

The American Junior Academy of Science: STEM's Fountain of Youth

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Abstract. The American Junior Academy of Science (AJAS) is STEM's Fountain of Youth. The AJAS mission is to enable our nation's best high school science research students to be honored in the presence of and interact with the scientific community whose career paths they wish to follow. The spirit of AJAS is to develop lasting national and global networks of friendships with other similarly motivated future young scientists, as well as with the many scientists and leaders they meet. AJAS encourages inquiry-based science that a DIMISHING number of master science teachers are promoting in the America's education systems.

Keywords. STEM, education, science policy, K-12 competition, secondary education opportunities

Introduction

For at least three decades in the United States, virtually every national report on how to improve the economy has cited the importance of STEM (science, technology, engineering and mathematics) education. Similarly, reports on how to improve STEM education justify their conclusions by saying the economy will benefit from the recommendations.

For decades, the U.S. has put minimal investments in K-12 STEM education resulting in the poor performance of high school students and more students fleeing the sciences. In the effort to reverse this trend, professional educators seek to turn the tide and mount a nationwide response. Buzzwords like 'seamless system', 'alignment with standards', 'lifelong learning' and 'economic competition in a flat world' are now vogue.

There have been two recent national reports: *Rising Above the Gathering Storm* (http://newton.nap.edu/execsumm_pdf/11463) by the National Academies and *Tapping America's Potential* (<http://www.tap2015.org/>) by the consortium of the Business Roundtable. Both reports acknowledge the importance of regional, state and local action (in addition to national action and policies) for both the economy and STEM education.

1. National Association of Academies of Science (NAAS) Initiative

1.1. Organization of NAAS

The National Academies (consisting of the National Academy of Sciences, National Academy of Engineering, Institute of Medicine, and the National Research Council) and representatives of state science academies (NAAS) are exploring ways and means for informing science-based policies that affect education, economic development, health and the environment. The 43 state and regional academies of the National Association of Academies of Science (NAAS) are strategically located at state and local levels where many policy makers in governor's offices, state legislatures and in state government agencies need advice on setting policies that can benefit from the knowledge and judgment of science academy members. NAAS has the framework in place to supporting the future of STEM education.

1.2 Formation of the American Junior Academy of Science (AJAS)

NAAS is the national parent organization for state and regional academies (<http://astro.physics.sc.edu/NAAS/>). It grew from a standing committee of AAAS (American Association for the Advancement of Science, publisher of *Science*) appointed in 1927 and first met as the "The Academy Conference" in 1928. One of the major goals of NAAS is to promote the state-member academies that have developed junior academy of science programs. In 1964, NAAS had the vision of encouraging and developing STEM education at the K-12 levels through its state academies. To this end, the American Junior Academy of Science (AJAS, www.amjas.org) was established that year.

1.3 Purpose and the mission of AJAS

The mission of AJAS is to accelerate the careers of students into the world of professional scientists and engineers. Students who excelled in inquiry-based scientific research were targeted. NAAS supports this opportunity to excite and encourage this diverse group of young scholars, many of whom will go on to become our nation's researchers and engineers.

1.4 Relationship of NAAS/AJAS with AAAS

AJAS is sponsored by NAAS and AAAS (American Association for the Advancement of Science), publisher of *Science*. NAAS organizes the AJAS annual convention working closely with AAAS. The goal is to enable our nation's best high school science research students to be honored in the presence of and interact with the scientific community whose career paths they wish to follow. Individual NAAS members annually donate their time to organize and assure the success of this event.

2. Selection of AJAS Scholars

AJAS brings together our nation's most dedicated and truly serious high school science students, providing them an unparalleled opportunity to meet the nation's top researchers and leaders. Each year, about 120 students nationwide are selected as AJAS Scholars in regional and statewide competitions. AJAS student scholars are actively engaged in their research. They are chosen by senior scientists in their respective state academies to attend at the national meeting of the AJAS. Students were evaluated based on their research, often involving statewide competitions.

3. The annual AAAS/NAAS/AJAS convention

AAAS and NAAS, the sponsoring organization, organizes this annual meeting of AJAS. As members of the scientific community, AJAS students make oral presentations of their research, attended scientific sessions of the AAAS meeting, tour college and university campuses, research labs, as well as historical sites .

3.1 AAAS lectures

AJAS delegates attend lectures and symposia sponsored by *Science* magazine. They have opportunities to meet individually with many of the nation's leading scientists. They may attend sectional meetings where scientists from individual disciplines meet. *For example*, AJAS delegates were on hand in San Francisco when Francis Collins and J. Craig Venter presented the first public presentations of their work on the sequence of the human genome (<http://www.amjas.org/>).

3.2 Tours

There are special tours of local university, governmental and commercial research facilities, as well as historical and cultural sites. AJAS scholars have visited outstanding universities such as Harvard, MIT, University of California Berkeley, Washington University, and the Air Force Academy. Other sites visited include National Institute of Health, Department of Energy, Boeing Aircraft, Amgen Pharmacia, Sigma Chemical, and Monsanto's R & D Center.

Many tours feature our nation's top scientists. *For example*, the tour of the University of Colorado Boulder featured Nobel laureates Eric Cornell and Carl Wiesman. After presenting their research, the Nobel laureates sat with students as they had lunch. In a casual atmosphere, they posed for pictures and got to know the delegates. A human face was painted on the science. For many, the events will confirm and strengthen their educational goals.

3.3 Breakfast with Scientists

Perhaps the highlight of each meeting is the annual "Breakfast with Scientists" at which students spend a morning discussing educational opportunities and career objectives with notable scientists, including Nobel Prize winners. Breakfast invitations are extended to scientists attending the NAAS and AAAS meetings and to faculty at nearby universities.

This year's event was attended by Dr. Warren Washington (National Science Board), Peter Raven (St. Louis Botanical Gardens), Shirley Malcolm (AAAS), and Doe-Sun Na, PhD (President, Korean Science Foundation), Mu Sang Lee, PhD (Head, Science Culture Research Center) and Prof. Kyungpook (National University). One recent event featured seven Nobel laureates!

3.4 Posters

The opening of AAAS exhibits featured AJAS delegates making poster presentations of their award winning research as world's leading scientists discussed their own research. Imagine the thrill of a young, inner city scientist who suddenly realizes that the person reading her poster is the nation's first black Surgeon General, Dr. David Satcher. Or the memory shared by all those who shook the hand of the President of the United States. Waves of excitement went through the AJAS poster session as "Bill Nye, the Science Guy" looked at their posters! Or the excitement of the young teen who finds that the friendly lady next to her at breakfast who seems so interested in her study ambitions is the first woman to head the National Science Foundation.

4. AJAS and "Co-op tition"

4.1 What is "co-op tition"?

AJAS promotes the spirit of "co-op tition"- a combination of cooperation and competition. AJAS student delegates develop strong bonds with each other during their week together at the AAAS national conference. Many of these young scholars report that their interactions are different than those established in high-profile competitive events like the Intel International Science and Engineering Fair. In this spirit of friendship, there is professional, scientific pride in their research-this in the only competitive part of the conference. This is the key to the success of AJAS.

4.2 *The AJAS noncompetitive atmosphere*

In sharp contrast to many of the high profile events held annually for high school students, the AJAS event is noncompetitive. All AJAS student delegates present their research both orally and in scientific poster session format for the sake of scientific communication, not prizes.

- AJAS Scholar Doug Lavanture describes AJAS in this way: *“What made AJAS truly defining for me is that the competition was completed before the actual presentations and the conference began. Because of this, the discussions the students fostered and our commitments to science could remain more pure--more authentic. It certainly felt as if we were entering a more professional realm, as the process mirrored what would be experienced by professional scientists.”*
- *“We all were able to unite under a common passion, and instead of fighting for money, for prizes, for prestige, we all entered at the same level and were instead able simply to bond and to share something which we all deeply cherished—science. The activities outside of the poster presentations themselves—the activities, the trips—helped to cultivate personal bonds between the students, many of which continue today. And even within the conference events themselves, being surrounded by professionals in all of our respective fields without the air of overwhelming competition experienced at intensely competitive events allowed us to more effectively communicate with some of the most respected scientists in the world—and with each other. It was an experience unlike any other.”*

Students who are the AJAS delegates form lasting global networks of friendships with other similarly motivated future young scientists, as well as with the many scientists and leaders they meet. The AAAS Meeting provides student delegates an exceptional opportunity to meet and interact with leading scientists from disciplines that span the life, physical, and social sciences, as well as engineering.

5. AJAS Convention Costs

Financial sponsorship reduces the overall cost for individual students, as well as make possible scholarships and other forms of financial assistance to those who might otherwise not be able to participate. NAAS is a not-for-profit [IRS 501(c) (3) tax exempt] organization with an annual income of \$3500 from dues assessed to state academies. This amount covers NAAS annual operating expenses only.

5.1 Volunteer based

The NAAS Board of Directors oversees activities planned and executed by a national cadre of volunteers who serve on various AJAS and NAAS committees. These volunteers include high school science teachers, delegates from state academies, and college and university faculty from across America. Individual NAAS members annually donate their time to organize and assure the success of this event. There are NO salaried personal within NAAS/AJAS- this is all accomplished by volunteers.

5.2 Sponsorships

All costs for the AJAS event must be borne either through financial support from our sponsors or through the fees paid by individual student participants. Corporate, foundation and institutional financial sponsorship reduces the overall cost for individual students, as well as make possible scholarships and other forms of financial assistance to those who might otherwise not be able to participate. Private sponsors have donated money to cover some events but these donations are short term and leave more than 90% of AJAS activities self funded by students and teachers.

5.3 Cost to each participate as of 2007

More financial support means that more students are able to afford to participate. About 150 AJAS student delegates and 75 AJAS chaperones (often their teachers) attend the annual AJAS meeting; each participant must raise their own funds. On average, they pay about \$600 for the AAAS and NAAS registration fees (on-site housing, meals, tours, local transportation) and about \$600 for travel and meals to/from the meeting site.

5.4 Teacher/mentor incentives

A growing crisis in inquiry-based science is that a DIMISHING number of master science teachers are in the education systems that have the expertise to keep research program going in their schools. As the experience teachers leave, few step forward to take up the mantle of inquiry-based science. There are little or no incentives for these teachers. The NAAS/AJAS conference is the few national rewards for teacher and student. But, in many cases, convention expenses are not covered. Over the past few years, the number of students that are encouraged to do high school has plummeted. Clearly, our long term goal is to actively change pursue funding for both educators and students.

6. Conclusions

The American Junior Academy of Science is STEM's Fountain of Youth. Since its founding in 1964 the AJAS has touched the lives of thousands of students, most of whom have advanced degrees and now lead the world in research, education, engineering and medicine. AJAS is a proven success story in American STEM education. AJAS seeks long-term participation in American future by providing this exceptional opportunity to the nation's and the world's future scientists. AJAS will continue to support these worthy students and teachers by continuing to offer them an educational opportunity far beyond what they could receive from any single school activity. The answer to the "gathering storm" in STEM education will not be a simple solution, but a combination of effective policies. AJAS is a very effective policy.

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