Inspiring FUTURE SCIENTISTS

Developing a science enrichment program for teens

The Academy of Natural Sciences

Philadelphia, Pennsylvania

The Purpose of This Book

This book is intended to describe a successful science enrichment program designed specifically for high school students by The Academy of Natural Sciences. The yearlong program emphasizes natural science content and research skills, self-confidence and cooperation, environmental stewardship and exposure to science careers. Activities include classroom lessons, science experiments, behind-the-scenes tours, and daylong, weekend and weeklong field trips. A highlight of the program is the opportunity to work directly with scientists in the field and in the lab on an Academy research project.

This publication describes two similar models of the same program. The first, called Student Experiences in the Natural Environment (SEINE), is designed for students entering 9th, 10th or 11th grade and involves mostly group activities. The Science Enrichment Expansion Curriculum (SEEC) is designed for slightly older students, those entering 11th or 12th grade, who have the skill sets to work one-on-one with a scientist on a project of the scientist's design. Both models are built on the same science-education principles and have the same goals. Thus they are considered one program.

This book is intended as a guide for replicating or adapting the program at other science museums, science-education facilities, nature centers, and similar places devoted to science learning. It is not meant to be all-inclusive, and readers are invited to contact the Academy's Education Department for more information.

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What Is The Academy of Natural Sciences?

The Academy of Natural Sciences, an international museum operating since 1812, undertakes research and public education that focus on the environment and its diverse species. Our mission is to expand knowledge of nature through discovery and to inspire stewardship of the environment.

The 42,000-square-foot public museum houses four floors of permanent and temporary exhibitions for adults and children. Visitors can view classic wildlife dioramas, dig for fossils in Dinosaur Hall, stroll through a tropical habitat filled with live butterflies, see a show featuring live animals, and more. Educational outreach programs, overnight camp-ins, summer camp, behind-the-scenes tours of the research collections, arts-and-crafts activities, special lectures and day trips for members compliment the museum experience.

The foundation upon which the exhibition and education programs are built lies within the Academy's three research centers: the Biodiversity Group, the Patrick Center for Environmental Research and the Estuarine Research Center. The Biodiversity Group explores the diversity of life forms and their evolution, adaptation, survival and extinction. The collection of more than 23 million plants and animals, some dating to the earliest life forms, is among the world's top research collections. The Patrick Center studies the health of freshwater ecosystems and how people's activities affect water quality and aquatic organisms in watersheds. The Estuarine Center, a satellite lab on Chesapeake Bay in St. Leonard, Md., studies the natural processes that occur in estuaries and along ocean coastlines and how land use affects their living resources. Collectively, the three groups comprise one of the nation's foremost watershed research and education centers.

The Academy's comprehensive approach to watershed research, combined with a history of environmental education and a more recent commitment to intensify the message of environmental stewardship led to the program described here.

Introduction

Ever since she was 3 years old, Keneesha wanted to be a veterinarian. "It was my dream," said the Philadelphia public high school junior. But the statistical odds of Keneesha finding and then following a path to a science career are against her. She is female, African American, lives in a big city and hails from a single-parent home where every dollar is stretched to do the work of two. What she has going for her is that she is smart, motivated and interested in science. And her teacher connected her with The Academy of Natural Sciences.

"This program just happened to come through my school, and my science teacher thought it would be a good thing for me to do," said Keneesha, explaining her involvement in the Science Enrichment Expansion Curriculum (SEEC) program. Keneesha spent the summer in a lab coat working with Ned Gilmore, Collection Manager for Vertebrate Biology. She helped sort a collection of 600 reptiles and amphibians that had been donated to the Academy. Each specimen was examined, identified, tagged, sorted and stored. She typed information into a computerized database so it is now accessible to researchers around the world.

Not only did Keneesha learn what it is like to curate a scientific collection, but she got to work side-by-side with a respected expert in the field. She observed and participated in the inner workings of a prestigious science lab, and she contributed her talents to help the Academy. She got a jump-start on developing the skills to work in a professional environment. In sum, she gained a wide range of knowledge and skills that her public school was unable, for financial and other reasons, to provide. All this while still in high school!

Keneesha went on to participate in an accelerated-start program at Tuskegee University in Alabama and to take pre-veterinary courses. As evidenced by Keneesha's experience, the Academy's science enrichment program is designed to fill in the gap between what traditional schools can provide and what students need in order to enter the field of science. The Academy's program addresses a major and timely need in the scientific community: the need for more minorities and for female representation.

Studies Show Minorities at Disadvantage

A study published in February 1999 by the National Science Foundation showed minorities (including women) were poorly represented in graduate science and engineering programs. The number of underrepresented minorities earning PhDs within the biological sciences grew since 1985 but remained woefully low.

The NSF-published study, *Women, Minorities, and Persons with Disabilities in Science and Engineering: 1998*, pointed to low academic achievement among minorities in grammar school and high school science courses as contributing to the lack of further advancement. Although women and minorities made gains in terms of science achievement, differences based on gender, race/ethnicity and disability status remained. These differences can then become a basis for unequal participation in further science education, employment, and technological and science literacy, the study said.

Student attitudes toward math and science—and their understanding of the relevance of the subject to their future aspirations—affected their enthusiasm for studying the subject and helped determine whether they would continue on to more advanced studies, the study said. One explanation of why so few students took advanced courses in science may be the low numbers of students who thought the courses necessary for their planned careers. Even among students who expected to become scientists, the proportion who believed that advanced math or science was necessary to their careers was below 75 percent. Math and science achievement also tended to be directly related to lower family incomes and parents' own lack of formal education. In other words, students who hailed from low-income families where the parent or parents had a low level of education were less likely to excel in science then their wealthier counterparts from families with parents who went to college.

How the Academy's Program Addresses the Inequalities

Over the last two decades, interest in science enrichment programs for high school students, particularly those from low-income and minority families, has grown. Similarly there is a national focus on nurturing a new generation of scientists, specifically from underrepresented audiences. More and more attempts have been made to integrate real science with quality education and to use scientific institutions to foster scientific literacy and career access.

The Academy of Natural Sciences has been a pioneer in addressing each of these national issues. Since 1982, nearly 500 underserved teenage girls have participated in science enrichment coursework and hands-on research with scientists through a program called Women In Natural Sciences (WINS). *(See Appendix 1).* WINS is the precursor to the program described in this book. The Academy first developed WINS to help ameliorate the differences in scientific achievement and career progress based on sex. Thanks to a variety of special programs like WINS, girls have made significant gains in the field, however the overall minority population has not. Studies show that socio-economic factors continue to pit girls, but also boys, against the odds for achievement.

Hoping to address these factors, the U.S. Department of Education in 1997 awarded the Academy a grant to build upon the WINS model to create a similar program that would also serve boys. This program, the subject of this book, was designed to serve inner-city teens in Philadelphia and also youth in rural areas in the vicinity of the Academy's Estuarine Research Center in St. Leonard's, Md., and at the Stroud Water Research Center in Avondale, Pa.

How the Book Is Organized

Chapter 1 describes the steps in getting the program up and running.

Chapters 2 and 3 describe two models of the same science enrichment program. Chapter 2 deals with Student Experiences in the Natural Environment (SEINE). SEINE was designed for boys and girls in grades 9, 10 and 11 and does not require a previous knowledge of the scientific method. SEINE students work mostly as a group, then break down into smaller groups to produce a science project. This model operates at the Academy's Estuarine Research Center and at the Stroud Water Research Center in Stroudsburg, PA.

Chapter 3 describes what could be considered a next-step version of the program. This model, called Science Enrichment Expansion Curriculum (SEEC), is designed for boys and girls in grades 11 and 12 with some prior experience who take part in paid internships with Academy scientists. This model operates at the Academy's Philadelphia research laboratories.

Throughout, there are quotes and short stories about the experiences of the students—what they liked and what they learned.

Chapter 4 describes how to evaluate the program and how the Academy program's evaluator perceives its value. A series of appendices include sample forms and sample curriculum that can be adapted to specific needs.

"Ashley is working with me on a project reassessing the distintiveness of the birds of a river valley in Northern Columbia."

— Leo Joseph, Ornithologist

Chapter 1 – Getting Started

Program Theme: Watersheds

The theme of the program is the watershed concept. Whether we live in the city or the country, we all live in a watershed, and our actions directly affect the ecosystem of that watershed. Students are better able to relate to their watershed once they learn what it is, where it is and how their lives are connected to the environment around them. Since a major part of the Academy's research is centered on watershed studies, integrating this information into a program for teens directly corresponds to the Academy's mission.

> *"I think that it is a great program. And it would be a wonderful program for other kids to experience. It really teaches you a lot."*
> *— Jeannie*

Watershed studies can encompass a wide range of scientific disciplines, and this program attempts to introduce as many as possible, including chemistry, physics, geology, ornithology, malacology, entomology, ichthyology, hydrology and geomorphology. The topic also is examined through literature, art and history and permits use of an interdisciplinary approach.

Program Goals

The goals of the program are:

- To expose students to careers in science
- To instill in students a sense of environmental stewardship
- To increase students' understanding of science and associated skills
- To develop students' interpersonal skills and self-esteem through cooperative learning

The goals are achieved through learning experiences that focus on the unifying theme of watershed research performed by the Academy. The laboratories involved plan activities for students that are related to this research. Students engage in various topics of study including (to name a few):

- Exploring the impact of dams on river systems
- Discovering how water quality affects blue crabs in Chesapeake Bay
- Investigating how changes in the population of organisms affects the environment
- Identifying the effects of sediment composition and distribution on watersheds

Naming the Program

The official name of the program is Science Enrichment Expansion Curriculum (SEEC). Inventing a clever name or acronym that defines or relates somehow to the program is a good marketing tool to attract students and school officials who nominate the students. Program providers at the Estuarine Research Center and the Stroud Water Research Center decided to name their program Student Experiences in the Natural Environment (SEINE) which has a special meaning to them. Merriam Webster's Collegiate Dictionary defines a seine as "a

large net with sinkers on one edge and floats on the other that hangs vertically in the water and is used to enclose fish when its ends are pulled together or are drawn ashore." Academy scientists typically use seines to gather fish they want to test as water quality indicators. Seines are also used by students participating in similar projects involving field research.

Who Is Eligible to Participate?

The program aims to serve the needs of a specific segment of the student population. In order to be eligible to participate, students must:

- Be entering 9th, 10th or 11th grade for SEINE and entering 11th or 12th for SEEC.
- Be academically talented and motivated. SEEC participants also must have no grades below B, preferably As in science and math, and be involved in extracurricular activities.
- Demonstrate financial need or live in a single-parent household or be from a recognized minority group or be geographically isolated from participating in similar programs or encounter other circumstances that would prevent access to an enrichment opportunity like this.
- Be nominated by a teacher, counselor, principal or, for SEEC students, satisfactorily completed the WINS program.

Criteria for Applying to the Program

Besides meeting the eligibility requirements listed above, students must:

- Submit two recommendations written by adults *(See Appendix 2 for sample form)*. Recommendations are accepted from current or past teachers and a student's principal or counselor. If necessary, a non-related adult may be substituted for one school educator.
- Submit a complete application *(See Appendix 3 for sample form)*. Note: Often students leave out information and follow-up calls are necessary. The application for SEEC is more detailed because the program seeks students with a more intense interest and greater ability in science. The students also must be mature enough and responsible enough to work with scientists on a long-term research project and to keep a regular working schedule.
- Submit an official student transcript.
- Come to the facility for an interview with the program provider. Arrangements to interview the student at another location, such as their school, can also be made.

Recruiting Applicants

Finding young women to participate in the SEEC program was not a problem because all successful graduates of the Women in Natural Sciences program were invited to apply. These girls had already received two years of basic aquatic and terrestrial science instruction

as well as an overview of the scientific method and workplace training through WINS. For male recruits, contacts at the School District of Philadelphia provided qualified candidates. Another source of recruits could be other science enrichment programs that provide enough workplace training and science background to equip students to work in a lab.

For those starting from scratch without a student "feeder" program, the first step toward recruiting students is to "sell" the program to various interest groups connected with students. Create some materials that describe the program such as a brochure, poster, booklet, and, if possible, a video or Power Point presentation and even a Web site. Develop a mailing list of contacts in the area including:

- Educators who have some relationship with the host facility
- Science teachers for grades 8 to 11
- Guidance counselors
- Parent-teacher associations
- Scout groups
- Church-based youth groups
- Youth advocacy groups such as Big Brothers/Big Sisters, Upward Bound

Distribute the information via mail, e-mail, live presentations and postings in teacher lounges, community centers and other areas where a large number of potential interested parties gather. Try to get feature stories published in the local newspaper, teacher or school newsletters, and on the Internet. Follow up inquiries immediately and offer to meet personally with the interested party.

In the first year it may be a challenge to get a large number of applicants. Start making contacts with educators early in the year—January—in order to begin processing applications in February or March. Consider limiting the marketing campaign to two or three school districts closest to the host facility. This may help with transportation issues and also with the dynamics of the group: some students will share common ground in the schools they attend.

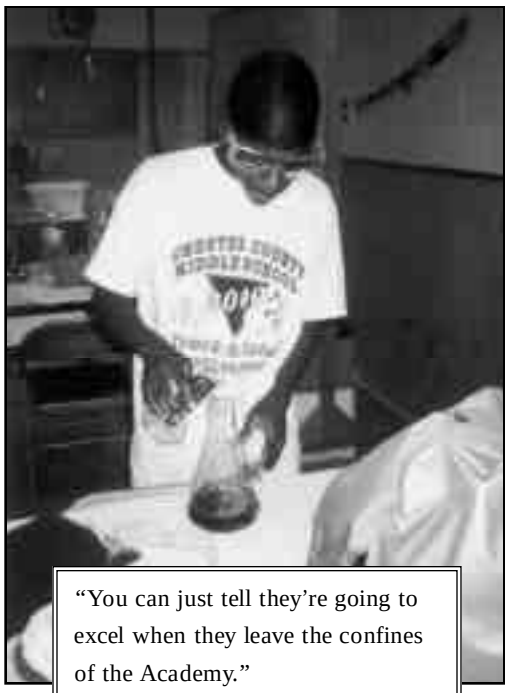
Program providers at the Stroud Center implemented more aggressive recruitment measures in the second year of the program resulting in an increase in applicants. They targeted only two school districts, chosen for their proximity to the facility. Representatives contacted guidance counselors from the districts' middle and high schools by phone and mailed them information. Then they visited the guidance counselor in each school to further explain the goals of the program. Guidance personnel distributed the information to the schools' science teachers, and they also directly nominated some students. Word-of-mouth also helped recruitment efforts.

Potential Recruitment Problems

Recruiting students can be challenging. Remember, some teenagers (especially boys) think science is not "cool." Others may prefer to spend their summer working for wages.

It is important to market the program as an exciting and fun science adventure. Drum up enthusiasm by arranging for alumni (once the program is at least one year old) to talk about the program at a school assembly or at a small-group gathering arranged by the school counselor. Pitch the program to administrators also as a service project, as the students will spend time helping scientists with their research. Key to getting the students interested is to first interest the educators, for they are the liaison between you and the children.

Identifying ideal candidates for the program proved more challenging than envisioned. Program providers relied on the teachers to target students who not only fit the admittance criteria but who also were sufficiently motivated to stick with the program for the duration. "They were all smart kids who applied," said one program coordinator, "but they were not all necessarily motivated." The teachers knew the students the best and were able to advise.



"You can just tell they're going to excel when they leave the confines of the Academy."

— Anthony Paino,
Academy Educator

The Interview Process

The interview involved explaining the program and the expectations. The student was asked about career aspirations, science knowledge, character background and goals.

It was a very good idea to require a parent, guardian or teacher be present when interviewing the student—especially older students—so that an adult would know what was expected of the child. As teens get older, there are more distractions to keep them from their commitments to the program. An adult at home enforcing their attendance was very helpful. At the interview, the adult was given a packet of information and told that their involvement in their child's experience was important. Throughout the year, the adults were kept informed through mailings of workshop schedules, meetings and outings their children were expected to attend.

If a student interviewing for the SEEC program successfully completed the application and the initial interview, he or she was called in for a second interview. At this time, the student was invited to tour the science lab and meet the scientist/mentor that he or she might be working with. The mentors had been identified earlier and coupled with students based on the initial phases of application. A mentor had a right to reject a student and interview with another who they thought would be a more appropriate match.

Providing Transportation

If the host facility is located in a city or suburb, students most likely will have access to public transportation or a car pool to get to and

from the site. The challenge arrives when the program is located in a rural area where students have no reliable transportation.

The Stroud Center, located in a rural area 40 miles southwest of Philadelphia, solved that problem by renting a 15-passenger van and picking up and dropping off the children at their homes. But program coordinators wouldn't recommend it for everyone. The van rental and gasoline were costly, not to mention the time it took to pick up all the kids at their homes in the morning and drop them off in the afternoon. The Estuarine Research Center arranged to have the students meet at a central location, and they were picked up and dropped off from there. Other transportation alternatives might include:

• Holding the program at a centrally located site, such as a YMCA, community center or school.

• Arranging with a third party, such as a YMCA or a summer camp provider, to transport the students.

"I tend to spend science class bored and disgusted. This gave me a chance to enjoy science."
— Vicki

Dedicating Space

At most facilities, space is at a premium and finding a separate area to house the program is a challenge. Initiate discussions with the head of the organization and the building manager early in the process in order to identify a classroom and training lab that could be made available or that could be constructed.

Developing Curriculum

Teachers often report that students don't know how to think or how to look at a problem and figure out ways to solve it. With that in mind, the Academy took a hands-on, inquiry-based approach to learning. The idea was to teach the students by encouraging them to discover the answers for themselves by asking questions, similar to how scientists tackle a problem using the scientific method.

There are numerous sources available to help with creating curriculum; some are available for free and some for a fee. *(See Appendix 4 for curriculum resources.)* School districts and state and federal agencies all have developed educational standards. These standards are universally seen as basic abilities students must master to succeed. The Academy's science curriculum is closely aligned with the National Content Standards for grades 9-12.

"My favorite part of the program was testing the water quality at White Clay Creek and surrounding streams, through chemistry."

— Jeannie

Poetry by Jeannie

A beautiful being
Up high in the sky,
Wings opened wide
My, oh my.
You hunt in the trees,
Oh beautiful thing
Now you sing
A song.

Chapter 2 – SEINE In Action

Student Experiences in the Natural Environment (SEINE) was designed as a yearlong program beginning in the summer with an intensive five-week program. Students worked in groups directly with staff scientists on research projects. Other activities included classroom lessons, science experiments, behind-the-scenes tours and field trips. During the school year, they participated in weekend day trips to scientific and cultural institutions and sometimes a weekend camping adventure.

Organizational Timeline

January–February – Disseminate recruitment materials, recruit scientists

March–April – Process applications, interview candidates

May – Notify successful applicants

July–August – Hold 5-week program

September–May – Go on day trips periodically, weekend camping trip

Curriculum: Intensive Summer Program

This curriculum was based on a five-week schedule with activities, trips, workshops, lectures, games and experiments interspersed so the day would not be tedious. Each session ran from 9 a.m. to 3 p.m., and the length of the week varied from three days to five days. Be flexible. If students get rambunctious, take a break. "There was one day when I could tell the kids were losing their concentration, so we went out and played Frisbee—with a science theme, so the kids were still learning," said one program coordinator.

Following is an outline of the program as conducted by the Estuarine Research Center. *(See Appendix 5 for daily activities.)*

WEEK 1 – Introduce Program, Lab, Each Other

The first week was dedicated to laying the foundation for future cooperative and inquiry-based learning. They played team-building games, learned a little about watersheds, and toured the facility. The scientific process was outlined and students started a field notebook by answering questions about themselves and their career goals. They collected and examined oysters to begin their research projects.

WEEK 2 – Hiking, Boating, Exploring Science Careers

Students delved more deeply into inquiry-based experiments and working cooperatively. Field trips afforded the opportunity to learn about careers in science and how science is applied to various pursuits. The students went out on a research boat to collect plankton and fish and then examined them under a microscope.

Boat-based Exploration

George Abbe lowers the basket over the culling table and out spills a potpourri of rocks, shells, oysters and other organisms dredged from the Patuxent River in southern Maryland. The students on the 42-foot research vessel *Joseph Leidy* watch with anticipation, waiting to dig in and start sorting the oysters. Their guide is George Abbe, a scientist at the Estuarine Research Center, who has been sampling oysters for years in a long-term study of oyster diseases and population declines in Chesapeake Bay. This bright summer day, the students are helping him scrape barnacles off oyster shells. Abbe will teach them how to weigh and measure the oysters, then record the data on a computer spreadsheet. The students will also inspect the meat for signs of disease, which has plagued the oyster industry in this part of the nation's largest estuary.

"One girl was concerned that we were opening oysters (causing them to die)," said Abbe, who explained that this was the only way to determine whether they were infected. "The experience is totally new to the kids. That's one reason it's so much fun to work with them."

In another hands-on exercise, Abbe and his fellow scientists taught the teens how to bait crab pots with dead fish. Later, when they pulled them out of the water, the students were taught how to sort them by sex and to weigh and measure them. They also learned how to use instruments to test the water quality and perform tank experiments. "This gives the kids a feel for actually how this whole scientific study is done," said Abbe. "I told the kids they may think the work we do is glamorous, but it's really repetitive. But that's what science is."

Experiencing Nature First-hand

Freshman science class for Marcus consisted mostly of standard classroom lessons with little opportunity to go outside and explore nature first-hand. That's what he liked so much about his summer at the Stroud Water Research Center.

"We took walks through the woods, looking at the different insects and animals and listening to the sounds they make," he said. "We built an insect trap and watched mayflies and dragonflies and what they ate." He also learned how to use laboratory instruments that his school did not have.

Marcus said he liked science and felt that what he learned through the Academy would help him in his biology class.

WEEK 3 – Application of Scientific Knowledge

Students worked with staff scientists on an ongoing research project involving blue crabs and on the students' own projects. Team-building and self-esteem-building games helped the students bond and work cooperatively.

WEEK 4 – Personal Development

A 3-day overnight trip to Echo Hill Outdoor School, on Maryland's Eastern Shore, presented individual and group challenges aimed at building and enhancing confidence, self-esteem and cooperation. The school's 300 acres of forests, meadows and swamps served as an outdoor laboratory for exploring the environment up close. The students engaged in outdoor problem-solving activities and tested their physical mettle by climbing trees and conquering rope courses. This type of adventure is highly recommended, especially the challenge of sleeping away from home. It was a great opportunity for personal growth, where students had to make choices not only based on their personalities and past experiences. They were put in new situations where they needed to rely on one another and work together to accomplish their goals.

WEEK 5 – Conclusion

Students finalized their experiments and presented their research findings to an audience of parents, teachers and scientists. They also filled out a survey about the program that would be helpful in planning next year's curriculum. *(See Appendix 6)*

Follow-up Throughout the Year

Once the 5-week summer program ended, it was important to keep the students engaged in and enthusiastic about science learning throughout the school year. To that end, students were encouraged to participate in monthly activities that were planned well in advance and that were within a reasonable distance from the host site. These included a whale watch, a tour of the National Aquarium in Baltimore, Md., hands-on learning at a nature center, a weekend camping trip to an island with wild horses, and a sleepover at The Academy of Natural Sciences' museum. The students looked forward to seeing each other and comparing notes as the school year progressed.

"I can see how this program has helped Marcus. His science teacher said he has a real understanding of the material they are studying, and he has more confidence in himself."

— Sheila Norman, Parent

Poetry by Marcus

Today I saw a woodpecker.
It was not drinking nectar.
It was knocking o' so loud
I did not make a sound.
As it took off in a flight,
I just stared there at the light.

"Students are actually participating in our knowledge-gathering that is distributed throughout the world."

— Ned Gilmore,
Collection Manager
for Vertebrate Biology

Chapter 3 – SEEC In Action

The Science Enrichment Expansion Curriculum (SEEC) was designed as a yearlong program beginning in the summer with group science and workplace lessons, followed by internships with Academy scientists and group field trips. Students developed a science project, which they presented in the spring.

Selecting Science Mentors: Finding a Good Match

Finding science mentors was a bit of a challenge. Most of the senior-most scientists were unable to participate because of other demands on their time, although they did serve as advisors. A major motivating factor for second-tier scientists was monetary compensation that was made possible through the grant. It also was helpful to point out the benefits that the mentors and the science departments would enjoy including:

• Satisfaction of knowing they made a difference in a young person's life by fueling an interest in science and perhaps informing a science career.

• Help in carrying out the duties of the lab and of the department, whether it be data collection, entry and analysis or field sampling and monitoring.

• Creative insights and unique perspectives of youth.

• Increasing the participation of underrepresented and underserved youth in science and science careers.

• Bringing instrumentation, expertise and a sense of importance to student learning, thus improving society's perception of science and mathematics education.

When selecting mentors, it is important to be clear about their role and how much of their time is required, after all there is a big time commitment. Discuss what work the mentor would like the student to perform and make sure it is age- and skill-appropriate and that it segues with the program's goals. Mentors felt that their more realistic expectations about interns could be developed if they had a better understanding of the science curriculum being taught in those grades and general science experiences being provided in the high schools.

Preparing Scientists to Work with Students

In order for both mentors and students to benefit from the intern experience, it was necessary to train the staff in how to deal with the particular needs of teenagers. Initially, some staff were uncomfortable working with young people. To alleviate the problem, several steps were taken.

Each mentor received a handbook that explained:

• Mentor duties and responsibilities

Gauging the Health of a Stream

Diana, a high school sophomore, was curious about the health of Philadelphia streams, so she set to work on one particular creek with the Academy's Dr. Donald Charles.

During one summer, Diana helped collect water samples from an area of Tacony Creek that was contaminated by trash and from another area of the creek that was clean. Charles taught her how to prepare microscope slides of the samples and to examine them for different types of diatoms, (algae) which are key indicators of water quality. She learned how to take digital images of the diatoms and how to enter the images in an electronic book that the Academy had been compiling for comparative studies. "This work was very different from anything she had ever done before," said Charles. "She got to see what scientists really do. She was very good at the technical aspects, and she picked up the computer skills really quickly."

Diana went on to win Honorable Mention for a science project she developed with Charles' help. She also learned valuable skills that will be critical if she decides to pursue a career in science.

- Benefits to mentors
- Roles of key program staff
- How students were recruited
- Suggestions for student orientations
- Student requirements
- The role of the Advisory Committee
- Tips on dealing with teens
- Answers to frequently asked questions

Each mentor was required to attend an orientation workshop where they learned more about the program and what was expected of a mentor.

Periodic workshops were held throughout the year to discuss any issues that developed.

A Planning Committee was established to discuss the work the students would perform, the science concepts they needed to understand to perform that work and how the program educators would teach those concepts if necessary.

Role of the Planning Committee

One of the first steps in developing the program was to establish a Planning Committee that crafted the framework of the initiative. The committee consisted of staff educators, science mentors and a representative from the School District of Philadelphia (to advise on student maturity, curriculum level, outside perspective). The role of the committee was to:

- Design viable student projects and lab and field experiences.
- Determine appropriate goals and outcomes, such as lab notebooks, journals, presentations, published papers, science fair projects.
- Determine student selection criteria.
- Determine skills necessary for students to work in the labs.
- Develop workshops to prepare students to work in the labs.
- Identify spending issues and future funding sources.

Role of the Advisory Committee

There were plans to establish an Advisory Committee of top-level administrators, program officials and school district representatives that would be responsible for the long-range vision of the program. This committee was proposed to meet quarterly to:

- Keep the program on track with the Academy's overall goals and mission.
- Ensure smooth operations among administrative divisions.
- Develop partnerships with corporate and academic sources in order to expand the student experience.

Preparing Students to Work with Scientists

When the program was first established, some of the scientists were concerned that some students did not have the basic knowledge required to work effectively in their labs. There also were problems with student tardiness and attendance, attitudes toward superiors and excessive socializing with peers.

Training students in the basic scientific method before they reach the labs was an important first step. A monthlong curriculum on watershed issues was being developed, with input from the scientists, in order to better prepare students for science concepts they would be expected to understand. The mentors need to be involved early on in the process so students can be properly trained to work with them. Mentors also were expected to orient students to their workspace and to discuss rules specific to their departments.

To facilitate learning and to correct the tardiness and attendance problems, a binder was created for each student, and meetings were held to discuss each section. The binder contained information on work schedules, workshop dates, workplace guidelines and ethics, dress, and other information students needed to know to succeed in the workplace. Students also filled out sign-in and sign-out sheets in order to keep track of their work hours. Failure to comply with the rules resulted in disciplinary procedures.

Work for Pay

Not everyone will have the "luxury" of being able to pay the interns and mentors. The Academy was able to do this through a grant, and it admittedly was an incentive in motivating both parties to participate. However, compensating participants is not necessary for the program to be a success; many students are academically motivated and will recognize the program's value without pay. If students are to be paid, the Human Resources Department needs to be involved to post job descriptions and to supply W2 forms and any other working papers. As for staff, it is important that top management be committed to the program in order to allow mentors to spend time away from their regular duties.

Communication Is Important

It is important to establish an on-going dialogue among students, mentors and the program coordinator right from the start. When problems arise and are not dealt with in a timely fashion they can escalate. Regular discussions are important if only to affirm that the student is doing a good job. After experimenting with different meeting schedules, a calendar of regular meetings was established.

- Students meet as a group once a month to discuss their lab experiences.
- Each student meets once a month with the program coordinator to discuss their work in more detail and to resolve any problems.

Studying Oysters in Puerto Rico

Some people go to Puerto Rico to enjoy the splendid beaches. Batichia, a high school junior, and Khalilah, a senior, went to pick oysters off mangrove roots—and a whole lot more.

Batichia, Khalilah and several other students were engaged in an Academy research project to determine whether the oyster population of La Parguera was being affected by environmental changes resulting from turning the tiny fishing village into a tourist mecca. Oysters are excellent indicators of ecosystem health because they are very sensitive to poor water quality. Under the guidance of Academy scientist Heidi Hertler, the students scraped 100 oysters of various sizes from each of six mangrove sites, placed them in Ziploc bags and froze them. They took sediment samples and, back at the Academy, they learned the methodical steps of scientific analysis. "I scraped out the insides of the oysters, weighed them, freeze-dried them, ground them up, and recorded their weights. I used my math skills a lot," said Khalilah.

Batichia and another student presented the results of the project at Inter-American University's Student Conference on Environmental Science in Puerto Rico and won awards for their presentations. Khalilah entered her project in two science fairs and won Third Place in both.

Of Sea Grapes and Shrimp

Johnathan mechanically pulled on a surgical glove and fished about in a jar for his catch. The high school junior extended a handful of dirt-coated creatures to his audience of SEEC students, who were touring the Academy's fish lab. "These are sea grapes and shrimp," he said, explaining how he had scraped them off of two piers along the New Jersey seaboard, and preserved them for study.

"EEEWWW," whined Jeannie, a freshman, throwing her eyes up to the ceiling. "That's disgusting!" Jeannie said she couldn't stand to look at dead animals, but she did get over her fear of live aquatic insects, and even live fish, while slogging through streams on a collecting expedition with her peers in the SEINE program.

Johnathan explained how he, under the guidance of Dr. Dominique Dagit, had tested the turbidity, salinity, pH, dissolved oxygen and temperature of the water at the collecting sites in order to compare the biodiversity at each site. He especially liked collecting the aquatic animals and studying them in the lab. He found working with a real scientist inspiring. The program "allowed me to do things I've never done before," he said.

• Each mentor meets every six weeks with the student to evaluate performance.

• The coordinator meets with each mentor every six weeks to discuss the internship.

The goal of all these meetings is for the students to enjoy an uplifting and satisfying experience in a supportive and learning environment where they can prove their maturity by being responsible and diligent workers.

Organizational Timeline

January–February – Disseminate recruitment materials, recruit scientists

March–April – Process applications, interview candidates

May – Interview SEEC candidates second time, notify all successful applicants

June – Prepare scientists, begin SEEC program curriculum

July–May – Oversee SEEC internships, organize project presentations in spring

Group Activities and Field Trips

Group activities and field trips were designed to incorporate the scientific expertise of the Academy staff and a diversity of learning experiences. The dynamics of the group were interesting to observe as the students had to work cooperatively, respecting each other and passing on information they had learned from their own lab experiences. Some of the trips and activities involved:

• Observing migrating birds along one of the East Coast's busiest avian corridors.

• Preparing a bird for the research collections.

• Exploring and recording the geomorphology of a region in southern New Jersey.

• Experimenting with and manipulating the DNA of bacteria.

• Camping overnight on an island where they collected and examined marine animals and learned how to set up tents, tend campfires and prepare meals.

Student Science Project

One of the goals of the program is for the student to develop a tangible product that will benefit both the student and the institution. The final product can take a variety of forms including:

• A scientific paper published in a student science journal.

• A science project entered in a science fair.

• A scientific database for internal and/or external use.

• A project presented at a science symposium or conference

Handling a crab helps students learn about the habitat of a river.

Learning to work cooperatively and to depend on each other.

Chapter 4 – Conclusion

Evaluating the Program

It is important to employ a variety of evaluation tools to determine whether the program achieved its goals and to decide how to make improvements. The institution will benefit from the feedback and the students will benefit from the opportunity to affirm who they are, what they value, and the fact that their opinions really do count.

Here are some of the most helpful methods of evaluation.

• Students came together as a group each month to discuss their experiences and any problems they had. Discussing problems in a group setting could be comforting, as a student realizes that he or she is not the only one experiencing a situation.

• Students met individually with the coordinator each month to discuss their research project, review their journal and address any problems. It was helpful for the coordinator to meet with the mentor beforehand to review the performance of the student.

• Mentors completed written student evaluations on a quarterly basis.

• Students completed written program evaluations at the end of the program. *(See Appendix 6 for sample form.)*

• Coordinators maintained an "open-door" policy for both students and mentors.

• A (SEEC) Planning Committee met periodically to review strengths and weakness of program and to recommend improvements.

• A professional evaluator was hired to objectively review the program and its providers to determine whether the program was meeting the goals of the students, of the Academy and of the funder.

"My science teacher in 8th grade told me about the program, but it wasn't because I liked science. He just told me it was a nice program. Then I started coming, and I just started liking science."
— Khalilah

A Final Word from the Independent Program Evaluator

The following is excerpted from a report prepared by an independent program evaluator who was asked to examine the program's effectiveness and potential impact, as well as ways to strengthen it.

"The SEEC/SEINE program is clearly having a significantly positive impact on the student participants. As with most strong authentic educational experiences, the full impact may not be known and/or acknowledged for years. The students have participated in experiences that neither home nor school have provided thus far—trips to Puerto Rico and out of state to collect data; participation in realistic, on-going scientific research projects that have awakened and/or enhanced awareness of the environment and the effect of human intervention (for pleasure, housing, food or general economic motivators) on nature; overnight and weekend camps that force interaction with others in not necessarily positive ways but ultimately leads to reckoning with/questioning issues of diversity; and interacting with and learning from nationally recognized natural scientists in their

Soil core sampling and data collecting in Pigmie Planes, New Jersey.

APPENDIX 1

Women in Natural Sciences: The Model for the Academy's Science Enrichment Program for Teens

Women in Natural Sciences (WINS) is an innovative and successful science education program conducted by The Academy of Natural Sciences in collaboration with the School District of Philadelphia. WINS was founded in 1982 in response to the lack of women in the sciences. Historically, there had been fewer opportunities for high school girls to engage in science and technology tasks, and there had been constant under-representation in college-level science, engineering and mathematics studies.

Each year public school eighth- and ninth-grade teachers nominate their most academically talented and motivated students to take part in WINS. The program places special emphasis on training girls who might otherwise be exposed to fewer opportunities in science enrichment due to restricted family income.

The initial exposure students have to WINS is through a yearlong summer and after-school enrichment program for ninth graders. This phase involves a classroom approach where students are introduced to basic scientific concepts through hands-on interactive exploration. Field trips provide ample opportunity for outdoor experiential learning. Once students have completed WINS, they may apply to participate in the second phase to pursue higher-level instruction and lab experiences. Students may act as "explainers" in the museum or as junior interns in the science research areas. Others go on to university-based science programs. Since 1982, nearly 500 underserved teenage girls have participated in WINS and the program has received national recognition.

Appendix 2

Sample Recommendation Form

APPLICANT'S NAME: _____

TO THE RECOMMENDER: _____

Acceptance into this SEINE program is not based solely on academic achievement. The willingness and ability of the applicant to take advantage of this opportunity also are important. The applicant must be an academically motivated high school student in 9th, 10th, or 11th grade who, because of race gender, economics, single-parent status, geographic isolation, or other circumstances would otherwise not have access to this enrichment opportunity.

How long and in what capacity have you known the applicant?_____

_____

In your opinion, does the applicant meet any one of the criteria described above _____ yes _____ no

If no, please explain: _____

_____

Does the applicant have a record of satisfactory scholarship performance? _____ yes _____ no

Do you believe the applicant can advance through the 12th grade and graduate? _____ yes _____ no

PLEASE EVALUATE THE APPLICANT ON THE FOLLOWING QUALIFICATIONS:

	EXCELLENT	GOOD	AVERAGE	BELOW AVERAGE	NO BASIS FOR JUDGEMENT
Intelligence					
Maturity					
Oral Communications Skills					
Written Communications Skills					
Imagination					
Emotional Stability					
Ability to Work with Others					
Motivation					
Leadership Ability					

YOUR ADDITIONAL COMMENTS WOULD BE GREATLY APPRECIATED.

CHECK ONLY ONE:

_____ I recommend

_____ I recommend with some reservation

_____ I do not recommend

_____ I recommend without qualification

Signature _____ Date _____

Name (Please Print) _____

Position _____ at _____

Telephone _____—_____—_____

THIS FORM IS CONFIDENTIAL: DO NOT RETURN TO THE APPLICANT.

PLEASE MAIL DIRECTLY TO: EDUCATION COORDINATOR
THE ACADEMY OF NATURAL SCIENCES
ESTUARINE RESEARCH CENTER
10545 MACKALL ROAD
ST. LEONARD, MARYLAND 20685

Thank you for your honest evaluation of this applicant.

Appendix 3

Sample Application Form

Student Name _____

Address_____

City_____ State_____ Zip _____

Phone Number_____—_____—_____

Date of Birth_____

Current School_____Current Grade Level_____

Parent or Guardian Name_____

Parent or Guardian Day/Work Phone Number _____—_____—_____

Emergency Contact Persons (please give two contacts)

Name _____ Phone Number_____—_____—_____ Relation _____

Name _____ Phone Number_____—_____—_____ Relation _____

PLEASE ANSWER THE QUESTIONS BELOW AS COMPLETELY AS POSSIBLE.

How are you able to meet the criteria for this program?

What science courses have you taken? Describe and indicate year.

How do you spend your free time? What are your hobbies and interests?

Why are you interested in participating in this program?

What type of career(s) would you like to enter when you finish school?

Signature of Parent or Guardian_____ Date_____

For students applying to the SEEC program, this additional information is requested:

Social Security Number (if students are paid for internships)_____

Do you have computer skills or computer experience? If so, describe.

What extracurricular school clubs or activities have you participated in?

What types of science things (such as facts, procedures, overall concepts) did you learn in your school science classes?

Sample Application Form (cont.)

Explain any special health, medical or dietary concerns or limitations. Be sure to list ALL allergies.

Have you ever worked in a laboratory? If so, explain when, where and what types of lab work you performed.

Do you have any objections to working with preserved animal specimens or involvement in projects where animals are collected and killed for scientific research? (e.g. insects, birds, fish, reptiles)

On a separate piece of paper, write a one-page, typed essay about why you should be one of the students chosen to work in an Academy collection or research area. Include how this will affect your education, your career interests and yourself as an individual.

Which of the following Academy departments would you prefer to work in? Rank in order of preference, one being your first choice.

_____Patrick Center for Environmental Research

_____Mammalogy (mammals)

_____Ornithology (birds)

_____Herpetology (reptiles)

Appendix 4 – Resources

SCIENCE RESOURCES

Holley, Dennis. *Viruses & Bacteria.* Critical Thinking Books & Software. ISBN 0-89455-717-3.

Ingram, Mrill. *Bottle Biology.* Kendall/Hunt Publishing. ISBN 0-8403-8601-X.

Jones, Gail. 1989. *Project Estuary.* The NC National Estuarine Research Reserve.

McHale, Barbara. *Learning About Microbes: A laboratory manual.* J. Weston Walch Publisher. ISBN 0-8251-3765-9.

UNC Sea Grant Publication. S.E.A. Lab (Science Experiments and Activities): *Marine Science for High School Students in Chemistry, Biology, and Physics.* UNC-SG-90-01.

Acorn Naturalists (catalog)
17821 East 17th St. #103
P.O. Box 2423
Tustin, CA 92781-2423
800-422-8886
www.acornnaturalists.com

The GLOBE Program
www.globe.gov

Leaf Pack Experiment Kit
LaMotte Company
P.O. Box 329
Chestertown, MD 21620
www.lamotte.com

Save Our Streams Teacher's Manual
Izaak Walton League of America
707 Conservation Lane
Gaithersburg, MD 20878
800-BUG- IWLA

Women's Education Equity Act
Equity Resource Center at EDC
P.O. Box 1020
Sewickley, PA 15143-1020
800-793-5076
www.edcorders@abdintl.com

WOW: The Wonders of Wetlands
Environmental Concern Inc.
P.O. Box P
St. Michaels, MD 21663-0480
ISBN 1-888631-00-7

SCIENCE EDUCATION/ LITERACY RESOURCES

American Association for the Advancement of Science. *Benchmarks for Science Literacy*. ISBN 0-19-508986-3. www.project2061@aaas.org

Camenson, Blythe. *Great Jobs for Biology Majors.* NTC/Contemporary Publishing Group. ISBN 0-8442-1917-7.

National Research Council, *National Science Education Standards*, ISBN 0-309-05326-9.

Reeves, Diane L. *Career Ideas for Kids Who Like Science.* Facts on File, Inc. ISBN 0-8160-3680-2.

Silberman, Mel. 1995. *101 Ways to Make Training Active.* Josse-Bass/Pfeiffer. San Francisco, CA.

National Science Teachers Association

1840 Wilson Blvd.

Arlington, VA 22201-3000

800-277-5300

www.nsta.org/scistore

TEAM-BUILDING RESOURCES

Jones, Alanna. *104 Activities That Build.* Rec Room Publishing. ISBN 0-9662341-3-8.

Jones, Alanna. *Team Building Activities for Every Group.* Rec Room Publishing. ISBN 0-9662341-6-2.

Jones, Alanna. *The wRECking Yard of Games and Activities.* Rec Room Publishing. ISBN 1-882883-35-7.

Korb-Khalsa, Leutenberg & Azok, 1996. *S.E.A.L.S. Self Esteem and Life Skills, Too!* Wellness Reproductions and Publishing Inc. Beechwood, OH.

Lewis, Barbara A., 1998. *What Do You Stand For? A Kid's Guide to Building Character.* Free Spirit Publishing, Minneapolis, MN.

Rydberg, Denny, 1985. *Building Community in Youth Groups.* Group Books Thomas Schultz Publications.

Samuals, Linda. *Girls Can Succeed in Science!* Antidotes for science phobia in boys and girls.
Corwin Press, Inc. ISBN 0-8039-6731-4.

Appendix 5

SEINE Curriculum Day to Day

Below is an outline of activities that students participated in during the Student Experiences in the Natural Environment summer program at the Academy's Estuarine Research Center.

WEEK 1 – Introducing the Program, the Facility and Each Other

Day 1

Toured the lab and facility, reviewed rules and regulations.

Played indoor and outdoor games and picked partners.

Started field notebooks by answering these questions:

What will you get out of the program personally and academically?

What are your career goals?

Rate your interest in science (scale of 1 to 10).

What do you like best about yourself?

What do you like least about yourself?

What would you like to do that you haven't already done?

Played a value-statements game involving environmental issues.

Explored a nearby salt marsh and collected specimens for lab study.

Day 2

Identified specimens collected yesterday.

Academy scientist discussed her career in marine biology.

Helped a scientist complete experiment that already was in progress.

Identified and counted organisms in raceway (tank with constant flow of salt water piped in from outdoors).

Cleaned raceway and tanks by scraping off algae and barnacles in preparation for use in students' own experiments.

Day 3

Compared species identification of organisms collected during raceway cleaning yesterday.

Team-building activities, including discussion of environmental and political issues.

Watched movie "The Perfect Storm," which highlights marine biology careers, coastal weather systems, fish behavior, fishing regulations and over-fishing problems.

Day 4

Started work on student research projects by identifying, counting and measuring certain species of fish that students will add to raceways.

Added equal quantities of fish to each raceway and established control.

Discussed life cycle, habitat, predation and prey of oyster.

Dissected oyster, identified parts.

Day 5

Spent the day on 42-foot research boat *R/V Joseph Leidy* with two Academy scientists.

Used field notebook to record air quality, temperature, weather conditions, sites for oyster dredging and organisms collected.

Dredged oysters.

Assisted scientists by sorting, cleaning and bagging oysters.

Assisted in operating and cleaning the boat.

Identified organisms collected during dredging.

WEEK 2 – Daytripping and Exploring Other Careers in Science

Day 1

Visited Flag Ponds Nature Park in Maryland.

Discussed Chesapeake Bay and beach ecology highlighting differences between salt marsh, swamp, wooded and beach environments.

Hiked wooded and swamp environments, seined through bay.

Team-building activities.

Continued work on students' experiments.

Fed marine animals in raceway.

Day 2

Academy scientist discussed his career in marine biology, answered questions.

Visited Battle Creek Cypress Swamp Nature Center.

Did activities with amphibians and insects.

Hiked swamp area and identified plants and animals.

Used dip nets to explore pond and identified species native to ponds.

Day 3

Spent the day on *R/V Joseph Leidy* collecting plankton and fish and examining some under microscope. Tested water chemistry of Chesapeake Bay.

Day 4

Took trip to cliffs along Chesapeake Bay for an introduction to paleontology and a chance to search for fossils.

Swam in the bay.

Day 5

Visited an aquaculture center to learn how and why it operates; met staff and learned about their jobs.

WEEK 3 – Application of Scientific Knowledge

Day 1, 2 and 3

Part of the group spent each morning with scientists on the *R/V Joseph Leidy* where they learned how to bait and fish crab pots, how to handle crabs safely and how to measure and identify crabs.

The other part of the group stayed on shore baiting crab pots from the dock and continuing their research projects.

Tested water samples for pH, temperature, salinity, dissolved oxygen and ammonia.

In the afternoons the groups switched activities and did what the other had been doing in the morning.

WEEK 4 – Personal Development, Working as a Team

Three-day overnight trip to Echo Hill Outdoor School, on the Eastern Shore of Maryland.

Hiked, climbed trees, conquered rope courses.

Engaged in many other outdoor problem-solving and team-building activities.

WEEK 5 – Conclusion

Day 1

Learned a little about microbiology and how to prepare culture dishes for bacteria study.

Took a canoe trip that included spotting birds and collecting water and soil samples.

Learned how to inoculate a culture dish, then prepared three: one with soil, one with water and one from a surface in the lab.

Day 2

Finished student experiments and cleaned equipment.

Used math skills to calculate the growth and death rate of fish in the experiment to come to a conclusion.

Staff scientist discussed her career in microbiology and answered questions.

Day 3

Filled out a survey about the program.

Play a team-building game where students role-play as scientists and homeowners of an environmentally threatened area.

Day 4

Staff scientist helped students identify bacteria that grew in specified sites.

Took field trip to Maryland Archaeological Consortium lab.

Dug for artifacts then identified, cleaned, tagged and preserved them.

Day 5

Final discussion of program.

Final team-building game.

Lunch with parents and staff scientists. Students delivered their presentations.

Appendix 6

Sample Student Survey

Please be as honest as possible with your opinions. Use the back if you need more space.

1. What prompted your interest in participating in the SEINE program?

2. How did you hear about SEINE?

3. Do you feel that the summer portion of SEINE was a worthwhile experience?
   YES NO Please explain.

4. The goals of SEINE are to offer science enrichment as well as group skills such as communication and cooperation.
   Do you feel that you gained helpful experiences in science?
   YES NO Please explain.

   Do you feel that you gained helpful group skills?
   YES NO Please explain.

5. Please rate the activities performed at the Estuarine Research Center, 1 being Horrible to 5 being Terrific.
   Please circle the number you feel best describes the activity.

	Horrible	Not Bad	OK	Enjoyable	Terrific
Patterson Point Salt Marsh-collecting	1	2	3	4	5
Set-up, design, conduct experiment	1	2	3	4	5
ID organisms	1	2	3	4	5
Oyster dissection research	1	2	3	4	5
Tour Estuarine Research Center	1	2	3	4	5
Tour PEPCO Fish Aquaculture Center	1	2	3	4	5
Flag Ponds Nature Park trip	1	2	3	4	5
Battle Creek Nature Center trip	1	2	3	4	5
Leidy trip, water quality, plankton tow, ponar grab, fish trawl	1	2	3	4	5
Tour of MAC lab	1	2	3	4	5
Work on archaeological dig site at MAC	1	2	3	4	5
Canoeing on Parker's Creek	1	2	3	4	5
Scientist Cliffs: fossiling	1	2	3	4	5
Boat-building activity	1	2	3	4	5
Field Notes	1	2	3	4	5
Classroom discussions	1	2	3	4	5
Crab population study	1	2	3	4	5
Bacteria culturing	1	2	3	4	5
Team-building activities	1	2	3	4	5

6. What did you enjoy most about the summer portion of SEINE?

7. What did you enjoy least about the summer portion of SEINE? Any recommendations for improvements for next year's program?

9. Would you be interested in working one-on-one with a scientist on a project?

10. Would you recommend the SEINE program to someone else?

11. What would you have liked to have done more of?

12. What would you have liked to have done less of?

13. Were the days too long? Too short? Any recommendations/suggestions for the time frame? Or was it just the right amount?

14. Please rate your instructors.

Jessica Ward

Explained information clearly.	YES	NO
Knowledgeable about Chesapeake Bay.	YES	NO
Easy to talk to.	YES	NO
She enjoyed working with the SEINE group	YES	NO
You enjoyed working with her.	YES	NO
Made learning about the bay and other topics fun.	YES	NO
Was fair in dealing with issues.	YES	NO

Erin Strickland

Explained information clearly.	YES	NO
Knowledgeable about Chesapeake Bay.	YES	NO
Easy to talk to.	YES	NO
She enjoyed working with the SEINE group	YES	NO
You enjoyed working with her.	YES	NO
Made learning about the bay and other topics fun.	YES	NO
Was fair in dealing with issues.	YES	NO

Even though the summer portion of SEINE is over, we will still be getting together for various activities throughout the year. Please rate the following possibilities for future activities, on a scale of 1-10 (1 worst and 10 best).

_____Assateague Island camping
_____Earth Day event participation
_____Swallow Falls camping
_____Visit to Stroud Center
_____Bird banding
_____Ropes course
_____Horseshoe crab trip
_____Whitewater rafting trip
_____National Aquarium, Baltimore
_____Assisting scientific research
_____Washington, D.C. museums
_____Science fair project assistance
_____Visit to The Academy of Natural Sciences in Philadelphia
_____PEPCO facility tour
_____NOAA tour
_____Parkers Creek water monitoring
_____Other

Appendix 7

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