones that really got them engaged. The variety of programs attracted students of varying interests and creates diversity in skill-sets. As a teen community, youth are able to learn from each other and collaborate, and to find a place within the museum where they can feel comfortable and confident. Student interviews suggest this approach can change how teens view the museum and their relationship with STEM fields.

The Adler also found providing opportunities for teens to continue relationships with the museum is valuable. The STEM SMARTS college scholarship program, started in 2013, has given teens in the Youth Leadership Council and involved in Adler programs something to aspire to. A former AFAHS student continues to volunteer with YLC, providing mentorship and information about the college experience to younger students. A full suite of programs from freshman year through post-secondary studies will continue to inspire high school students to achieve their STEM career potential.

3) Designing to Empower Youth Increases Impact

Feedback from students indicates they value the opportunity to create their own experiences at the Adler. AFAHS students who felt the greatest impact from the partnership often ended up as YLC members, summer interns, or Far Horizons volunteers. These opportunities called on youth to be active members of

the Adler community by creating and facilitating their own programs, and managing youth-facing programs from the Adler perspective.

Summer internships, Far Horizons volunteering, and the Youth Leadership Council have been invaluable in inspiring youth to continue in STEM fields. Of the six students in STEM SMARTS—a program requiring the pursuit of a four-year STEM degree—five have been involved in at least one of these programs. During the next phase of growth, the museum plans to design new opportunities for a youth voice, particularly in the areas of citizen science and using technology for civic engagement.

4) To Successfully Engage Underrepresented Youth, It Is Imperative to Remove Access Barriers

During the course of the partnership, the museum learned from AFAHS students and teachers about the number of barriers they face to access Adler resources, including the museum's location, ease of transportation, admission fees, and a lack of familiarity with the culture of museums. The Adler will continue to explore ways to bring the museum experience directly to the community.

Providing teachers with buses, students with pre-paid transportation cards, and teachers, students, and families with free admission contribute to lessening barriers to access. During the partnership, AFAHS students have taken advantage of free admission to share the museum with friends and family. Students also noted they would not be able to afford coming to the Adler without transportation cards. These elements should continue in the future.

5) Financial Incentives Improve Low-Income Youth Recruitment

A number of lessons were learned about recruitment. As expected, significantly lower numbers participated in voluntary, outside of school hours, and/or unpaid

programs. When Operation Airlift shifted to a voluntary program, participation rates dropped to approximately 33% of the freshman class. While programs that gave stipends or hourly wages had over three times the number of applicants that could be accepted, programs that were unpaid internships struggled to fill the maximum number of spots. Teachers also brought up concerns about attracting teens who were not already interested in the Adler after freshman year, emerging leaders in their class, or exceptionally good at science.

The target audience for the Adler has largely become youth from low-income areas, and partnership programs would benefit from compensation or incentives for its participants, even at minimal levels. Offering additional paid internships and stipend-based programs would enable these teens to feel more financially secure and make Adler programs more competitive with part-time job opportunities and other paid programs around the city.