# 4-H SET Afterschool Program


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## Abstract

The 4-H SET (science, engineering and technology) Afterschool Program is delivered throughout the year, including 18 weeks during afterschool hours at three school-based sites and five weeks during the summer at seven sites, reaching over 300 youth with 20 hours of project driven science learning. Innovative ways of delivering SET programming were piloted to develop 4-H Science Abilities and leadership skills, promote an interest in science careers, and partner with the community to enhance educational readiness. Partnering for program delivery is emphasized to leverage networks, resources, and opportunities to reach youth traditionally overlooked by science programs, including girls. Topics include exploring scientific methods, 4-H Aerospace, and 4-H Digital Storytelling. Several evaluation strategies were implemented at different phases of the program including: the Youth Engagement, Attitudes, and Knowledge (YEAK) Survey (see *http://www.4-h.org/resource-library/professional-development-learning/science-training-guides-resources/*), authentic evaluation, skill-a-thon, interviews, and focus groups with 6th grade girls. Outcomes include the establishment of 4-H SET Afterschool Clubs, teens recruited to mentor and teach younger youth, and new opportunities for youth to be involved in science programs.


## Program Needs

The Houston 4-H SET Afterschool program is aligned with state and local efforts to improve science and math achievement among youth attending Precinct2gether Inc. extended day programs in east Harris County Precinct 2. Texas ranks 29th among states graduating students into careers as scientists, and ranks first in the number of high-tech jobs lost between 2000 and 2005. Science education achievement gaps continue to be significant among economically disadvantaged youth. In Texas, economic development is dependent on sustaining a workforce with scientific and technological expertise. Texas AgriLife Extension Service partnered with Harris County Precinct 2 Youth Services to impact educational readiness in science, engineering and technology with afterschool enrichment to improve academic success and future college education opportunities for youth in those fields.

## Targeted Audience

The program targets middle school age minority youth attending school in Galena Park Independent School District. Ninety percent of these youth are from Spanish speaking families residing in the highly industrialized and impoverished areas of east Harris County.

## Program Goals and Objectives

The 4-H SET Afterschool program was implemented to provide youth at risk for academic failure with opportunities to participate in program areas including computers, aerospace, science filmmaking, and scientific method hypothesis testing.

The program goals are to:

1. Support academic enrichment for Science Abilities with opportunities to participate in science, engineering and technology projects.
2. Increase interest and explore careers in science, engineering and technology fields.
3. Improve leadership, life skills in critical thinking, communication, teamwork, goal setting, responsibility, life-long learning and positive attitude.
4. Partner with teachers and community leaders to promote family inclusiveness in the educational readiness process.
5. Establish 4-H Afterschool project clubs to expand the 4-H SET experience and develop caring relationships with adults.

## Program Design/Curricula and Materials

The program design evolved over two years with feedback from site staff, youth, and data from evaluations. Content and topics were selected to fit with youth interests. Most youth will tell you they love science stuff if it is messy, does something weird or blows up. A series of stand-alone activities which do not require prior knowledge were introduced in the first six weeks of the program to explore scientific methods. Sessions that appealed to both boys and girls included: making goo, seven layer density, and colored milk. Youth work cooperatively in "science pods" to perform experiments, test hypothesis, and record data in a lab book.

Sessions to support scientific methods were adapted from teacher lessons on websites. During each activity, groups reflected upon the activity, shared and answered questions to explain what they discovered. Topics evolved from those aligned with the scope and sequence for 5th grade science, to youth centered topics and activities. Youth expressed an interest in the environment. *The National 4-H Science Day Experiment curricuulum* was used to explore issues such as Bio Fuels, Oil Spill Clean Up and 4-H2O. More complex project driven activities were added as the program progressed and youth gained confidence with the scientific method. A 4-H Aerospace series culminated in a Speed Lab Skill-A-thon that reinforced leaning concepts on the "forces of flight."

Engineering design challenges were implemented to promote team building, communication and problem solving. The challenges support inquiry based learning which is non linear unlike the scientific method's step-by-step approach to problem solving. Technology was interjected into the science learning process with filmmaking. The 4-H SET Digital Storytelling project included completing 4-H Filmmaking Modules online, researching a science issue impacting the community and producing a short film with a "call to action." Different approaches to evaluation were considered at each phase of the program including authentic evaluation of science lab books, quality of projects completed, and direct observation of 4-H Science Abilities.

## Knowledge and Research Base

Research shows that school-based afterschool programs designed to supplement the school day run the risk that youth will not be motivated to participate (Yholem & Shouse, 2009). Most experts agree 4-H science programs need to be informal; they cannot look or feel like school (Schwarts & Noam 2004). The experiential "learn by doing" model is the "Fun Factor" catalyst for afterschool science learning. Com-

mon characteristics shared by successful programs include, support for learning through mentoring, co-operative learning, and connecting youth to community (Peterson & Silbi, 2007). The program trained teenagers to mentor youth projects, used group project work to facilitate learning, and established 4-H clubs to nurture science learning. 4-H SET Afterschool implements activities that support development of 4-H Science Abilities (National 4-H Council, 2008), is aligned with the 2009 National 4-H Council Science Logic Model (National 4-H Council, 2009), and meets the requirements of the 4-H Science Program Checklist.

One checklist requirement is inquiry-based learning. Staff facilitate discovery. They do not ask too many questions, or provide too much information. Youth have time to test their ideas and time for interaction. They can manipulate materials and repeat experiments to test different variables. Project based learning opportunities help youth build on the knowledge base gained from stand alone activities, and help them apply what they learned to complete more challenging projects (National 4-H Council, 2009). Projects are introduced to support engineering and design skills, and deeper investigation of science phenomenon.

## Partners

The Harris County 4-H Urban Youth Development program partnered with Precinct 2 Youth Services and Precinct2gether Inc. to deliver weekly 4-H science afterschool programs at three sites, reaching 75 youth. The program also conducts five-week 4-H Science Summer programs at six sites reaching over 300 youth. The partnership was cultivated over several years by introducing new resources, collaborating on summer staff training, and establishing a planning team consisting of Extension and Precinct 2 Youth Services administration staff that meets monthly. Extension 4-H staff attend Precinct 2 Youth Services administrative meetings to assist with the program planning, suggest resources, curriculum, and plan training for site staff to improve program delivery. Common program goals were identified in the planning process, and the team collaborated to pursue additional funding to support new educational opportunities for youth.

## Funding

In 2008, Texas AgriLife Extension Service, Texas 4-H, Harris County 4-H Youth Development Program and Harris County Precinct 2 Youth Services collaborated to secure a National Institute of Food and Agriculture (NIFA), USDA Children Youth and Families at Risk (CYFAR) Strengthening Communities Grant to fund 4-H Ready SET Go for Educational Preparedness. The grant funds a full-time program assistant, travel, professional development, and resources for program delivery. In addition, Harris County Precinct 2 Youth Services secures funding through Precinct2gether Inc., a 501(c)3 to fund staff for their extended day school-based programs, which provide help with homework, recreation, and afterschool enrichment programs.

## Staffing

Precinct 2 Youth Services coordinates site staff, consisting of teachers paid for extended day programs and student aids recruited from area high schools. Extension staff provide lesson plans, resources, and conduct sessions with support from site staff. Site staff gain practice working with science content delivery, and duplicate the session with additional youth. Summer programs are expanded to six additional sites. Extension personnel train summer staff, and provide lessons, resources and teaching plans to support program delivery by site staff. In addition, Extension staff conduct programs with middle school youth at two sites, staffing with teenagers as cross-age teachers and mentors for projects. This strategy builds capacity and expands program outreach to new youth.

## Program Delivery

A series of six experiments to explore scientific methods were conducted by youth working in "science pods" to identify characteristics of acids and bases, liquids, and chemical reactions. Youth performed experiments, recorded results in lab books and made conclusions about the results. The following year, a series on the Diet Coke Mentos experiment followed a science fair project format, with youth performing the experiment, testing different variables, recording measurements, collecting data and producing a video to explain the chemical reaction.

The 4-H Aerospace series was a combination of stand-alone activities with similar knowledge and skills that reinforce learning from the previous experience. Youth completed five sessions from Aerospace Adventures (National 4-H Cooperative Curriculum) on the "forces of flight" to design parachutes, straw rockets, balloon rockets and balloon shuttles. Teams recorded test data and responded to questions on worksheets. At each session, teams were awarded points for completing activities to qualify for the Speed Lab Skill-A-Thon. The top five teams competed in the Speed Lab Skill-A-Thon, and others were assigned duties as trouble shooters, looking for "what went wrong." Each team had one hour to construct a JET-STREAM balsa wood airplane powered by competition rubber band motors and conduct speed lab tests. Site staff served as judges, using a checklist to identify specific 4-H Science Abilities, such as problem solving, building and constructing valid tests, and drawing conclusions. Each team turned in Speed Lab reports, calculating distance and speed to earn points. The top five placing teams were ranked and youth received prizes, certificates and ribbons. The next week all youth participated in the Skill-A-Thon. Each child received certificates and resource books from the 4-H Aerospace program.

The 4-H SET Digital Storytelling project required youth to work in production teams, complete a series of online 4-H Filmmaking Studio modules, identify and research a science issue impacting their community, and produce a short film with a "call to action." This project, conducted in both afterschool and summer programs, included over 20 one-hour sessions and extra support to ensure completion. Environmental issues identified by youth included: recycling at school, styrofoam trays, the oil spill, sea of trash and air quality in Houston. Producers of Houston's Green Spot surveyed peers, collected data on a questionnaire, created a pie chart and interpreted results on school recycling attitudes. They produced a debate exploring both sides of the issue and asked peers to do more recycling to protect the planet. Teenagers from the high school media department were trained to work with each production team and mentor projects. As part of the inquiry based learning experience, a panel of experts was interviewed by youth, and field trips were made to area agencies addressing science-based issues. These activities connected youth to the community and a network of professionals with careers in science-related fields.

Six engineering design challenges were introduced throughout the year to engage teams in cooperative learning to solve problems. Youth were challenged to build a bridge out of newspaper, design a protective container for the "egg drop" contest, and make a space rover from recycled materials to explore Mars. These challenges were rated high on the "Fun Factor" as favorite activities by youth, and site staff reported kids were learning to work together on problem-solving strategies.

## Recognition of Participants

Recognition is given for both completion of a project or series of sessions and for achievement in an event. A chance to participate with peers on a winning team promotes cooperation, teambuilding, and a sense of achievement. Contests, challenges and skill-a-thons motivate youth to complete projects and provide opportunities to recognize youth. Both site staff and youth agree that recognition with prizes, ribbons and certificates helps participants feel a great sense of accomplishment. Certificates and resource books are awarded at the end of an educational series to extend the learning with families and siblings at home. The summer program includes a showcase of youth projects, with families and key stakeholders invited to celebrate youth achievements. In addition, leadership opportunities and titles are awarded to "top teams." Groups who complete tasks are offered special assignments such as assisting with project set-up, roles as lab assistants, or called on to demonstrate an experiment. Feedback from site staff suggests that it is important to find ways to recognize youth every day for participation.

## Program Evaluation and Outcomes/Impact

The 4-H SET Afterschool and summer programs reach over 300 minority youth annually, providing opportunities to participate in science programs, and have trained 35 site staff to support delivery of project based science activities. Several methods of evaluation are used to measure outcomes and guide program design. Considerations for evaluation included using a variety of methods with direct feedback from youth and staff.

A Pre/Post SET Abilities Survey provided inconsistent results as ESL youth struggled with understanding terminology. Authentic evaluation data collected from 4-H SET lab books provided weekly reference on 4-H Science Abilities: answer and form questions, record data, test hypothesis, and make observations about each scientific experiments. This information was used to adapt activities for youth struggling with English as a second language by increasing visuals and adding support materials for science literacy.

In January 2009, a 4-H SET Aerospace Speed Labs Skill-A-Thon was conducted to observe 4-H Science Abilities as youth worked in teams to construct and fly a JETSTREAM Balsa wood plane tethered to a pylon. Forty 5th and 6th graders worked in teams to construct the planes, set up pylons and set the tether to the plane wing for flight trials. Site staff used check sheets to record 4-H Science Abilities observed, and assigned scores on a scale of 1 to 5 for the following: (a) solved problems/developed solutions, (b) constructed adapted plane designs, (c) conducted timed flight tests, (d) measured distances, (e) recorded data, (f) performed calculations, (g) used verbal and written communication skills, and (h) drew conclusions after each flight. Sixty two percent of youth scored over 75 of 100 points demonstrating 4-H Science Abilities. Staff noted youth used problem solving skills, ingenuity and resourcefulness to finish the Speed Lab trials.

In April 2009, a survey of participants and site staff was conducted. Both written and videotaped responses provided information to assess client response to the program. Sixty-three youth and six site staff responded to open-ended questions: What do you like best about the program, what do you like least, what did you learn, and what would you change about the program. The "Fun Factor" was reported by 95% of the participants to be "what they liked most about the program," followed by, "we get to do experiments," and "I like the engineering and aerospace activities." The least favorite part of the program was, "too much writing," which referred to the lab books, and "not enough time." Youth indicated they learned, "how to make gliders fly better" and "make ex-

periments and follow directions." Staff reported they observed youth were excited about the activities and that the youth were working together to complete projects.

Summer 2010, the 4-H SET Digital Storytelling Project engaged youth in the process of making a short science film on an issue impacting their community. They worked in production teams to research the issue, narrow the focus of the film and identify a call to action. Six films were produced on issues ranging from air quality and recycling to the oil spill clean-up in the Gulf. The Youth Engagement, Attitudes and Knowledge (YEAK) Survey was administered at the end of 20 hours of programming. Eighty-four percent of participants responded "usually or always" to questions on critical thinking. Teen teachers worked with youth on all phases of research, planning, filming and editing the project. They reported that youth were excited about their films, shared roles and worked together to get the job done.

An important outcome was to connect families and staff to the 4-H SET program. In 2010, 4-H SET Afterschool Clubs were established at two sites. Youth elect officers and provide leadership for recreation and service projects. Clubs meet once a month with site staff serving as club advisors. The establishment of 4-H Clubs increased youth interest in 4-H science projects and motivated youth to take on leadership roles in the program.

## Evidence of Sustainability

Partners are committed to planning for program sustainability and work to secure funds, leverage resources, and develop volunteers to support program delivery. Extension 4-H staff attend monthly program planning meetings and bring expertise for science program development. A network of civic organizations, local businesses and industry are invested in the Precinct2gether Inc. extended day program, providing funding to expand the educational outreach. Through this collaboration, new ideas for better ways to partner with other networks are developed, and new opportunities to bring more comprehensive science experiences to youth are possible. Plans for program expansion include establishing new 4-H SET Afterschool programs at area feeder schools serving higher grade levels. This will provide youth currently involved in 4-H SET an opportunity to stay engaged with the program through high school.

## Considerations for Replication

The 4-H SET Afterschool Program is a work in progress. It is expected that adjustments may need to be made, and it is important to listen to partners at all levels from administration to site staff, and work toward common goals for program successes. Partnering with established afterschool programs provides a sound foundation for collaboration. Building relationships with site staff at each school site is important to the success of any program. Extension 4-H staff conduct workshops to train site staff, work "shoulder to shoulder" with them on program delivery, and consistently ask for feedback. This support in the field at school sites, working one-on-one with site staff provides valuable information for the planning team as changes are made and new programs are initiated.

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