



Union County 4-H Summer Science Program

Abstract

The Union County 4-H Summer Science Program of Rutgers Cooperative Extension, New Jersey, seeks to develop interest in science and science careers in low-income, elementary school youth. (In Union County, NJ, the majority of low income children live in the urban parts of the county.) Since 1992, for seven weeks each summer, 4-H science teachers travel from the 4-H Center to independently run day camps in low-income areas of Union County. There, they share science activities with the children. Activities emphasize experiential learning about the process of science. Recent lessons have been taken from the *Design It!* and *Acres of Agriculture* curricula. The day camps welcome the science program because of its high quality and affordability (\$60 for seven weeks of activities). To maintain the high quality, 4-H hires certified teachers to facilitate the lessons. Science professionals (lab technicians, researchers, and chemists) also visit the camps to talk about and demonstrate their careers with the children. (The majority of children have never met a science professional in person.) Program evaluations show an increase in students' interest in science as a field of study and also as a career. Approximately 600 youth participated in the program in 2010. The program has been funded since 1993 by a pharmaceutical corporation located in Union County. Approximate cost each year is \$11,000. (\$10, 000 comes from the corporate sponsor and \$1,000 from the day camps.)

Program Needs

Union County, New Jersey, is an urban/suburban county of 496,000 people. While much of the county is of middle to upper income background, large pockets of poverty remain. In the City of Plainfield 16% of the residents (7,500 people) live below the poverty level; in Rahway 7% (2,000 people), and in Elizabeth 17% (21,000 people) (Information Publications, 2009). In these populations, science test scores are extremely deficient. The percentage of youth passing the 4th grade *New Jersey Science Proficiency Test* in Elizabeth, Plainfield and Rahway is 36%, 58% and 47%, respectively (*The Star Ledger*, "2008 School Report Card"). These scores are in comparison to a district less than 8 miles from each, where 97% of the students pass the test.

This poor performance in science has severe consequences. It excludes students from career opportunities in the science field. According to the Bureau of Labor Statistics, the average salary for a physical scientist is \$80,000 per year. This is almost four times what many restaurant and service workers earn. Even a lower level science job, such as a science technician, pays well at an average salary of \$29,000 per year (United States Department of Labor, 2004-5). Union County offers many science related jobs. The Merck Pharmaceutical Company employs over 7,000 workers. The county also has many smaller firms that require knowledge of science.

Targeted Audience

The program targets low-income youth in grades 1 through 6 residing in New Jersey's Union County communities of Plainfield, Elizabeth and Rahway. These communities were chosen because of their high poverty rates (16%, 17% and 7% respectively), free school lunch figures, and students' low achievement on standardized test scores.

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Program Goals and Objectives

Goal: To increase interest in science and science careers for low-income students.

Objectives

- Enroll 500 students in the 4-H Summer Science Program; 300 of whom will be from low income backgrounds.
- 50% of the students will be able to report that they can solve a problem better as a result of the 4-H Summer Science Program.
- 50% of the students will be able to report that they can observe things better as a result of the 4-H Summer Science Program.
- 50% of the students will be able to report that they can do an experiment as a result of the 4-H Summer Science Program.
- 50% of the students will be inspired to say they like science more as a result of the 4-H Summer Science Program.
- 50% of the students will consider that they would like to learn more about science as a result of the 4-H Summer Science Program.
- 50% of the students will want to tell someone about what they learned in the 4-H Summer Science Program.
- 25% of the students will think about becoming a scientist someday because of what they experienced in the 4-H Summer Science Program.
- 50% of the students will meet at least one scientist in person.

Program Design/Curricula and Materials

The 4-H science program offered at the day camps complement the other activities, such as arts and crafts and recreation. 4-H does not duplicate existing programs, and a different science theme is presented each year. Some past themes have been the human body, aeronautics, robotics, kitchen chemistry, and physics with toys.

Since the inception of this program in 1992, the Summer Science Program has presented varied curricula. The *4-H S.E.R.I.E.S.* curriculum was used for the first 10 years. It was created in 1988 by the University of California. Since then, we have used other curricula such as *Teaching Physics with Toys—Activities for Grades K to 9*, by Taylor, Poth and Portman; and *Fender Bender Physics* by Bevin and Raudebaugh. Most recently, the program utilized the *Acres of Agriculture* curriculum from the National 4-H Cooperative Curriculum System, and *Design It!* from the EDC Center for Science Education.

When the program first started in 1992, the camps were involved in the program schedule. We met as a team to plan a schedule that worked for everyone. Since that time, we have followed the original schedule and added groups into any vacant spots. So far, we have not requested the sites to be involved in the curriculum. However, they seem to be pleased with what we select, including the camps that have been with the program since its inception.

Knowledge and Research Base

The 4-H Summer Science Program is unique in many ways. First, it is a 4-H program that is *not* volunteer or club based. Due to the intensive nature of the program (40-hours per week, seven-weeks), it was decided that using paid employees would work best; a finding corroborated by the Union County Family and Community Health Sciences Educator. Secondly, this program was the first of its kind in Union County to bring science lessons to day camps located in the low-income parts of the county. Although science is studied in the county's elementary schools, it had rarely been offered at a professional level through the low-income summer day camps. Lastly, this program was implemented with several groups that had not previously collaborated with 4-H.

The Union County 4-H Summer Science Program is partially based on the *4-H S.E.R.I.E.S.* program as developed by Dr. Richard Ponzio in 1989. *S.E.R.I.E.S.* stands for *Science Experience and Resources for Informal Education Settings*. It was developed with support from the National Science Foundation. According to personal correspondence with the principal author of the curriculum, *S.E.R.I.E.S.* has been used throughout the United States (R. Ponzio, Jan. 2006). It is also being used in Africa and several Latin American countries.

S.E.R.I.E.S. is effective because it is experiential in nature. Quoting from *S.E.R.I.E.S.* materials, "The instructional model used in presenting the inquiry based activities is an adaptation of Karplus' Learning Cycle." The learning cycle consists of the following steps: Exploration, Concept Introduction, and Concept Application. In the Exploration phase, again quoting from the *S.E.R.I.E.S.* curriculum, "The youth learn through their own actions and reactions with minimal guidance or expectation of specific accomplishments." In the Concept Introduction phase they "begin with the introduction of a concept or principle related to the activity or unit." The last phase is the Application phase. Activities in this phase provide "relevance and connection between what is being learned in the world by focusing on high intrinsic interest topics chosen by the participants themselves."

The effectiveness of programs such as *S.E.R.I.E.S.* was evaluated by the National Science Foundation in 1998. In its report, *A Report on the Evaluation of the National Science Foundation's Informal Science Education Program*, there is a broad overview of the effectiveness of programs such as *S.E.R.I.E.S.* More specifically, Exhibits 8, 9 and 10 of the study document how a significant number of current scientists became interested in science because of exposure to it through programs such as *S.E.R.I.E.S.* (National Science Foundation, 1998). The 4-H Summer Science Program initially used the *S.E.R.I.E.S.* materials. Recently, we have used curricula from the National Science Teachers Association, 4-H Cooperative Curriculum System and School Age Notes. This change came about because the materials and supplies needed for *S.E.R.I.E.S.* were no longer available.

Partners

The program is supported by non-profit groups that host the day camp sites. In Plainfield our partners are: The King's Daughters Day School, The Plainfield YMCA, The Neighborhood House, The Black United Fund, and the United Church of Christ Summer Day Camp. In Rahway our partners are the JFK Community Center and the Rahway Recreation Department. In Elizabeth we work with The Union County Coalition to House the Homeless and The YMCA of Elizabeth.

The non-profits mentioned above provide sites for our program to work with the children. The camps also provide an environment that attracts children; arts and crafts, recreation, meals, and all day supervision. A one period stand-alone science program would not attract children who need all day childcare. The





centers also provide funds for the science materials.

Just as much as 4-H needs the centers, they also need 4-H. They do not have sufficient funds to hire workers to teach science lessons to the children. Without the 4-H teachers, they would have to eliminate science from their curricula.

The funder for our program is the Merck/Schering–Plough Corporation. This company also supplies science role models, which means their chemists, biologists, and other science workers visit the day camp sites. During their visits with the children, they describe their work, carry out a hands-on activity that relates to their work, and discuss the training their job requires.

Funding

- Merck Corporation - \$9,800 support in 2010.
- Camps in Union County, NJ – contributed about \$1,000 in 2010.
- Rutgers Cooperative Extension 4-H Program of Union County - invested 50 hours of salary for one 4-H Agent.

Staffing

The Union County 4-H Agent contributes approximately 50 hours to organizing and preparing the program prior to the summer. Time is spent soliciting sites for the program, organizing the schedule for the program, interviewing/hiring the teachers, and planning the summer’s activities.

Two seasonal employees, both of whom are experienced certified teachers, are employed for seven weeks in July and August. During that time, they travel from day camp to day camp, providing science instruction and activities for the children.

Program Delivery

The instructors provide the children with seven 45-minute sessions of science instruction over a seven-week period, or one visit each week for 7 weeks. The children are summer day camp participants. The camps are run by various non-profit groups (e.g. YMCA) in the low-income neighborhoods of Union County. Rather than requiring the sites to transport the children to the Union County 4-H Center, the 4-H instructors travel to each of the day camp sites.

Program staff work with small groups at the day camps of no more than 10 children at a time. The smaller groups allow facilitators to proceed more rapidly than similar lessons in larger classroom settings. Thus, students begin to understand that science is action-oriented, rather than tedious and slow-moving.

In addition to the standard group sessions, scientists and science workers are introduced to the children. The scientists offer a hands-on activity that reflects their occupation. Chemists demonstrate a variety of chemical reactions. Biologists demonstrate mock programs about how a compound becomes a pharmaceutical, and microbiologists show the children how scientists look at cells. These activities are successful because they are age appropriate, hands-on, and reflect what the scientists actually do in their full-time positions.

Recognition of Participants

Each day camp receives a framed “Certificate of Participation” signed by Rutgers Cooperative Extension and Merck staff. The recipients highly value the certificate. I have seen them posted on the walls of many of the day camps. Recognition of individual youth has varied from year to year. Some years we gave away plastic cups with 4-H Summer Science Program written on them. Other years we gave pencils or raffled off science equipment as door prizes for the youth.

The program has also received significant press coverage. The program’s corporate sponsor schedules a center visit with one of their scientists, and informs media contacts about the visit. When a scientist visits the site, usually one or two reporters and photographers are there as well. Sometimes, government officials visit the sites with the scientists. The officials are also accompanied by photographers or reporters. Recently, an official presented the corporate sponsors with certificates of appreciation.

Program Evaluation and Outcomes/Impact

Our most recent program evaluation was done in August 2010. The results of this end-of-program survey of the children included:

- 90% said they can solve a problem better now.
- 86% said they can observe things better.
- 87% said they can do an experiment.
- 78% said they like science more than before.
- 78% said they would like to learn more about science.
- 73% said they would tell someone what they learned.
- 42% said they would like to become a scientist someday.

Quotes from participants in the program point to other gains. “This is something I could do for my school science project”, said one child. Other children said that the program expanded their horizons, “I can do an experiment; I can be my family’s scientist” or “I can do something new.”

Camp directors were asked what they thought the “. . . campers liked best about the science program?” Replies included:

- The interactive experiments and the diversity in each presentation.
- New teacher, hands-on activities, allowed campers to be creative & work as a team.
- The hands-on activities, they enjoyed experimenting in new fun ways.
- The campers enjoyed learning about science through hands-on activities.
- The hands-on and interactive activities.
- The campers enjoyed the hands-on nature of the program and had fun with the activities.
- They enjoyed the hands-on activities and experiments.

The directors were also asked, “What did you like best about the Summer Science Program?” Responses included:

- It helps our youth understand that science can be interesting, exciting, and useful in their daily lives.





- All new activities, kids were engaged and they weren't bored. (*some new activities for the DASH After School Program)
- Seeing their progress. Since many of the activities we have done in previous years, seeing the kids apply what they learned last time was exciting.
- The program encouraged the children to be creative. The campers really enjoyed the glider activity.
- The staff were great and the activities were engaging.
- I liked that the program kept the children engaged and that they were genuinely interested in the projects. I liked that the children had fun and also that the project was mostly left up to the students to do, with minimal intervention from the instructor.
- The instructor was engaging and assisted the students in the various experiments.

Additional comments from camp directors included:

- I support this program because of the value it brings to encouraging our students to take a different view of science. I hope that each year this program is made available to all camps.
- Our school summer program has participated in the 4-H Summer [Science] Program for the last several years. We have always [had] fun.

Evidence of Sustainability

When the 4-H Summer Science Program started, it was initially funded by a private foundation known as the Janet Memorial Fund. When I learned that they could not fund the program after the first year, I approached the Schering-Plough Corporation. (In 2010 they became Merck Corporation.) They have been our funder for the last 16 years. I believe they have funded the program so faithfully because it reaches an audience that they are deeply committed to helping.

If Merck could no longer fund the program, I believe other funding streams could be found. If sufficient funds could not be found to carry on the program as it currently exists, I would adopt a 'Train-the-Trainer' model. Using this model, we would train summer camp staff to carry on the program in place of paid teachers.

Awards or Other Recognition Received for Program

USDA Program of Distinction, 2006. This award is presented to programs that have demonstrated significant and documentable success.

Urban Programming Award, National Association of Extension 4-H Agents (NAE4HA) for Union County 4-H Traveling Science Program, October 2007. Program was chosen as a successful urban program and entered into NAE4HA Directory of Successful Urban 4-H Programs.

Urban Program Showcase, NAE4HA 2008, one of four featured programs that were presented at 2008 NAE4-HA National Conference.





4-H Youth Development Programs of Excellence, United States Department of Agriculture, in acknowledgement of Union County 4-H Summer Science Program. Science Program was chosen along with 48 others from a pool of 141 applicants, February 2000.

Considerations for Replication

This program takes about 50 hours to organize in the winter/spring of the year. It may take up to 100 hours the first year. More time is spent in the beginning making contacts with funders and day camps to host the program. The Union County 4-H Agent [nichnadowicz@njaes.rutgers.edu] is available to assist anyone interested in starting this program.

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