



# Youth Astronomy Apprenticeship: Future Leaders

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# What and for Whom

- Out-of-school time (OST) initiative to foster science learning and 21<sup>st</sup> century employable skills among urban teenage youth (age 15-19).





# Why Urban Teenagers?

- In 2005 the average high school graduation rate in the nation's 50 largest cities was 53%, compared with 71% in the suburbs.

Ref. Cities in Crisis 2009: Closing the Graduation Gap. Report prepared for America's Promise Alliance, April 2009.

- As many as 40% of the nation's high school graduates lack work habits, ability to read and understand complicated materials, and math, science and writing skills, making them inadequately prepared to deal with the demands of employment and postsecondary education.

Ref. Rising to the Challenge: Are High School Graduates Prepared for College and Work?, Achieve, Inc. 2005.





# Why Urban Teenagers?

- Groups underrepresented in STEM often have the greatest educational needs, but they tend to be the least well served by the K-12 educational system. They are less likely to undergo early exposure to professionals and work environments related to STEM.
  - This lack of “social capital and status” is often a critical factor that prevents young people from getting the advice and support to pursue the preparation for future work in STEM fields.
- Ref. Pathway to STEM Careers: Preparing the STEM Workforce of the 21st Century, Final Workshop Report, NSF, 2005.





# Why Urban Teenagers?

- Among populations underrepresented in STEM, older youth are often underserved by OST programs because they require programming conditions, both programs offered and expertise of adult staff involved, different from those that serve younger children.

Ref. Hall and Gruber, 2007.

- Growing consensus that high-quality OST programming for older youth is an important tool to meet the need for increased engagement and success in high-school, enrollment in college and overall chances to become a productive member of society.

Ref. Friedman & Bleiberg, 2007.





# Why Urban Teenagers?

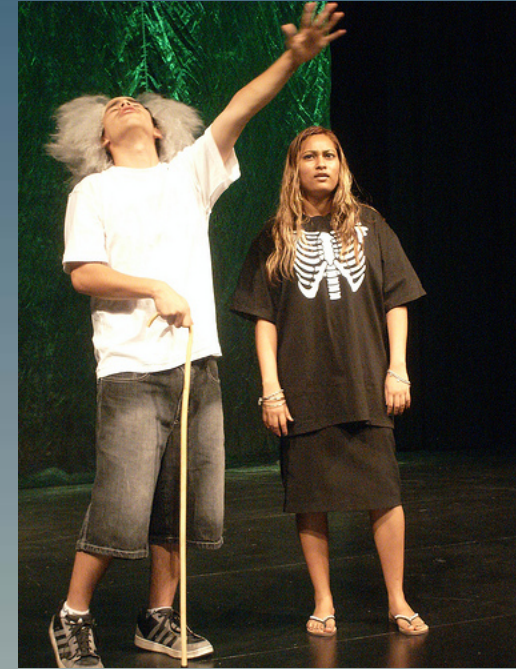
Because to promote the well being and access to a quality, well-rounded education for all teenagers in our society is a matter of social justice as much as it is in our society's best interest.





# Rationale

- For science learning to have a lasting impact on the life of older youth, it has to be integrated with the youth's personal development process so to be fully owned by the learner.





# YAA Approach to Science Learning

- Learning science is meaningful
  - When I share my knowledge with others
  - When I develop skills that I would not have developed otherwise
  - When I value science and the scientific enterprise because it affects my life, society, the world
  - When I realize that I can pursue a career in science if I want to
  - When I learn from professionals (in science but not only ....)





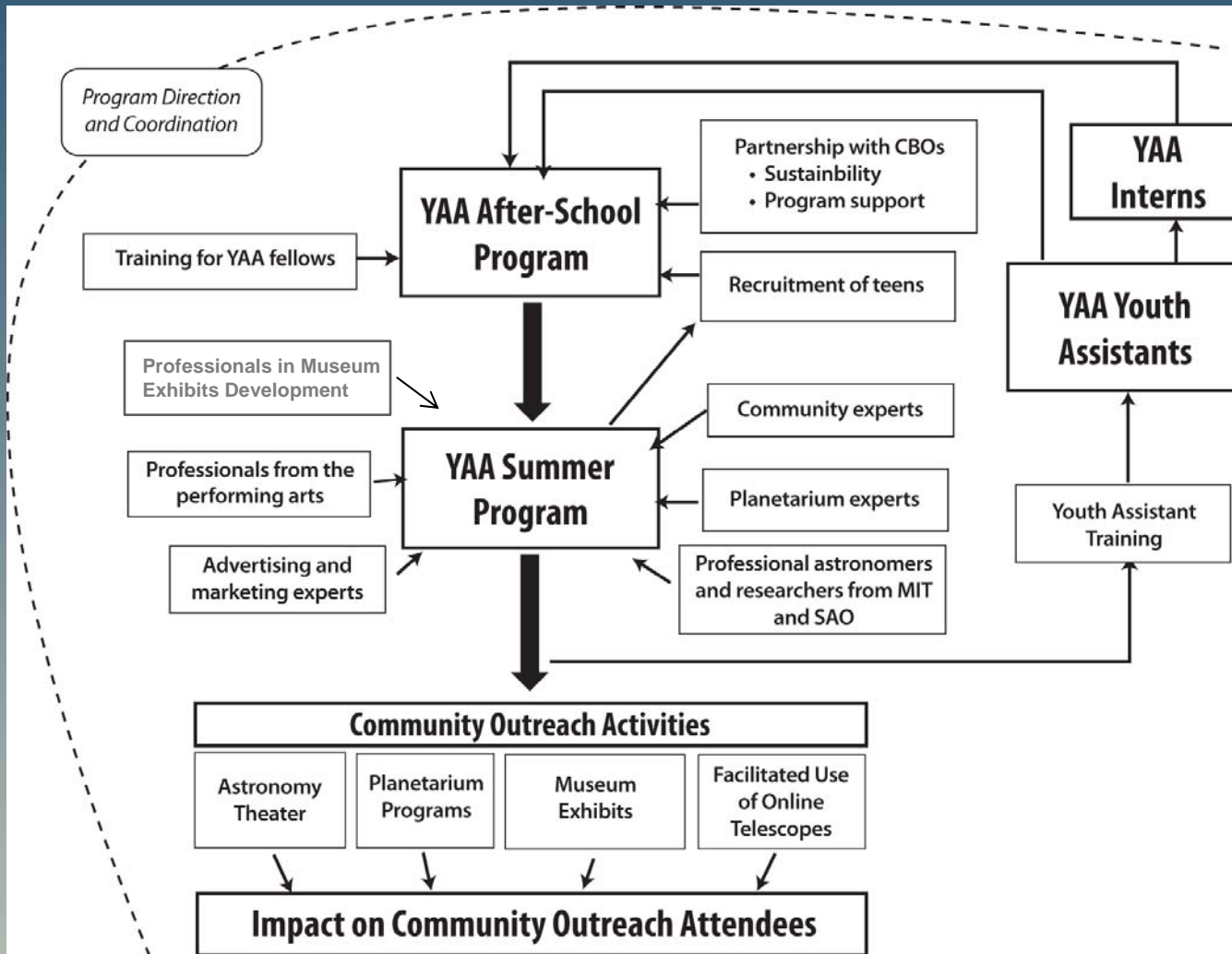


# **Apprenticeship Model**

- **After-School Program: Youth as Trainees**
- **Summer Apprenticeship Program: Youth as Apprentices**
- **YAA Outreach Program: Youth as Science Ambassadors**
- **Youth Assistant Program: Youth as Agents of Change**
- **YAA Internship: The Future Generation of YAA Instructors  
and Informal Science Educators**
- **Apprenticeship in “Informal Science Education” vs. “Science”**



# YAA MODEL



# Summer Apprenticeship

- Youth develop new science understanding and technical skills as they develop personal and interpersonal skills needed to fully participate in the life of our society.





# Summer Apprenticeship: Working with Professionals

- Scientists and science educators from MIT and Harvard
- Members of the amateur astronomy community
- Members of the Underground Railway Theater – a theater company
- Staff from Jeff Kennedy Associates - a museum exhibition design and planning company
- Staff from the Planetarium at the Boston Museum of Science
- The director of Think Collaborative - a local marketing and advertising company
- Key Ingredient: YAA Instructors/Facilitators/Mentors to provide continuity and to build YAA community







# Evaluation Overall Findings...

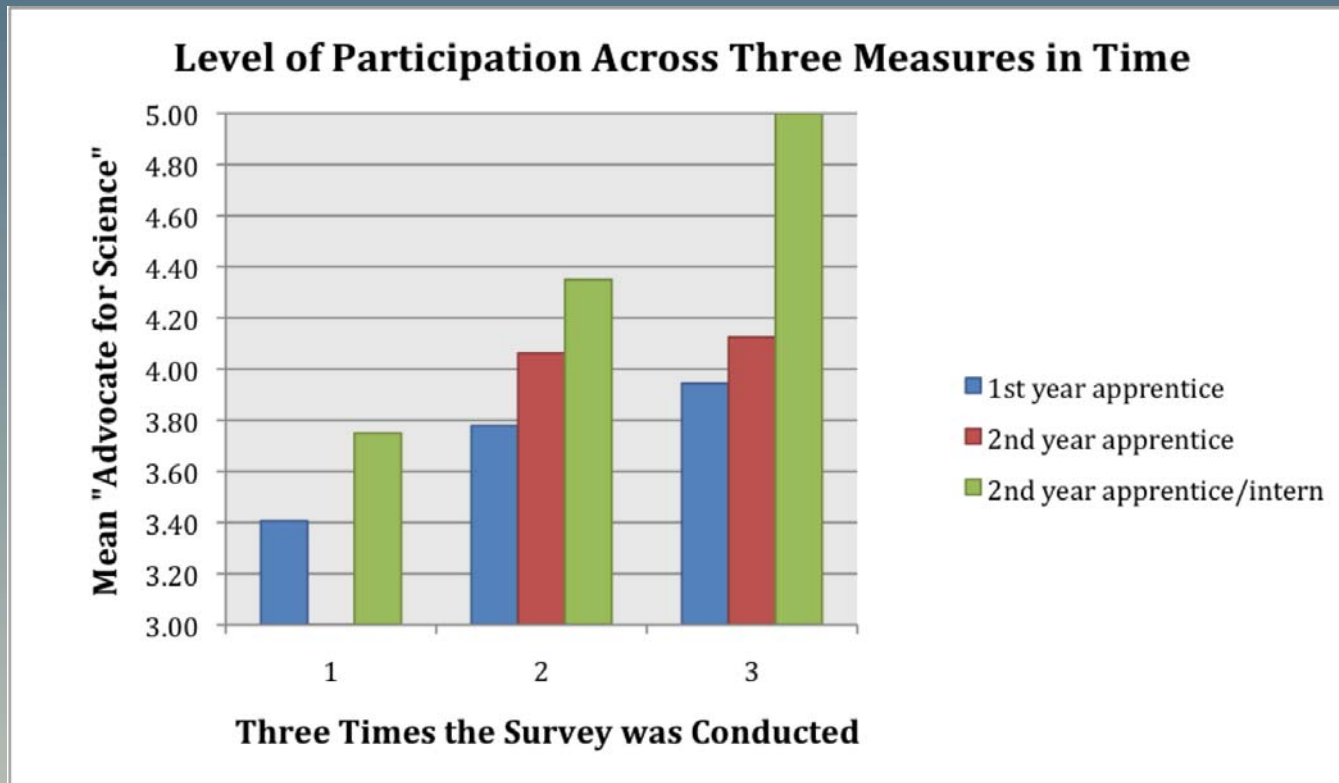
- Increased scores throughout the program year and higher scores for those participating for multiple years for:
  - ✧ Scientific Habits of Mind
  - ✧ Knowledge of Astronomy
  - ✧ Commitment to Science
  - ✧ Understanding of Science and Astronomy
  - ✧ Personal and Interpersonal Skills
    - Leadership in Science, the strongest indicator for Personal and Interpersonal Skills, had the largest increases in scores for all youth.





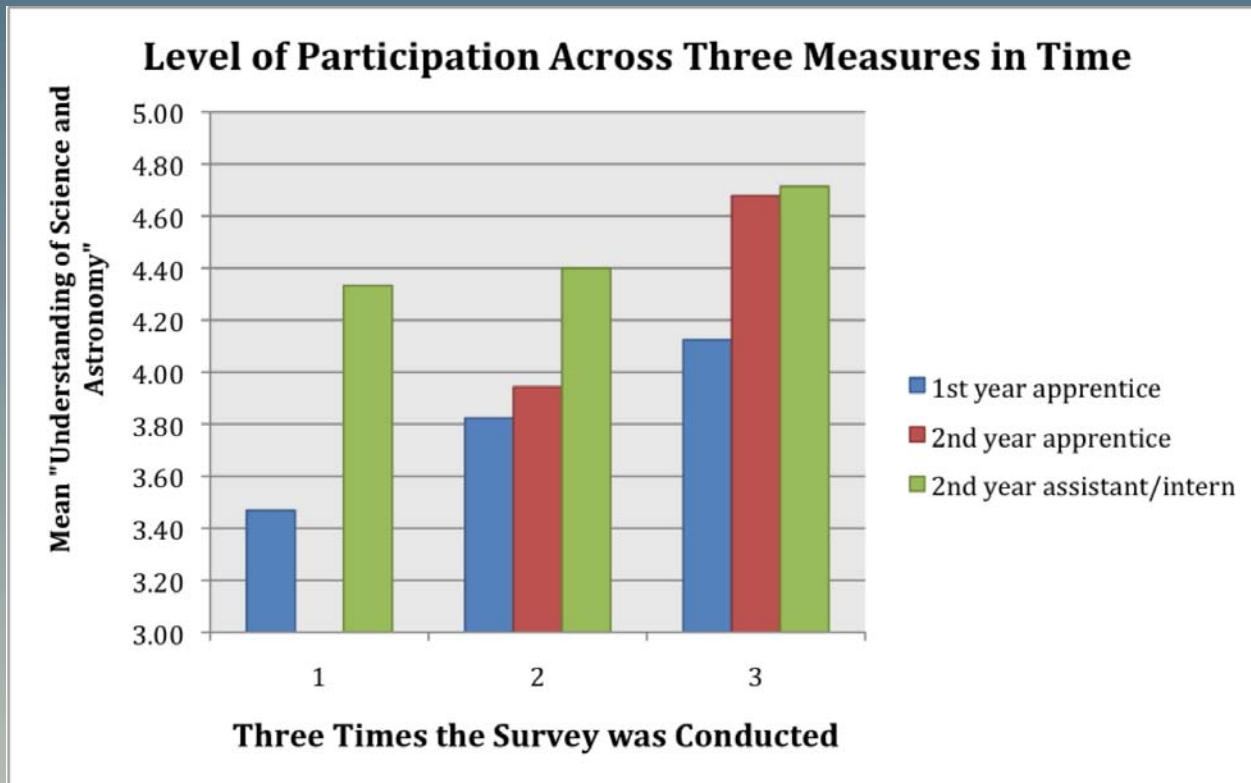
# Evaluation Results:

## Advocate for Science



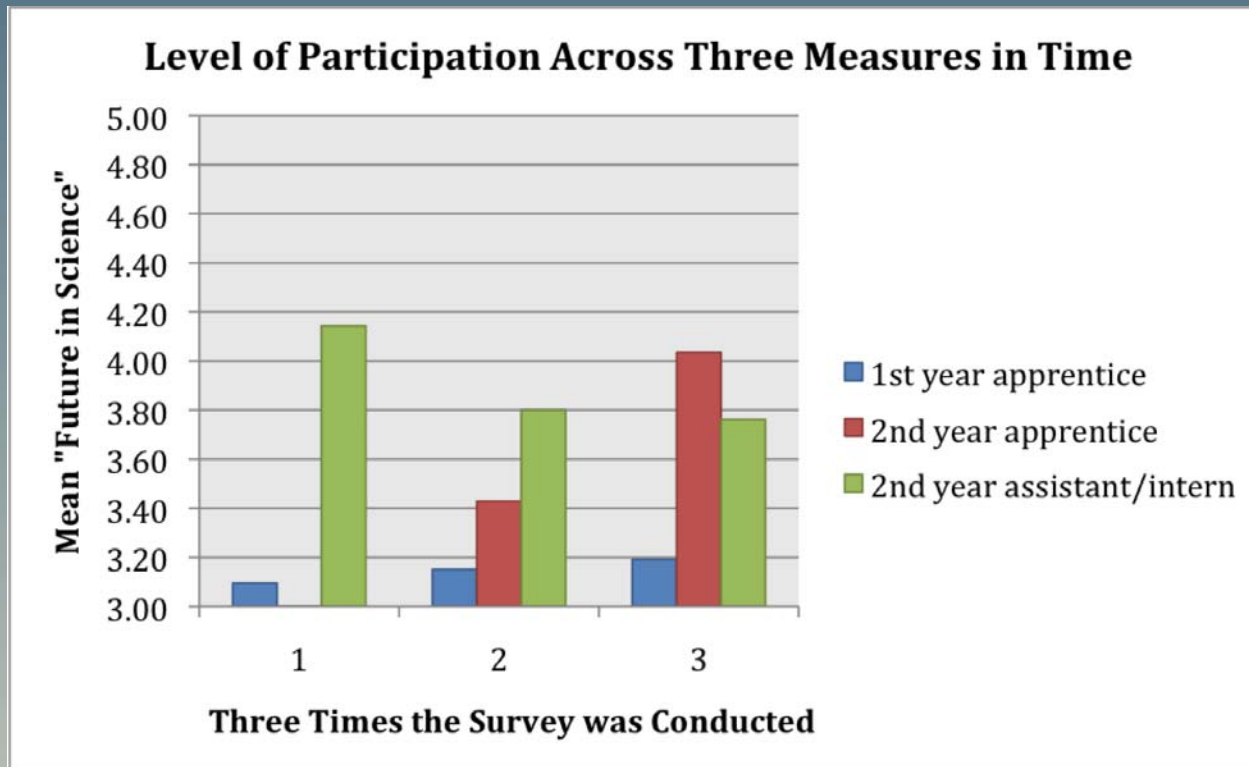
# Evaluation Results:

## Understanding of Science and Astronomy



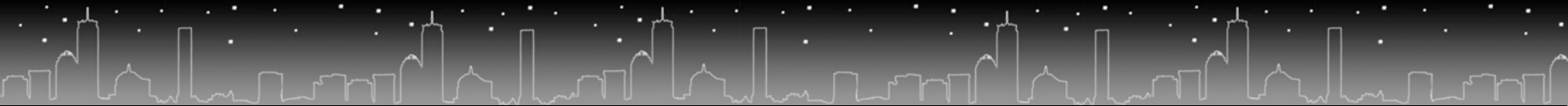
# Evaluation Results:

## Future in Science




**TABLE2: Descriptive Statistic from Third Administration of the Youth Questionnaire:  
By 2<sup>nd</sup> Year Youth Assistants and Interns**

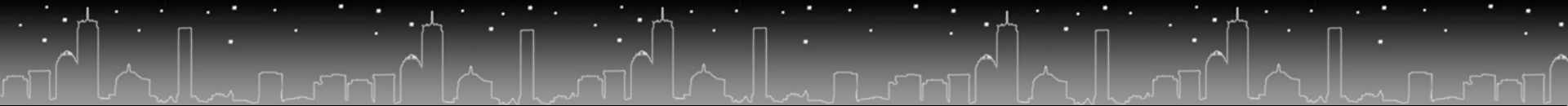
	All Youth		1st Year Apprentices		2nd Year Apprentices		2nd Year Youth Assistants/Interns	
	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD
Advocate for Science	4.1	0.7	3.9	0.7	4.1	0.6	5.0	0.0
Understanding of Science and Astronomy	4.3	0.4	4.1	0.3	4.7	0.2	4.7	0.3
Leadership in Science	4.0	0.4	3.7	0.6	3.9	0.5	4.7	0.2
Astronomy Knowledge	4.4	0.4	4.1	0.4	4.8	0.2	4.5	0.3
Positive Youth Development	4.1	0.3	4.1	0.4	3.9	0.3	4.3	0.1
Internal External Focus	4.0	0.7	3.9	0.8	4.2	0.5	4.2	0.4
Scientific Habits of Mind	4.0	0.4	4.0	0.4	4.1	0.7	4.2	0.4
Commitment to Science	3.7	0.7	3.5	0.7	4.1	0.6	4.2	0.5
Self Esteem	4.0	0.5	3.9	0.7	4.1	0.3	4.1	0.2
Communication	4.0	0.5	4.0	0.6	4.0	0.2	4.0	0.3
Teamwork	4.1	0.5	4.3	0.5	3.9	0.3	3.9	0.4
Future in Science	3.4	0.9	3.2	0.9	4.0	0.8	3.8	0.9



## Descriptive Statistic, Youth Questionnaire - 1st Year Apprentices (average of three administrations)


	N	MEAN	STD. DEVIATION
Teamwork	64.0	4.1	0.7
Positive Youth Development	64.0	4.0	0.5
Scientific Habits of Mind	64.0	3.8	0.4
Communication	64.0	3.8	0.6
Internal External Focus	64.0	3.8	0.8
Astronomy Knowledge	64.0	3.7	0.5
Leadership in Science	64.0	3.7	0.6
Self Esteem	64.0	3.7	0.7
Understanding of Science and Astronomy	64.0	3.7	0.5
Advocate for Science	64.0	3.6	0.8
Commitment to Science	64.0	3.3	0.7
Future in Science	64.0	3.1	0.9





**Descriptive Statistic, Youth Questionnaire –  
2nd Year Youth Assistant and Interns (average of three administrations)**

	<b>N</b>	<b>MEAN</b>	<b>STD. DEVIATION</b>
Astronomy Knowledge	11.0	4.5	0.3
Understanding of Science and Astronomy	11.0	4.5	0.2
Advocate for Science	11.0	4.4	0.8
Leadership in Science	11.0	4.3	0.5
Scientific Habits of Mind	11.0	4.2	0.4
Internal External Focus	11.0	4.2	0.4
Positive Youth Development	11.0	4.1	0.3
Commitment to Science	11.0	4.1	0.6
Communication	11.0	4.0	0.3
Self Esteem	11.0	4.0	0.4
Teamwork	11.0	3.9	0.3
Future in Science	11.0	3.9	0.7







# One of the YAA 1<sup>st</sup> Year Apprentices:

I honestly expected way back when I first applied to be part of the program that wouldn't be fun, but just be able to make money.

This expectation took a U turn however, because after joining the program, it was like the money came second and the program about astronomy came first.

I never expected to be doing such activities and having fun working with professionals. This was far from what had thought what the YAA program would be like.





# Three YAA Interns:

“YAA has helped me with realizing what is needed for my life to be successful in the future. Before I was with YAA I didn’t possess the passion and will power for college and to further my education, but now I have a joy for embracing the process of obtaining different types of knowledge.”

“Now I know that if it is my dream to become an astronomer that there is a person out there that is willing to help me get there. I have an idea now on what it takes to survive out there in the real world which is all about being responsible and get done what is asked of you but the most important of all to me is to do something that I enjoy doing, something that allows me to grow and be a better person over all.”

“When I was presented with a challenge I instantly felt overwhelmed and burdened. Attending YAA helped me develop a new prospective, now I welcome challenges realizing they will only help me grow as an individual.”





# Implications of inaction

- Impact on society:
  - Potential increase in high school drop-out rates, lack of skilled workers, potentially fewer people with well paying jobs and thus less tax revenues, etc. etc.
- Impact on individual human beings is much grater:

*“Education has no higher purpose than preparing people to lead personally fulfilling and responsible lives. Science education should help students to develop the understandings and habits of mind they need to become compassionate human beings able to think for themselves and to face life head on. It should equip them also to participate thoughtfully with fellow citizens in building and protecting a society that is open, decent, and vital.”*

*(Science for All Americans, AAAS, 1990)*





# Organizations Involved in YAA

- MIT Kavli Institute for Astrophysics and Space Research – Education and Outreach Group (PI Institution)
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- Timothy Smith Network
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