Enriching Science for Students

Strategies for Creating an Effective Program

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Preface

Throughout this guide, we will refer to science programs rather than the common acronym STEM for science, technology, engineering, or mathematics. This decision relates to the notion of introducing students to the wonders of science to engage their curiosity and enthusiasm for learning. Those familiar with the Burroughs Wellcome Fund (BWF) and its cohort, the North Carolina Science, Mathematics, and Technology Education Center, know that when we refer to STEM, we mean Strategies that Engage Minds.

BWF has invested more than $48 million in the science education arena since 1996 to help build systemic reform in science, technology, engineering, and mathematics education, primarily in North Carolina. We focus on the following areas:

Informal Learning—Student Science Enrichment Program

Formal Learning—Science and Mathematics Teacher Programs

Public Policy and Research—N.C. Institute for Education Policymakers, National Research Council

Capacity/Partnership Building—Annual Meetings/Workshops/Forums

Our initial investment in science education began in the informal learning environment with the establishment of the Student Science Enrichment Program (SSEP) to engage scientists, science teachers, and parents in working with primary and secondary students in out-of-school time programs. Although we have reached all 100 counties in North Carolina, we know there is much work to be done.

Introduction

How do schools and other organizations create a successful, informal science education program? Perhaps a program is already in place, but there's a need or a desire to add a science element. Or, maybe your institution, or organization is planning an outreach program, playing to its strength in environmental, robotics, computational, or genetics instruction.

For nearly two decades, BWF has helped informal science education programs across North Carolina become successful.

Through its Student Science Enrichment Program (SSEP) awards—three-year $180,000 grants supporting creative, hands-on science education activities for K-12 students—BWF has reached nearly 37,000 students across North Carolina. Since the program's inception in 1996, BWF has awarded nearly $24 million in 162 programs at more than 80 different N.C. organizations. Programs are offered year-round or throughout the academic year during after-school, Saturday academies, holidays, or summer camps.

In 2009, 72 percent of student participants reported they were more interested in learning science after completing a science enrichment program. Many participants—88 percent—stated they would refer a program to their friends. Having students share their experiences with peers is an important marketing tool to recruit new participants.

SSEP awards support career-oriented and practical programs that provide creative science enrichment activities for K-12 students who demonstrate exceptional skills, an interest in science and mathematics, and those with high potential. These programs must present hands-on scientific activities and inquiry-based avenues of exploration—an educational

approach BWF believes to be effective in increasing students' understanding and appreciation of the scientific process. In the National Research Council's *How Students Learn Science in the Classroom*, the authors found programs must place an emphasis on helping students develop familiarity with a discipline's concepts, theories, and models; an understanding of how knowledge is generated and justified; and an ability to use these understandings to engage in new inquiry. To increase academic achievement, programs offer a well-defined structure that aligns with the school-day curriculum, well-trained staff, parent involvement, and student follow-up.

BWF created this guide to help answer questions individuals at organizations may have in applying for the SSEP grant. We also hope new and existing out-of-school time programs may use this guide as a resource in determining how to integrate STEM education activities into their programs.

We interviewed several of our veteran program leaders, culling advice to learn from their experiences. We also recommend reading the National Research Council's *Surrounded by Science: Learning Science in Informal Environments* by Marilyn Fenichel and Heidi Schweingruber, Ph.D., for a detailed look at how learning takes place outside of the traditional classroom.

Guidelines of SSEP

The SSEP is clear on its guidelines for what it looks for in a program. Projects funded under the SSEP must pursue three goals through hands-on, minds-on activities:

- improving students' competence in science and mathematics
- nurturing students' enthusiasm for science and mathematics
- interesting students in pursuing careers in research or other science-related areas

The activities designed to achieve these goals must align with the N.C. Standard Course of Study for science and mathematics pertinent to student participants' grade levels. These standards are based on the Common Core Mathematics standards and the Next Generation Science Standards. Activities should be engaging and designed to help students learn content knowledge and develop critical reasoning skills to ask innovative questions in finding solutions to problems.

Nonprofit organizations including public/private schools, museums, universities, colleges, and community organizations such as boys and girls clubs are eligible to apply for SSEP. Successful projects generally include the following examples of activities to provide the following:

- helping students learn the basic process skills in scientific inquiry—observing, comparing, measuring (using apparatus), communicating, analyzing, generating, and evaluating
- providing students with opportunities to increase their insight into and appreciation of the investigative process
- supplying students with science-related career information and introducing career prospects

- connecting science, technology, engineering, and mathematics to students' daily lives
- providing an opportunity to use technology in project activities
- enabling students to interact with scientists, mathematicians, and engineers
- providing students with opportunities to explain their knowledge of science, technology, engineering, and mathematics to others
- linking students to or providing guidance on how they may link with other ongoing science, technology, engineering, and mathematics programs
- involving parents and peers in program activities

Other important attributes of a program are: having a targeted and appropriate curriculum, maintaining contact with students, linking other activities to continue development, involving science teachers and other science professionals, and having a large applicant pool.

Applicants offering summer camps, summer academies, or other summer activities must provide participating students with a year-round learning activity. These activities may range from interactions through the web to after-school clubs to Saturday academies.

Programs for high school students should be more career-oriented and engaged with science professionals who can guide their thinking about a particular field and demonstrate a range of career options. Primary and middle school programs are effective when they impact attitudes, behavior, interest, and knowledge through hands-on, learning-directed activities.

An advisory committee comprised of leaders in education, business, science, and policy selects and recommends grant recipients to be approved by the BWF Board of Directors.

The advisory committee considers:

- whether the proposed activity meets program goals and is innovative and engaging
- ability of the organization to conduct and sustain high quality science and mathematics enrichment activities
- manner in which students are identified and selected, particularly recruiting underrepresented groups in science and mathematics fields and how families and communities are engaged
- qualifications and expertise in the areas of science and mathematics of the organization's director and staff
- appropriateness of the budget to science and mathematics programmatic activities
- availability of additional resources, including partnerships, in-kind services, monetary support, and other resources
- effective and innovative plans for evaluation of science and mathematics program activities
- whether after school activities align with state standards of learning
- whether the proposed plan will help link participating students with other science-related activities in their schools and communities
- whether there are plans to continue the program after the BWF's support ends or to replicate the program
- whether special efforts will be made to reach disadvantaged students in low-wealth areas of the state

Organizations that previously received a SSEP award and are applying for another award must submit a sustainability plan with their application to demonstrate successful outcomes from the earlier award, to highlight significant achievements, and to identify other means of financial support or institutionalization of their program.

STEM: Strategies That Engage Minds

Head in hand, eyes glued to the computer, high school student Paris Fears stared intently at a screen. She scoured the seemingly endless lines of programming and code multiple times, attempting to fix the problem. No matter what she tried, though, the outcome remained the same: a message that read "Error on Line 177."

Eventually, her mentor at Shodor, an afterschool computational science program, stood beside her. Together, they worked through the problem, and, within minutes, Fears learned how to correct what was wrong. A wide smile broke across her face.

"It worked!" she said, amidst laughs and high-fives with her friends. "I can't believe it! I'm just so glad it finally worked!"

Fears' experience at Durham, N.C.-based Shodor isn't unique, but it's one that doesn't happen often enough. While schools offer science, technology, engineering, and math (STEM) curricula, that instruction rarely includes hands-on, inquiry-based experiences. Afterschool (or what is commonly referred to now as out-of-school time) programs can fill this void when armed with proper resources and detailed guidance.

In fact, afterschool programs are prime venues for STEM education, according to education experts. Participants can master skills at their own pace, there are fewer time restrictions, and the relaxed format encourages otherwise reticent students to speak up and become actively engaged.

"The afterschool setting allows for hands-on, longer-term, project-based activities that build upon and reinforce concepts learned in school without feeling like more school time," said

Anita Krishnamurthi, Ph.D., director of STEM policy for The Afterschool Alliance. "It provides a venue in which children and youths can experiment and play with STEM concepts without fear of failure."

STEM teaches inquiry, she said, and it's imperative that students learn to ask questions and apply the knowledge they've gained. These skills better prepare them for the future. And, as the demand for STEM-trained workers steadily increases, the need for afterschool opportunities is clear.

Creating a successful, effective program, however, requires substantial planning and collaboration for existing and new ventures alike. Missions must be clear; funding must be secured; and partnerships must be formed. Reaching these goals, however, experts said, isn't always easy.

The Challenges Facing Afterschool

Without a doubt, designing an afterschool STEM program invites many challenges. According to experts, though, the biggest of them all is identifying sufficient funding.

"Funding is always an issue that gets in the way," Krishnamurthi said. "There are 8.5 million children in afterschool around the country, and there simply isn't enough funding to make sure quality STEM education is available to all of them just yet."

Consequently, afterschool programs frequently find themselves in tight competition with other initiatives for grant monies or scrambling to find funders that match well with their missions. Program administrators often turn to private foundations, such as the Burroughs Wellcome Fund and the Noyce Foundation, for support. Government agencies, such as the National Science Foundation or the U.S. Department of Agriculture, are also frequent financial sources. Still other programs pursue corporate funding. For example, Change the Equation is a national organization that connects businesses interested in fostering STEM education with STEM programs.

Finding the right funder can be overwhelming. To make this stressful situation easier, The Afterschool Alliance—the only organization advocating nationally for afterschool investment—created its Funding Database where program leaders can fine-tune their search for financial support. StemConnector® also offers an extensive list of organizations and agencies that actively partner with and fund STEM initiatives.

Identifying strong potential partners is only the first step, said Nicole Yohalem, director of special projects at The Forum for Youth Investment, a non-profit group focused on ensuring students have the proper educational foundation for future successes.

"The clearer program staff can be about their mission as they approach potential partners, the more concrete conversations will be," she said. "If they say, 'Here's what we're trying to do, and here's how we think you can fit in,' then funders will be more responsive."

However, according to Shodor's executive director Robert Panoff, most programs have an operating budget that exceeds what grants can support. In those cases, program directors must find another avenue for raising money.

"We've had to adopt a financial model where we charge some students to participate," he said. "You can't just keep writing grants to get funding. If you have a fee associated with your program, the parents who can pay cover the cost for the parents who can't afford to."

Adding a monetary expense to the program can also change participants' attitudes, he said. Knowing the experience isn't free adds value to the time students spend in a STEM program, and they take the curricula more seriously.

But finding enough funding isn't the only roadblock many programs face. Sometimes, the bigger issue is making STEM information and concepts accessible to students. Integrating STEM professionals into a program is an easy way to introduce students to STEM careers, but it takes more than their knowledge and expertise to ignite a long-term passion in students.

"The biggest challenge a STEM professional can have is figuring out how to take information down to a child's level," said Moni Singh, founder of Raleigh, N.C.-based STEM for Kids, an organization that designs STEM curricula for elementary students. "You have to make it work for children. If you use too much jargon and load them up with concepts, you will lose them. Think about ways to keep a program really hands-on."

For example, she said, students in a STEM for Kids-supported computer science afterschool program create avatars that "magically" read their parents' minds by applying what they've learned about binary numbers.

There are lesser-known roadblocks to consider, as well. While some afterschool STEM programs generate from within schools, many are outside initiatives looking to come in, said Jamie Knowles-Griffiths, director of the North Carolina Center for Afterschool Programs (NC CAP), a state-wide group dedicated to increasing student access to high-quality afterschool programming.

"Sometimes there is an access issue, and it can be challenging because it's a local decision that has to be made," she said. "Program leaders aren't in charge of whether they can enter into a contract with a school, and it doesn't always happen easily."

The best way to clear that hurdle and build a strong foundation, she said, is to create an eclectic team by casting a wide net into the community. Schools and museums are excellent partners, but including elected officials, health department staff, or law enforcement can strengthen community support for a STEM program. Local businesses, community groups, and faith-based organizations can also offer unique ideas and perspectives on how to reach young people. Giving these groups a seat at the planning table often results in greater engagement and a wider pool of resources from which to draw in the future.

Maintaining enrollment can also be a problem, said Linda Rosen, Ph.D., Change the Equation's chief executive officer. Afterschool programs aren't required, so there is always a chance students will choose other activities over STEM education.

"As kids get older, there are lots of things that pull on their time and attention—soccer, scouting, religious youth groups, or part-time jobs," she said. "One of the biggest challenges afterschool providers have is taking advantage of the time they do have with students."

One way to spark interest is to not only ensure curricula cover interesting topics, but to also make it relevant to students' lives, said Kris Brenton, director of the New York Academy of Sciences (NYAS) Afterschool STEM Mentoring Program. This program pairs interested afterschool programs with graduate and doctoral students trained to teach STEM disciplines.

"You may have the super cool factor of dissecting a sheep brain, but kids want a deeper connection or relevance to their own lives," he said. "Instead of just talking about the anatomy of that sheep brain, talk about diseases that affect memory. Look at things that are happening in the lives of students and pitch to that."

Keeping students engaged is also easier if programs show them how STEM relates to potential careers, Panoff said. For example, Shodor's middle school students learn the intricacies of forensic science technology by solving a fabricated crime. Using chromatography, they identify from which pen ink used to write a ransom note came. They simulate the use of reagents in blood typing, and they analyze fingerprints. Their job is the same as any real-world investigator: identify the perpetrator.

Designing a Successful Program

Even with all these obstacles in the way, it is still possible to create a program that effectively introduces students to STEM and makes it an important part of their lives. To reach this goal, program administrators must have a well-considered plan.

"The very first thing a program must do is be very deliberate and intentional about what they're looking to do," Krishnamurthi said. "STEM is hot right now, and a lot of people are very interested in offering it. But you have to figure out a vision for what you want your program to look like."

The program's mission, however, must meet an immediate need in order for the initiative to flourish. Knowles-Griffiths recommended conducting a community needs assessment to identify whether a proposal is on-target or needs modification.

"These needs assessments are often overlooked, but they're very important," she said. "We read a lot of grant applications and have talked with folks across [North Carolina], and they sometimes assume they know the best fit for their program. But they haven't researched other programs or what could be good partnerships."

Program administrators must also be careful to set reasonable expectations based on available resources, she said. Promising more than a program can deliver makes the effort less likely to succeed.

Once it's clear how a STEM program can effectively address a local educational desire, Knowles-Griffiths suggested program staff sit down with their team of partners to pinpoint opportunities for collaboration, as well as any barriers that might exist.

It's also equally important to choose a teaching method that will prompt students to respond positively, said Shodor's Panoff. Getting students involved with instruction is a good way to increase their engagement.

Although Shodor staffers are always present as content experts, much of the actual instruction is student-to-student. High school students mentor middle schoolers, and college students work with high schoolers. Not only does this strategy reinforce STEM learning for the older students, Panoff said, but younger students also respond positively when they work with someone close to their own age.

"Having near-peer teachers helps keep the material grade-appropriate," he said. "It also reflects the flow of material and keeps kids involved as the material itself develops."

Shodor also offers older students real-world work experience through internships and apprenticeships. These students work alongside Shodor staff, maintaining and servicing the organization's own databases. And, for this work, they receive a stipend. It's on-the-job training, Panoff said, that will set the students apart from their future competitors in the job market.

According to NYAS's Brenton, the STEM Mentoring Program mirrors Shodor's near-peer approach. After teaching graduate and postdoctoral students how to teach STEM curricula to children and youths, NYAS places them in afterschool programs as mentors and instructors. Oftentimes, they are the first STEM professionals students meet.

"The question of 'why is this important?' isn't asked because they're presented with a person who does this as their job," Brenton said. "It provides a depth and authenticity that young students can feel."

Professional Development

As mentioned earlier, STEM professionals and afterschool program staff need more than content expertise to convey their knowledge to students. Many, if not all, need guidance on how to translate often complex information to a young audience.

Rich professional development opportunities are particularly important, Krishnamurthi said, because they also help program staffers select and deliver the right curriculum for their students. Shodor offers this guidance in addition to its on-site afterschool programs.

According to Panoff, he and his colleagues visit existing programs and teach a session while program staff observe. It's an effective method to demonstrate how best to impart STEM knowledge to students.

"Our suggestion for STEM education professional development is a watch one-do one approach," he said. "We go in and show them the things we do, whether it's astrophysics, environmental science, or programming and web design. Modeling how to teach the curriculum gives them a little bit of confidence that they don't have to start from scratch."

Programs are, then, free to implement the curriculum, and Shodor staff will provide additional assistance if needed.

Getting program administrators involved in curriculum design also strengthens their ability to teach students, said STEM for Kids' Singh, especially when afterschool programs strive to meet state science standards.

"It's really guidance in terms of content, as well as approach and delivery," she said. "For example, if someone comes in and wants to conduct a third-grade workshop on electricity, we help them figure out what might be a way to best bring this concept to their students. And, then, we have a session about delivery so they know how to keep the topic exciting."

There are also professional development resources available for afterschool programs that can't find such opportunities locally. For example, Wheelock College in Boston offers professional development courses online. The National Alliance for Partnerships in Equity's STEM Equity Pipeline also offers remote access to professional development resources. In addition, the Center for STEM Education for Girls maintains a list of nationwide professional development seminars for interested program leaders.

Afterschool Efficacy and Future Improvement

The quality and quantity of afterschool STEM programs have come a long way in recent years, and according to a January 2013 Afterschool Alliance report, "Defining Youth Outcomes for STEM Learning in Afterschool," they've had some significant successes.

Education experts evaluated eight indicators, such as the desire to participate in STEM activities or the awareness of STEM careers, and determined afterschool programs effectively reach three goals. They prompt interest in STEM and STEM activities, augment student abilities to productively engage in this learning, and lead students to value the STEM knowledge they gain.

Given these accomplishments, surveyed experts recommended afterschool leaders take additional steps to build upon achievements to date. Afterschool programs should actively embrace additional research efforts that delve into the long-term impacts of STEM learning outside the classroom. According to the report, these types of investigations may be the best tools through which "value and contributions of afterschool programs can be fully articulated and ultimately assessed."

Following these recommendations could help afterschool programs identify previously unrecognized needs and open doors to untapped resources, Krishnamurthi said. It's also important to remember that, even with additional resources, these initiatives must remain true to their original missions. Rather than extend school-day STEM instruction—and risk duplicating curricula—afterschool programs must use their resources to give participants the opportunity to immerse themselves in STEM and learn with their hands.

"Schools and teachers are trying hard to work with kids, and after six or seven hours, kids are ready for something different," Krishnamurthi said. "There are constraints on the school day and teachers. Afterschool, though, provides a great venue for afterschool facilities to build on what students are learning."

By Whitney L.J. Howell

Resources and Links

Noyce Foundation
noycefdn.org

National Science Foundation
nsf.gov

U.S. Department of Agriculture
www.usda.gov

Change the Equation
changetheequation.org

Afterschool Alliance Funding Database
www.afterschoolalliance.org/fundingData.cfm

STEMconnector
www.stemconnector.org

Wheelock STEM Teach Enhancement Project:
www.wheelock.edu/academics/professional-development-opportunities/online-courses

STEM Equity Pipeline
www.stemequitypipeline.org/ProfessionalDevelopment/Default.aspx

STEM Education for Girls
stemefg.org/index.php/resources/teacher-professional-development-opportunities

Defining Youth Outcomes for STEM Learning in Afterschool
www.afterschoolalliance.org/STEM_Outcomes_2013.pdf

Developing a Plan

Nearly all SSEP grant recipients have established programs or serve as a function or part of a program at a larger institution. As start-up funds, SSEP monies have enabled these programs to gain stability, become more established, and develop long-term sustainability plans.

To be successful, the writer for an existing program must be able to present data demonstrating the impact of activities on students' success in reaching the goals of that program. When applying for SSEP, we provide guidelines (see previous chapter) of our expectations of learning for students. Matching the parameters of these guidelines, as outlined in a previous section, shows clarity of purpose and eligibility to apply for this grant. This also helps the application reviewer move on to the next selection criteria. Creating a program to match a funding source is a sure way to failure. The award is competitive with an average 28 percent funding ratio, and the advisory committee looks closely at the program's content quality, as well as its ability to carry out the proposed work laid out in the application.

Successful programs will have a strong, structured foundation and will engage students in the learning process through meaningful, hands-on educational experiences.

Identifying the Need

The first steps to designing a successful SSEP program are determining what the need is and then finding—and figuring out how to fill—a void to eliminate that need.

"It's usually me thinking 'What can we offer?' and 'What have the teachers been asking for?'" said SSEP Director Emily Bloom, associate director of science education outreach at Campbell University, located in rural Harnett County. "Part of what we've done over the past 13 years is to have people understand that it's important to create programs with the students in mind."

Articulating the vision of the program is extremely important. The more specific you can be about it before you begin the grant-writing process, the better your chances in helping the reviewer understand your purpose.

According to SSEP Director Mary Arnaudin, Transylvania County's 4-H agent, spending focused time thinking about the program "forced us to get past the vague ideas and get us onto actually writing."

Leverage Existing Programs

Designing a unique program is imperative, but you don't have to start from scratch. There are a number of best practices and national models that can be replicated. The Burroughs Wellcome Fund has funded out-of-school time programs since 1996 and have solid profiles of exceptional programs that are replicable. Meeting with other program leaders to get ideas and incorporating some of their strategies into a concept you may have are often beneficial.

For example, Arnaudin partnered with SSEP Director Jennifer Williams, a Transylvania County science teacher involved with the Science House in Asheville, to enhance her grant-writing efforts. In addition, she leveraged her experience in creating curricula for programs with the Forest Service, as well as served as a reviewer for the Parks Scholarship at North Carolina State University to create program features and an application that fulfill SSEP requirements.

Partnering for Success

Strong partnerships are often the keys for success. It is important to engage partners early in the planning process.

Arnaudin's relationship with Williams not only improved her program's grant writing, but it also led to strengthened connections between the Science House in Asheville and the Science House in Edenton that focuses on aquatic environmental learning.

During the grant-writing process, an Asheville Science House faculty told Arnaudin her proposal closely resembled ongoing work at the Edenton Science House. Reaching out to that group, she said, was a logical next step.

"It was really good to have the Science House as a partner. That's why we started this whole thing with a trip there at the very beginning," she said. "I wanted our teachers and our kids to see [aquatic science learning] in action—what it looks like, what it's like to collect data."

SSEP Director Linda Cagley, vice president of funding and partnerships for McClintock Partners in Education, is also part of a successful partnership between Charlotte's McClintock Middle School and the Christ Lutheran Church.

Despite being in an affluent area, this school has a nearly 90-percent minority student body, and nearly 80 percent of students receive free or reduced lunches. These students have very few opportunities to learn outside of the classroom, so the school and the church joined forces to launch a summer camp for 20 high-risk students who were selected by the school. The program included math and language arts tutoring, as well as field trips.

The summer camp was so successful that it led to more plans, Cagley said.

"During that summer, we started to plan for a year-round program, called Family Nights," she said. "It takes place every Tuesday night at the school, and we invite the entire family to come for a meal and enrichment activities."

Additionally, Emily Bloom recognized the importance of partnering with a larger educational body. She began working with the university's SSEP grant during its early days. When a professor expressed concern that students weren't getting exposure to various types of science, Bloom stepped in to supplement existing efforts.

The first grant turned into STEP, a science program for middle schools linked to the University School of Pharmacy Wellness Institute Middle School Program. This partnership paved the way for STEP to expand into the College of Pharmacy's science education outreach department many years later.

To support STEP, Bloom's most important job is serving as a bridge between the university and the surrounding school district.

Strategies for Partnering

Nurturing Existing Relationships Mary Arnaudin was fortunate to have an existing relationship with the school system through other programs. Working with the Forest Service, she helped get related curricula into the schools.

"When you're going into a project you want to make sure you maintain these relationships for the long term," she said. "Don't just get somebody to do something and not keep that relationship going. We've developed people who are interested in the program, and we go back to them every year to be our reviewers for selection. They know exactly what's expected of them and that we appreciate their time. You want to nurture that so they'll still be there five years later."

Reach Out to Professional Societies Professional societies can also be a resource. A quick Internet search, email, or phone call can reveal a list of groups accustomed to coordinating professional development programs. Bloom tapped into resources from the American Society for Microbiology when the organization held an international workshop at Campbell.

Most professional societies have outreach components or local chapters in communities. You do not have to work in a university to reach out to them. Find one that aligns with your program's mission and begin the conversation.

Be persistent. Many professional societies are staffed by volunteers who already have demanding day jobs in the research field. An unanswered email may not be a definitive "no," but merely an oversight, buried under a list of priorities.

Writing Grants

Occasionally, BWF sponsors regional grant writing workshops that specifically target those interested in applying for SSEP. Most schools, museums, community groups, etc., do not have access to a professional grant writer. The workshops are designed to demonstrate how to write proposals. As a foundation, we advise potential applicants to follow instructions.

Partnering with larger institutions or universities can provide access to individuals with grant-writing experiences. Institutions, especially those in higher education, have the infrastructure and experience to manage the grant-writing process.

There are a number of consultants and workshops available through for-profit and not-for-profit organizations that offer assistance with grant writing basics.

Ideally, as mentioned earlier in this chapter, it's best to brainstorm on ideas to get a broad view of the program and assess the need. Is it a project that needs partners to capitalize on resources? Is this a joint venture?

Once consensus is established with the stakeholders, find organizations with experience in what you are proposing and funders that are interested in your cause—in this case, BWF. Look at any existing partnerships and those with potential. Do they have similar interests but different skill sets? Negotiate, but be flexible, to create a win-win situation. Partnerships and resources exist everywhere: business and industry; local, state, and federal government; nonprofit organizations; personal contacts; and volunteers. Be sure to get commitments in writing.

Once the foundation is constructed, now it's time to think ahead. How does the program play out over the long term? The SSEP is funding for three years, but what happens after that? How does the program continue?

When you're ready to write your proposal, first and foremost follow the instructions. Read the material on the BWF website. Then answer the following questions: Is your proposal well prepared? Thoughtfully planned? Clearly communicated? Concisely packaged? Did you follow instructions? Free of errors?

The major components of proposals in general are:

Summary This statement identifies the grant applicant. It should include at least one sentence each on credibility, the problem, the objectives, and the methods. SSEP is focused on K-12 students; therefore, you should describe the students you will reach through your program offerings. It should also include total costs, funds already obtained, and amount requested. This is an extremely important paragraph. Is it brief, clear, and interesting?

Introduction This section clearly establishes who is applying for funds and for how long. It describes the applicant organization's purposes, goals, programs, and activities. The introduction also describes the applicant's clients or constituents. It will provide statistical evidence of the applicant's accomplishments and quotes/endorsements in support of those accomplishments. The introduction will support qualifications in the area of activity in which funds are sought and lead logically to the problem statement. Following the summary lead, a good introduction is brief, interesting, and clear (i.e., free of jargon).

Problem Statement/Needs Assessment The problem statement or need assessment relates to the purposes and goals of the applicant. A good statement or assessment is reasonable, supported by statistical evidence, supported by statements from authorities, scaled to an area/region of problem, and is stated in terms of clients' needs and problems. It should make no unsupported assumptions. And once again be brief, be compelling, be clear.

Program Objectives Include at least one objective for each problem or need committed to in the problem statement. Objectives are outcomes not methods. This section describes the population that will benefit. State the time by which objectives will be accomplished. Objectives must be measurable, if at all possible, and should be connected to evaluation.

Why Proposals Fail

Failure is a very strong word. The BWF SSEP advisory committee is confronted with the unenviable task of selecting a limited number of applicants for funding. Many strong candidates do not receive funding.

We've explained what makes for a good SSEP, and perhaps it's time we explain why some programs don't make the cut.

One cause for rejection is that the application does not clearly identify the needs assessment or the problem. In other words, it does not define its niche or explain the void it is trying to fill. Sometimes, the objective and strategies do not directly relate to the stated need or are too vague.

In other cases, the evaluation methods are unclear, unrealistic, or not existent. How are you going to determine if your program can work?

Other reasons include:

- Inappropriate or unrealistic time schedule
- Inappropriate or unrealistic budget
- Bad timing
- Wrong funding source
- Proposal is too hard to read
- Connection to funder interests not clear
- Guidelines are not followed
- Proposals have errors that distract the reviewer
- Lack of clarity on student activities and how they will be carried out

The budget is critical because it tells the story of what are the priorities for the program. If, for example, you are planning to have an afterschool program at a facility away from school, the budget should include transportation costs to move students from one place to another. If your program is designed to reach high school students for a summer experience when they are generally working, the budget should include stipends to help students consider where to spend their time.

Assembling the Right Team

Successful programs do not happen in a vacuum. Perhaps a single person's drive and vision to create a project can assume some responsibility; but in order to lead, you need a team. Having a good team in place is crucial to a program's success or failure. While good leadership is very important, having a good team in place is perhaps even more so.

If you're working in a school, it's important to get buy-in from administration. They have the potential to provide resources and a larger network.

Recruiting staff and volunteers who believe in the program's mission is also very important. They can become your eyes and ears of the program and relay valuable information to the program's evolution.

Director

Establishing the Central Point Person Running a program is all about relationships. It's about relationships with local teachers to pinpoint any ground-level voids or needs. It's also about relationships with volunteers, faculty, and staff members willing to commit their time and energies on helping educate children.

There needs to be someone in charge of managing the assortment of relationships. There must be someone—somebody like you—who can be the node in the network, linking various people in order to get things accomplished and make sure the program succeeds. The point person serves as a type of translator or a moderator.

For example, it can sometimes be difficult for some volunteers to switch gears from instructing college students to working with secondary students. Giving them vague guidance about

your goals can often lead to confusion. That's where the point person can translate between the two worlds and provide information and support to ease communication.

"Professors do not do lesson plans in college," Emily Bloom said. "They don't write things out the way teachers do in middle school and high school. So if you can share [your goal] with them and give them a concrete example, they are much more likely to say 'I can do that.'"

Get Buy-In from Administrators Having administration support is critical to your program's success. For programs targeting primary school students, an administrator can relieve the teacher from managing paper work that may seem burdensome. For programs geared for high school students it can open doors for these students to visit, learn from, and work with scientists involved in ongoing research.

Campbell University's vice president for business—and a former Science Olympian—threw his support behind Bloom's efforts to make science more accessible to younger students and bring the Science Olympiad to campus.

Instructors and Staff

Search for Staff with Open, Excited Personalities Who are Passionate About Science Not all extraordinary, accomplished scientists are cut out to work with younger students, however. It's important to find the right balance between scientific expertise and a personality that sparks an excitement and love of science in a child. This can be tough since many SSEP programs run during summer breaks—a time when students are less enthusiastic about learning. So, selecting staff and faculty who can show that data collection, designing solutions, and doing hands-on experiments can be fun and interesting can make all the difference.

"Qualifications are one thing, but there certainly is a personality quality that we're looking for in a good staff member," said SSEP Director Dorothea K. Shuman, Ph.D., an associate professor

involved with Montreat College's Center for Learning and Investigation in Mountain Backcountry Ecosystems. "Our goal is for our kids to leave the program with a desire to be like our staff—someone who is enthusiastic about, has a good knowledge of, and who has chosen science as a career."

Identifying and Engaging Scientists To find scientists who will be the best fit for your program, focus on those on university campuses who have education outreach as part of their job description, Shuman said. These individuals will be more open to working with you and know how to make science information more accessible to younger audiences.

For Shuman, this meant connecting either with scientists or the liaison in the National Park Service who is responsible for outreach to get the full picture of science and create new connections.

"It's not just about the data collection in the field and coming back and playing around with it," she said. "You want to connect that with what other people are doing to have those 'Aha' moments of discovery."

Programs that include an outdoor or field work component should partner with working field scientists, if possible, she said. Not only are these individuals accomplished scientists, but they also know how to properly collect data in adverse weather conditions.

"We really felt like we were modeling what true field science was like," said Shuman, who connected students with scientists from the National Parks Service, National Forest Service, and U.S. Fish and Wildlife Service. "The students were able to indulge in projects that we made connections with. That was really my dream—that we could partner with real scientists so our kids would collect data the same way they would."

These scientists also helped Montreat's SSEP program develop the protocols students used to collect data. Shuman cautioned you to remember, however, that scientists too are learning the value of student research and investigations.

Volunteers

Engage Scientists and Volunteers Early Involve your scientists, science teachers, and your volunteers who know STEM content early in the program development stage. Not only does it ensure you'll meet everyone's needs, but it also opens the door for conversations about how to make the program efficient and engaging.

"Being flexible and bringing them in early I think is the secret," said SSEP Director Christi Whitworth, education director at Pisgah Astronomical Research Institute, home to the SSEP program Space Science Lab. "Listen to their opinions of how and what order information should be presented."

Ask your volunteers early about the teaching set ups that work best for them, and involve them in conversations about your agenda and curriculum. You might be astonished at what comes out of those discussions.

For Whitworth, that surprise came in the form of a volunteer who was very specific about how he wanted back-up carts organized. His system of separating and labeling the carts proved to be highly efficient for trouble-shooting and repairs. The program would never have known about the volunteer's idea had he not been included in conversations months before the program began.

Let Volunteers Decide Their Level of Involvement / Give Volunteers Hands-On Experience Talk to your volunteers about your goals and expectations for the program, and let them experience what you plan to offer. They can then make an educated decision about their level of commitment. It can also be a way to filter out those volunteers who are not a good fit.

According to Mary Arnaudin, "My 4-H experience has taught me that being as specific as you can be with volunteers take a lot of the guesswork out of things for them."

Many of Arnaudin's best volunteers have been retired scientists who have a deep interest in research. They have both the experience and the time to dedicate to the program. Conversely, many graduate student volunteers have discovered either through conversations about or working with the program that they aren't suited for research.

Encourage Volunteers to Teach Their Passion Be open to letting your volunteers and faculty teach something other than their usual subject area. Encourage them to discuss their hobbies, Bloom said. Their passion for a subject will seep through to the students, making the entire program more interesting for all involved.

"One thing that helps is, at least for me, understanding that people who teach science all the time are interested in lots of things," Arnaudin said "Just because they're experts in one subject doesn't mean they're not interested in helping kids learn about something else."

Another part of encouraging volunteers is helping them conquer the fear of working with younger students. For example, many academic scientists are accustomed to undergraduate—or graduate-level learners, and they might feel uncomfortable working with primary and secondary students. According to Emily Bloom, "convincing them that if they can teach their husband or wife about science, they can teach a middle school student."

Combine Outreach Programs and Professional Development Opportunities Coordinating the schedule for your student and faculty professional development programs can offer substantial benefits, Bloom said. Being able to attend a professional development workshop and volunteer for a student program without committing to double the time can be very attractive to faculty. It also gives them an opportunity to hone the activities and lesson plans they have with colleagues.

For example, when Campbell University hosts the Science Olympiad, Bloom said she schedules a professional development workshop. Attendance has grown each year.

"I don't ask people to rethink something. If they've thought it up for the kids and, then, they're thinking along the lines of 'What can we do to practice the activities with the kids?' they do it with professional development," she said. "I get two programs out of it, but I'm only asking the faculty to do one subject."

Engage High School and College Students as Unpaid Interns
Scour nearby high schools and colleges to identify students who would be interested in being interns. The benefit is two-fold: the program gathers additional volunteers for free, and the students get to participate and learn along with the younger students.

Linda Cagley at McClintock Partners suggested you work with guidance placement offices or science teachers to distributed applications to the most appropriate students.

"We didn't pay them anything, but we did write recommendation letters if they wanted them afterwards," she said. "It ended up being a great experience for them as we read through their evaluations—they got to say they were a part of this."

Partnering with a Sponsoring Group to Bring in Volunteers One of the biggest hurdles for a SSEP program can be recruiting volunteers. To make the job easier, find a sponsoring group—a company, church, or larger school—that can take over the bulk of that responsibility.

"Recruiting is a lot easier when it's a group effort," Cagley said. "The people are more comfortable volunteering. They can go to the school and see a lot more people they know because they're all coming from the same kind of group."

Volunteers can be responsible for helping with transportation, providing snacks, or even attending events, such as inventor's showcases, when many—if not most—parents are unable to come due to work responsibilities.

Provide Orientation and Guidance for Working with Students
It can also be helpful to give your volunteers information about how your students react to various situations. For example, Arnaudin uses a 4-H survey that describes various scenarios and asks whether the student has ever felt sad or diminished during that type of event. Students also identify specific moments where they felt as though they were learning.

"Showing volunteers these surveys is our way of giving them an orientation, a big picture of what the whole program is," she said. "I've done this with many people just to give them a feel for what kind of climate we're trying to create."

Avoid Teacher and Volunteer Burnout Don't suffocate your teachers' enthusiasm for the program. Instead of following the school calendar, consider shortening the program to allow for some time off, Renata Crawley said. For example, rather than meet from September to December, end the program for the semester at Thanksgiving. Those extra few weeks can help teachers and students rest and renew their interest.

"We realized we had to give the teachers a break," she said. "Teachers that worked with our program the first year didn't want to do it a second year."

Recruiting for the Program

Administratively and logistically you have all the pieces in place for a successful program. The only element left are the participants. All you need are kids to sign up, and who wouldn't want to sign up for your program? It's a little more complicated than that.

Recruiting students for a program is an individual and idiosyncratic endeavor. Elements, such as economics, geography, and demographics must be taken into account.

Some recruitment is successfully managed by teachers and relationships with schools and/or engaged parents. Others need a marketing strategy using social media and other recruitment tools. Some programs rely on a little of everything. One thing is true. If a student likes a program, she will tell her friends.

Recruitment Strategies

Use Teacher Connections Teachers are a good resource and collaborators in recruiting program participants. Not only can they identify what's missing in your program, but they can often offer suggestions on how to fix it.

The easiest way to engage teachers is to foster a relationship with them. Emily Bloom said she begins this contact with email contact. Don't start out with a request that they help you recruit for your program. Show them you can provide resources for them, as well.

"I try to let the teachers see I'm really interested in what they're doing," Bloom said. "So, I send them little tidbits that I find. Especially among teachers who have been to one of our workshops before, I'll send follow-up articles. I usually only send things out a couple times a month."

In addition, you can use social media to your advantage. Start a Facebook page or a Twitter feed, and invite teachers to follow you so they stay current with your activities. If you have a webpage or website, keep it updated.

Provide Incentives for Teachers to Help Recruit While many teachers may be happy to help you recruit, they have significant stresses on their time. To make finding students for your program a priority, consider offering them an incentive, Dorothea Shuman said. You could offer them the opportunity to come to the program or you could purchase a gift for their efforts.

Postcards to Students Sending information home to families can also increase your attendance. Not only does it add a certain gravitas to being selected into the SSEP program, but it also reminds students when to sign up, Bloom said.

"It's our way of saying, 'This is a big thing, not everyone gets to do this. So be serious when you're here,'" she said. "Once they're here, they'll have fun, but we make it serious at the outset."

Bloom said she chooses postcards over email because not every family has Internet access. Also, children enjoy getting an official letter in the mail addressed to them, even if the information inside is directed to parents.

Encourage Participants to Bring Friends Teacher recruitment can be very effective, but often students will listen to what their friends say about a program before they'll heed an instructor. So, encourage your students to spread the word and invite their friends to come, said Shuman.

"Our best recruitment, right now, is the students," she said. "They learned a lot about science, had a great time, and they want to come back for different programs. And, they're sharing that with their friends."

Building a Network of Past Participants Stay in touch with your past participants. For young students, hearing that their friends had fun in your program can often be a stronger pull than even their own interest in what you have to offer. Following up with

or maintaining connections with students you've worked with previously can offer two-fold success. It's an excellent way to help them internalize what they've learned, and it keeps your program at the forefront of their mind when they talk with others

Play Up Benefits for Parents Sometimes program success can depend as much on parental interest as it can on student interest—particularly in rural areas. Be sure to highlight all the benefits your program provides so parents and guardians can see it's a "good deal."

If you don't charge for parking, say so. If it's free to participate or if you'll provide lunch for students, mention it. Invite them to walk around campus during the program or provide directions to nearby attractions.

It can be a challenge to attract the parent or guardian, Bloom said, but the student ultimately benefits.

"Try to make it sound appealing as far as getting here," Bloom said. "These are kids—especially in our rural area—who if you do a program on anything, they're likely to show up if they can get here."

Parent-to-Parent Recruitment Utilize your parent network, as well, Christi Whitworth said. Encourage parents to talk with one another and share program information with others, even if students aren't talking about their experience. This method can be particularly helpful in a home schooling community, she said.

Other Issues

Encourage Students Who Often Don't Get Involved—Don't Base Acceptance on Grades or Achievement Don't make the mistake of only catering to the students who always get involved, have the best grades, or the most impressive list of extracurricular activities. Many times, those aren't the students who will benefit most from your program. Instead reach out to students who have few resources and even fewer opportunities to take advantage of science education.

"None of my programs are based on grades or class rank," Bloom said. "It's first come-first serve. Are you interested? Can you get here? If you can show up, we'll have you. It's about reaching that kid who really needs a push."

Part of encouraging students to expand their horizons can mean directing them to programs other than your own. If you can't fulfill their wants or needs, you can be a resource, providing contact information to point them in the right direction.

Narrowing a Large Applicant Pool Reach out to others to help you select participants from the applicant pool. It's a great opportunity to pull in volunteers or parents. But be very specific about the qualifications you're looking for in students—don't leave it for the evaluators to guess. You can make the process even easier, Mary Arnaudin said, by giving them a review sheet by which they can judge applications.

Most importantly, however, simply remove yourself from the selection equation.

"In a small town, you don't want to be the one that is known for not selecting someone's son or daughter into the program," Arnaudin said. "Instead, you can say 'We have this panel of educators and scientists who review them for their suitability to this program.'"

Consider Student Schedules Time, especially in a student's life, is at a premium. You have to find a way to compete against academic requirements, sports commitments, and other extracurricular activities.

"We've got to find the kids who are willing to do the program," said SSEP Director Howard Lineberger, a teacher with a Mars study program at Durham Academy. "They're already busy. We've got to convince them that it's going to be something that's worthwhile."

To keep programs full and attendance steady, he said, expand the recruitment zone and encourage students to suggest the program to friends.

Finding the Right Enrollment Number Determining how many students to enroll can be tricky, but over-enrolling can help you avoid having empty spots. Although students may enroll in the program, their life circumstances can often change, Linda Cagley said, especially among the lower-income students SSEP programs often target.

"We're dealing with families in poverty, and their plans change a lot," she said. "They tend to move to a lower-rent apartment or move in with relatives. So, this year we're going to over-enroll in an effort to boost our numbers."

Social Media and the Creepy Treehouse Social media is, by far, one of the most prevalent means of communication, particularly among young students. Having a Facebook page or a Twitter account for your program makes it easy for students to stay informed about your activities and up-to-date on any changes or deadlines.

Be careful, however, that you don't inadvertently create what it known as the "Creepy Treehouse" effect, a phrase coined at Central Connecticut State University. Don't make interaction on social media a requirement for your program. Forced communication between students and an authority figure, such as a program administrator or teacher, can often be seen as an invasion of the student's online privacy.

Implementation Issues

Developing a solid plan for creating a program is extremely important. However, in many ways, identifying and addressing any implementation issues is not only important for outlining an initiative, but it can also be more integral to your program's success.

Challenges can vary by a program's type and focus, but there are some fundamental obstacles that most grantees encounter.

Student Well-Being

Code of Conduct In order to meet the goal of giving all participating students hands-on scientific experience, you must set expectations for good behavior at the outset. In this case, Mary Arnaudin turned to the 4-H Code of Conduct, which outlines prohibited behaviors and corresponding disciplinary measures.

"We had the kids become 4-H members with us," she said. "They filled out an enrollment card, and, then, they initialed that they would abide by the 4-H Code of Conduct."

In tandem with setting behavior expectations, Arnaudin recommended surveying students to learn what encourages or discourages them to participate in group activities. Students' answers can also highlight the best ways to help teach science. This knowledge can drive the balance between quieter or more high-energy endeavors.

Set up Insurance for Students If your elementary-or secondary-school program occurs on a college campus or offers outdoor experiences, consider providing insurance for students. If the program is associated with a college or university or has another significant sponsor, asking them to contribute funds toward

insurance could help defray costs, Emily Bloom said. In her case, her department covers much of the cost, leaving her to pay only $5 per student, which for SSEP can be provided via the grant.

Complete Medical Release Form As with all out-of-classroom activities, SSEP grantees—especially those taking students on overnight excursions—should have each participant fill out and return a medical release form, Arnaudin said.

"We have these forms in case we need medical attention for a child, as well as medications and allergies," she said. "So, that kind of alerts us to what we're dealing with."

Be Sure Staff are Knowledgable in First Aid For Outdoor or Wilderness Programs, be sure all your staff who accompany students into the field complete the Wilderness First Responder program, a national initiative that provides First Aid and other medical instruction for outdoor situations. This certification is critical especially if your program take students to locations that ambulances can't easily or quickly reach. Only hire individuals over age 21.

Develop Plans to Accommodate (or Manage) Participants with Various Health Challenges There are times when a student's health becomes a great challenge. In these situations, you must have a strategy in place to either best accommodate or re-direct these individuals. Depending on your program's structure—whether it requires extensive outdoor activity—the risk to the program of including the student could outweigh any other potential benefits.

For example, Dorothea Shuman said, her program declined to let a student with Asperger's Syndrome enroll in a rock climbing program after she was unable to function well during a previous backcountry experience. Having a conversation directly with a participant's parents or guardians is the best way to address these types of concerns, she said.

Partnering With an Attorney to Double-Check Your Forms and Liabilities Engage a lawyer to make sure your program is properly protected. Have him or her review any existing risk forms. If your program is new, ask about any liabilities, as well as any risk form or permission requirements you should be aware of for primary and secondary-aged students. Consider putting an attorney on retainer if you offer significant outdoor or overnight activities.

Limit Class Size Due to Younger Ages Program size is often determined by the age of participants. Classes for younger students should be smaller, said SSEP Director Renata Crawley, a teacher with the SSEP program at West Marion Elementary School in Marion, N.C. With younger children, she said, not only are attention spans shorter, but larger groups limit the list of activities. For kindergarten through second grade, she recommended capping enrollment at fewer than 10 students.

Parent Communication Gaining parental trust is a fundamental component to your program's success. Be sure to keep parents and guardians updated on agendas, activities, and transportation. Doing so will help engender confidence.

According to Arnaudin, parents want to meet the program staff who work with their children. They want to read and sign forms, and they want to know plans. Involving parents can ensure the program's sustainability, she said.

"We've had several families that have had a second child in the program a few years later," she said. "I think they just feel it is very well thought out and that it's a privilege."

Planning Appropriate Activities

Develop Curriculum at Each Age Level Tailor each curriculum to the students' age so they can learn about science at their own level. It can also be helpful, Crawley said, to give teachers a written resource to supplement any lesson plans they might already have.

"I made notebooks for every grade level, and in that notebook, I put how to use the scientific method," she said. "I tried to make as little work as possible for the teachers so that they can just look through it and then go do it."

For instance, kindergarteners who participate in West Marion Elementary School's SSEP program focused on the weather and animals. First graders learned about plants by working in a vegetable garden. Second graders learned about life cycles by working with mill worms and butterflies. And, third and fourth graders studied ecosystems, trees, and animal adaptation.

Flexible to Student Interest SSEP is designed to focus on students' interests. Just as successful programs strive to meet teachers' needs, it is imperative to keep this at the forefront. Linda Cagley saw, first-hand, the importance of listening to what students want.

In 2007, Cagley's group launched Family Nights, a year-round program for the entire family. Every Tuesday night, families came to McClintock Middle School for a warm meal, educational programs for all attendees, and time for students to complete homework.

"When the program was first created, it offered tutoring and homework help," she said. "However, this was not particularly effective because the students tended to not bring their homework."

It was during the program's second year that Cagley and her team recognized the students want access to knowledge and activities they couldn't get elsewhere. To meet that need, two retired engineers started an engineering club with a dozen students. The club had the most regular attendance of any Family Night group, demonstrating that students craved hands-on experiences that exposed them to new opportunities.

"We switched our format to a club format, and as we watched these clubs, we realized our STEM engagement was the strongest thing we had," Cagley said. "The kids were more involved in that than anything else. We actually wrote a white paper, and the school became a STEM-designated school that next year. So there has been a lot of focus on STEM opportunities."

Budgeting for Snacks Prepare and budget for students to be hungry, Crawley said. You'll have little luck getting students to focus on science if they have an empty stomach.

"Our first year, we didn't allot money for snacks, and that was just crazy," she said. "The first thing they want is a snack."

Create Learning Games Get your students moving. Activities that make learning fun are the most successful. They are an easy and effective way to satisfy children's need for physical activity after school while introducing new scientific concepts.

For example, Crawley developed a Predator-Prey game that helps students learn what various predators eat. Each student wears a picture of a predator, carries a card detailing its prey, and collects laminated prey from the ground. The goal: collect enough prey to survive.

Crawley also recommended utilizing Environmental Resource Centers to increase the environmental knowledge among teachers. The expectation, she said, is these teachers will share what they've learned with colleagues. The Environmental Resource Centers provide a wealth of knowledge and activities. Crawley encourages the afterschool teachers to take courses with them.

Access and Transportation as Challenges In many geographic areas, the biggest obstacle facing SSEP grantees and program participants is the lack of transportation. Rural locations often do not have public transportation networks, making it difficult for many students to attend meetings.

SSEP funding can help. In the past, Bloom said, grant funding paid for teacher-driven activity buses to transport students

from school to the program site. In addition, if teachers are willing—and parents provide permission—having a teacher bring students to meetings is also an option.

But if it isn't feasible for you to provide transportation, strategically scheduling program meetings can make it easier for to keep attendance steady.

"We try to do things at a time when we know kids can get a ride, but it's hard," she said. "We avoid Wednesday nights because of church and those sorts of things. We do some things on Saturdays, it just depends."

Planning and Scheduling Appropriate Field Trip Activities—Corporate Facilities Well-timed and well-selected field trips can be doubly beneficial to you. Taking students to college campuses provides exposure to university life, as well as introduces them to science as a career, Cagley said.

However, trips to corporate sites can also produce positive results for your program's future.

"I'm in talks with [a couple of companies]," she said. "I thought it would be a great way to get the corporate aspect involved in the hopes that, as we move down the road, they might be willing to help fund some of the effort if they actually had a stake in it."

Identify Appropriate Teacher Spaces, Both Indoors and Outdoors Get outside the classroom for hands-on experiences and instruction, Crawley said. If a school doesn't already have outdoor resources, SSEP funding can support adding these amenities, such as building a butterfly garden or creating a nature trail for students to explore environmental science.

Provide Program Activities to Kids and Teachers Potentially in that Order To meet the chief goal of bringing science to primary and secondary students, make sure your teachers are well prepared to readily engage with program participants. Moving students directly into an activity as soon as a meeting opens is vital to keeping their attention and interest, said Bloom.

"We always try to have workshops where we do what SSEP does—to look at what they're supposed to be teaching in school," she said. "Then, we give teachers real activities that we've tried out on kids first. We try to give them as much as we can upfront."

Hold Professional Development and Topic-Based Workshops
Bloom also recommended you offer professional development workshops, giving teachers an opportunity to learn about unfamiliar science topics. It can also be beneficial to involve students in these sessions.

For example, last year Campbell University's SSEP program offered a workshop about Chytrid fungus and frogs for 10 teachers and 10 high school students. Teachers and students worked together, examining tadpole lips for infection under a microscope, and they reported information to a database.

"We had the kids here at the same time the teachers were learning," she said. "The teachers, then, took back the information they learned to share in their own classes, teaching other kids how to go out to a pond, find tadpoles, and see if they have Chytrid fungus."

The professional development programs—originally funded with SSEP money—have grown to include pharmacy and medicine instruction, supported by the Dean's office and participant payments.

Training for Engaging Underserved, In-Need Populations
While volunteers may be motivated to expose younger students to science, many of them may be ill-prepared to address the outlying issues that accompany teaching a low-income, in-need student. In fact, many may be uncomfortable entering the school if it's in a bad part of town.

For this type of situation, Cagley's group offering training through a program called "Building Bridges." Based on Ruby Paine's "Pathways out of Poverty" work, the initiative helps volunteers understand the logistical and financial challenges in-need populations face, such as transportation problems or worries about rent.

"The Bridges really helps [the volunteers] refocus a lot of their preconceived notions about people living in poverty," she said. "The training is a really 'make you think' kind of thing, and after volunteers take it, they're far more comfortable coming in and working."

Give Students Control Over Science Conducted Give your students an opportunity to own the science research they've conducted. If possible, allow them to discuss their work with researchers, Howard Lineberger said. Doing so validates that their work is considered science.

Students in Durham Academy's Mars Outreach SSEP program actually present their research to scientists who discuss the work with them afterward and offer tips and advice.

"The kids absolutely feel like they're doing real science," he said. "We let them design the experiment, take all the data, worry about looking at the data every day, and worry about controlling factors that might have been a problem."

Link with Labs to Analyze Collected Data—Engage Students in Discussion of What's Learned Although it might be difficult, stay in touch with your students throughout the school year after they leave your program. That contact will help them retain what they've learned with you, Shuman said.

But to make their work more meaningful, try linking with an individual or a lab that can analyze what they've done and determine what it means.

"I would say putting student work and data in the larger picture was our struggle in our past few programs," she said. "We didn't really have a direct place where that data were being used. But we've made a connection with the Appalachian Trail Conservancy that uses our data for their work with invasive species and other topics."

In addition, a scientist is currently working with the students, modeling the data for them. He will also help them prepare their research for a poster presentation competition. The best student presentations will be selected and presented at the Southern Appalachian Man and Bio-Diversity Conference.

Be Somewhat Flexible with Deadlines It can be to your benefit to stretch deadlines, especially if you are a new program. While having deadlines is certainly important, you don't want to reject someone who missed a cut-off point simply because he or she just learned about your group. Take steps to prepare for that possibility.

"If you build in a little cushion, you will be able to say, 'Don't miss the deadline next time, but go ahead and submit your material,'" said Christi Whitworth. "That is one of those tricks of the trade. If you put a hard and fast deadline out there, you've got some folks who will be well ahead of it, and you've got another group who will be right behind it."

Participation is really the key to demonstrating your success, so you want to include as many students as you can.

Connect Activities and Learning to a Larger Outlook For SSEP programs in rural areas, helping students connect their science research to a larger world view is a critical component of the program. However, doing this is also age-specific. Younger students are more interested in experiencing science for the first time and demonstrating what they can do, Whitworth said. High schoolers, on the other hand, are more apt to think about how what they do fits into the bigger picture.

"In instances with older students, if you can connect them with national scientists for a conversation, that can make a significant impact," she said. "That's a big connector for a lot of kids."

Sustainability

The SSEP grants could be considered venture capital funds. These are funds to get a program up and running and prove that it is essential and meaningful to its students. The program is expected to find a way to provide self-sustaining capital after the initial three years are up.

Maximize Other Existing Relationships for Resources Don't shy away from asking existing partners and collaborators for help when you need it. According to Mary Arnaudin, her program has always benefited from outside assistance. Nearby universities, other groups, and companies can help with grant-writing, research instruction, or even a location to hold the program.

"I consider it an endorsement," she said.

Build Upon Program Successes; Launch Larger Initiative Embrace program growth when it comes. If you design and organize your program correctly, you are likely to see your attendance numbers increase. When that happens, take the opportunity to reach out and bring more scientists and faculty into the fold. It not only spreads your program's name, but it also spreads science learning.

"Our first SSEP grant, written in 1997, was for a program called STEP for middle schoolers," Emily Bloom said. "That program really got started, and now we're the Department of Science Education Outreach in the College of Pharmacy and Health Sciences."

Maintaining Teacher Relationships See the "Use Teacher Connections" section in the Recruiting for the Program chapter.

Engaging Community Members and Parents Students deserve attention and credit for what they accomplish in your program. Unfortunately, for many, their parents are unable to take time off work to attend any presentations. This is another place where your volunteers can help, Linda Cagley said.

"Our kids did an inventors showcase, with help from Habitat ReStore, where we showcased what they created," she said. "Most families have hourly jobs, so we invited church members to come, listen, and see what they were doing."

Bringing volunteers to these presentations is an excellent way to strengthen the bond between the program and its sponsors, as well as students and the volunteers, she said.

Making sure your students have something physical to carry home with them—something to demonstrate what they accomplished that afternoon in your program—can be the extra push a parent needs to continue their support.

"It shows the parents that it wasn't just a waste of an afternoon or it wasn't a babysitting thing," Bloom said. "The students are actually doing something in the program."

In addition, take photos and share them with students and parents, as well as posting them on Facebook. It's an easy way for parents to remain engaged with what their child is doing and learning.

Hold Career Day or Fair Introduce new careers throughout the year so your students have a full idea of what they can accomplish with their science learning. Holding Career Nights is one way to do this, as it brings together students, volunteers, parents, and area organizations.

For example, West Marion Elementary School's SSEP program —Unlocking the Mysteries!—holds career nights and one large career fair annually. The first evening, in the fall, focuses on outdoor learning and associated professions; the second, in the winter, concentrates on career awareness. Lastly, they have a large Career Day in March at the end of the school day. Students research their chosen professions and dress up as someone in that career.

"We invited parents to come and ask the students questions," Renata Crawley said. "It's really fun, and it's a great way to get the community involved."

Create Collateral to Advertise the Program Continuously Be sure to proactively advertise your program early and often. At the start of every school year, put up posters and fliers that talk about what you do. Take-home handouts can also be helpful.

"On the first day of school, we have posters everywhere, advertising our after school club, the Sound of Sea program," Crawley said. "And, thanks to Burroughs Wellcome Fund, we have a huge poster from one of their poster sessions right outside our science lab."

A few weeks later, Crawley said, the program sends home information about their field trips to the beach and what students in the club do. Most importantly, keep enough applications in easily accessible locations to encourage students to apply.

Identify One Person to Be Responsible for Money Matters— Administrative Support Chances are, you're busy enough wrestling with curriculum, recruitment, or faculty issues. Let someone else be responsible for the program's money— someone who will keep track of how much funding you've spent and where.

"It's good to have somebody strong and somebody who can do the math for you," Crawley said. "Having the program director do it, I think would be too much."

Evaluation

Some of you may live in areas that are considering reducing the number of school days to below 180 each year or cutting out programs that introduce students to new intellectual and academic pursuits. Don't take this possibility as a reason to throw in the towel and abandon hope of launching your own SSEP program. Instead, view it as a call to arms for providing these valuable—and shrinking—opportunities.

Besides, if these cuts do materialize, SSEP programs are uniquely positioned to reach students where they're already spending most of their time—outside the classroom. According to the National Research Council report, *How People Learn*, students spend 53 percent of their time at home or in the community and only 14 percent at school. BWF is committed to helping you connect students to the outside world in a variety of exciting ways.

One Foundation's Journey There's no doubt that as educators and academic researchers, we know a lot about learning. But, that knowledge doesn't often translate into effective strategies that push American students toward success in and out of school.

BWF took on the challenge of that universal level of achievement in 1996 when it launched SSEP in an attempt to bring the wonders of science and problem-solving skills to North Carolina's students. In the past 16 years, award recipients have varied widely: K-12 public and private schools; universities and colleges; museums; and community groups; such as the Boys and Girls Clubs. The only requirement has been giving students a hands-on scientific experience as a way to teach them that the scientific process can apply to any subject.

Rather than focus on students interested in a specific career, your SSEP program should tap into members of the student body who demonstrate exceptional skills and interest in science, engineering, and mathematics. Be sure to include, when you can, those believed to be high-level critical thinkers and innovators.

Program Evaluation Helps to Identify Strengths and Weaknesses
Despite best-laid plans and staff dedication, SSEP programs aren't perfect. There's always room for improvement, and to help you identify your strong and weak points, BWF adopted an evaluation plan that uses independent, external evaluators to annually analyze the success of the SSEP grant program as a whole and to provide assistance to projects in the individual evaluation of their programs.

Evaluators use self-reported data from students and apply this information to three SSEP program goals:

> **Goal 1:** Improving students' competence in science
>
> **Goal 2:** Nurturing students' enthusiasm for science
>
> **Goal 3:** Interesting students in pursuing careers in research and other science-related areas

A database now exists that includes program-level and student-level data from the 2003–04 to 2006–07 school years. The information was used to study how closely program characteristics and student outcomes during this time period were connected. The results can also be compared to the individual SSEP program evaluation plans that highlight expected outcomes and how activities help students succeed.

Overall, data from 2,162 middle-school and high-school students provided insight into demographics, student attitudes, interest in science, project activities used, and measurable program toward program goals. Based on the results, BWF has suggested program changes.
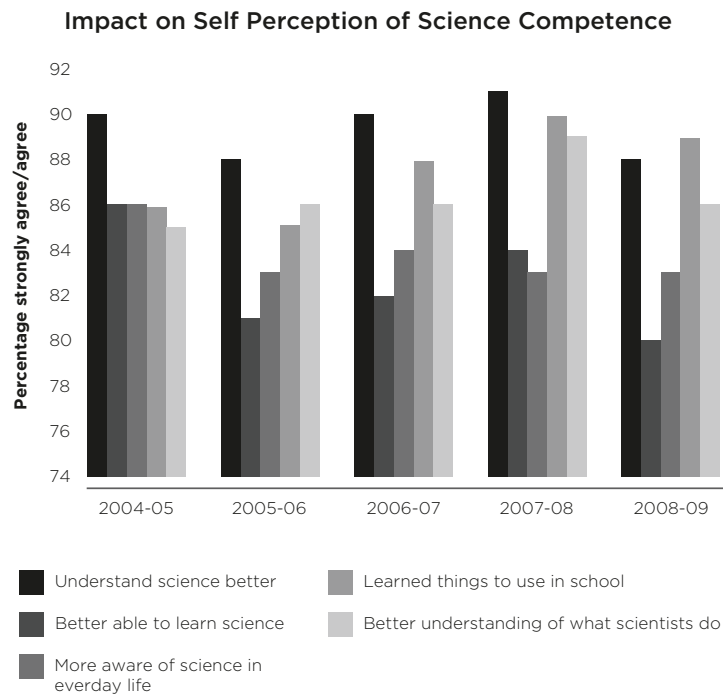
These program evaluations are ongoing, and they've consistently revealed three findings. First, our programs must continue their targeted efforts to include minority students. Second, we have to listen to our students—their input it critical to designing the most effective programs. And, lastly, we must pinpoint new ways that will bolster student confidence in learning.

The graphs below show how the findings relate to SSEP goals.

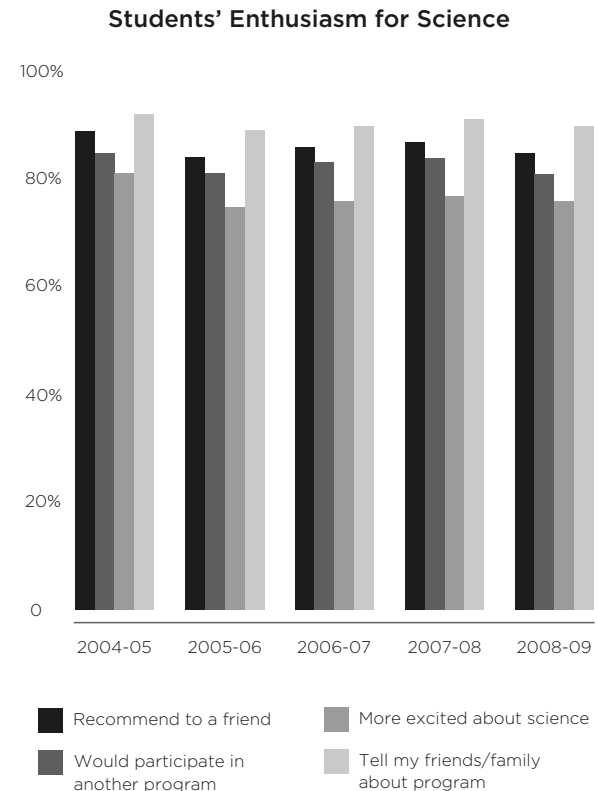### Goal 1: Improving Students' Competence in Science

The SSEP evaluation revealed 85 percent of N.C. students participating in a program reported an improved understanding of science.

There's no direct evidence in the survey data that points to any measurable competence improvements. However, the results indicate students certainly perceived they had greater competence.

Impact on Self Perception of Science Competence

Legend:
- ■ Understand science better
- ■ Better able to learn science
- ■ More aware of science in everday life
- ■ Learned things to use in school
- ■ Better understanding of what scientists do

Goal 2: Nurturing Students' Enthusiasm for Science

Since SSEP's inception, we've determined students are truly learning and enjoying the programs if they invite their friends to participate or if they share experiences with their families. In fact, more than 90 percent of students reported that they want to share what they're doing.
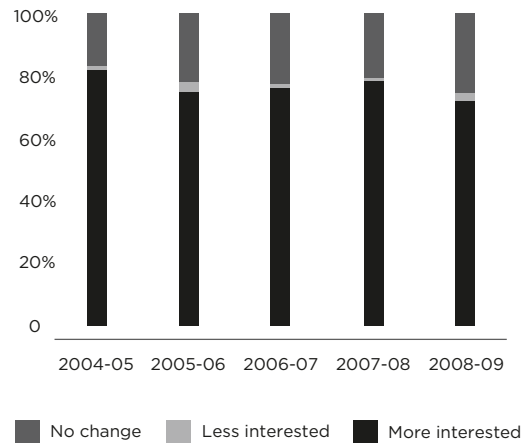
Students' Enthusiasm for Science

Legend:
- ■ Recommend to a friend
- ■ Would participate in another program
- ■ More excited about science
- ■ Tell my friends/family about program

Goal 3: Interesting Students in Pursuing Careers in Research and Other Science-Related Areas Based on SSEP surveys, we found that, while high school programs target students already interested in science careers, a big number of students didn't clearly understand what scientists do, had never talked with a scientist, or have never seen a scientist at work.

Consequently, early on, BWF required scientists and science teachers to spend a lot of time working directly with students. That time and effort has worked—since 2004, approximately 50 percent of more than 650 student participants stated they have learned more about what scientific work is all about. In addition, more than 70 percent of students have changed their feelings about science learning altogether.
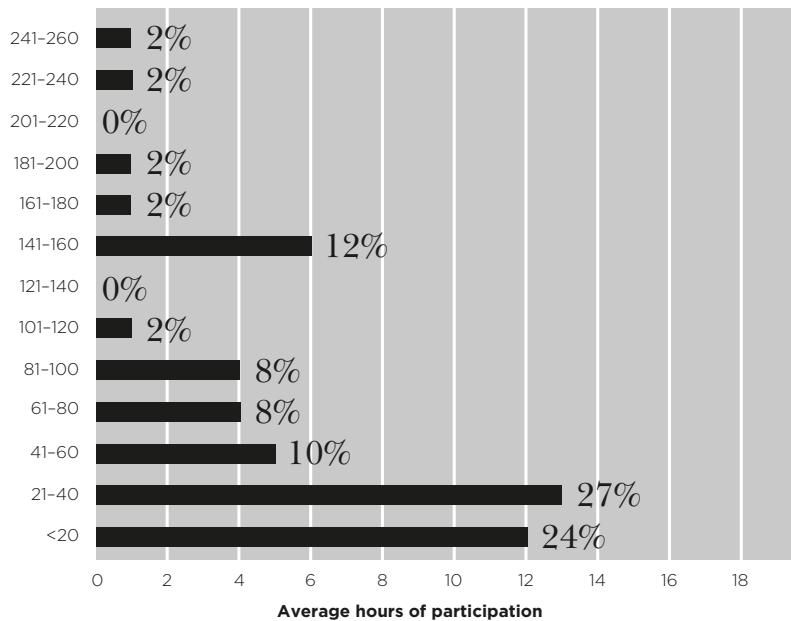
Changed Feelings about Science Learning

No change   Less interested   More interested

Alongside the student-reported data, BWF has used other collected information to change SSEP guidelines and what is required of program directors. Here's a list of attributes found in successful SSEP projects to help you better understand what we want to see in applications:
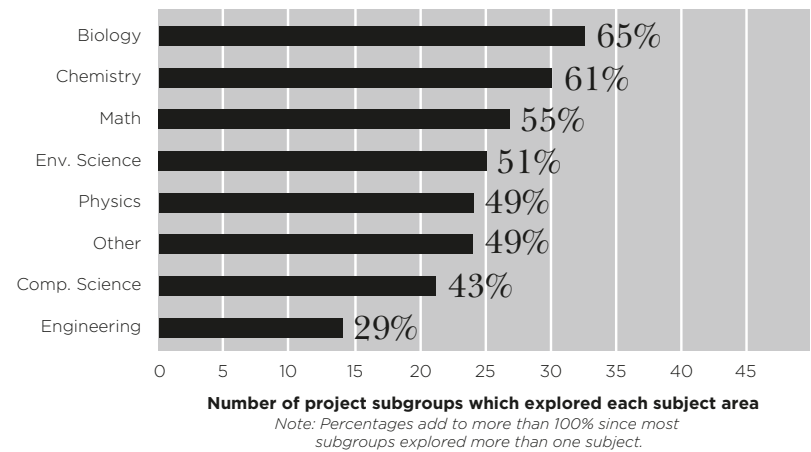
- Programs must use a curriculum that is appropriate for targeted students
- Programs must offer "minds-on," as well as hands-on inquiry based activities
- Programs must involve scientists and science teachers
- Programs must provide students with opportunities to discuss their work and present it to others
- Programs must have a large applicant pool from which to draw in order to ensure participation by quality students
- Programs must maintain an ongoing relationship with students, as it has been demonstrated that programs that continue throughout the school year make a bigger impact

Average Hours of Student Participation (49 Project Subgroups)

Average hours of participation

We routinely ask SSEP directors to provide details about the approximate number of hours the average student participates in their program's activities. So far, we've collected a decade-worth of data, and it's still relevant. The following chart shows outcome data for 49 programs from 1996 to 2006. Student contact hours in each subgroup ranged from 8 hours to 250 hours with more than 75 percent of students having more than 20 hours of contact time.

Subject Areas Explored (49 Project Subgroups)

Number of project subgroups which explored each subject area
Note: Percentages add to more than 100% since most subgroups explored more than one subject.

To date, biology has been the most popular subject area for SSEP projects, followed closely by chemistry. The chart above details the relative popularity of other subjects generally offered by SSEP afterschool projects. Now that elementary schools are eligible to apply for SSEP grants, we believe this listing will expand further.

What's Next? So, what does this all mean for BWF? A few things are clear. We're reaching students who never before considered giving up their summers or afterschool hours to do science. We're beefing up the pipeline of young people who will likely become America's future scientists. We're creating connections between scientists and K-12 learners. And, above all, we're giving students creative and fun opportunities to learn critically, to problem solve, and to hang out with new and old friends.

The SSEP outcome data is good news, but there's more work to be done in reaching North Carolina's students. There are currently more than 1.5 million K-12 students in the state, and SSEP has only reached nearly 37,000 of them to date. That's why we're fortifying our efforts to build partnerships and work with other afterschool providers to weave more science, technology, engineering, and mathematics into their out-of-school time programs.

The BWF-created North Carolina Science Mathematics and Technology Education Center (www.ncsmt.org) offers a list of resources communities can use to connect scientists with programs. There's also a statewide alliance called the North Carolina Center for Afterschool Programs (NC CAP) (http://www.nccap.net/index.cfm). It's part of the national Afterschool Alliance movement dedicated to improving the quality of afterschool activities and training for providers funded by the Mott Foundation.

BWF is also working with organizations, such as the N.C. Department of Juvenile Justice and Department of Health and Human Services through NC CAP, to reach students who need out-of-school experiences the most. The national, membership-only organization, Grantmakers for Education (GFE), also strengthens education philanthropy in the United States by bringing like-minded funders together to impact student learning. The STEM Funders Network is an outgrowth of GFE. The Network consists of funders partnering to advance science, technology, engineering, and mathematics learning across the nation.

External evaluation consultants include The Program Evaluation Group, Chuck Eilber Associates, Donley & Johnson, and Horizons Research, Inc.

Points To Remember

When designing your program, keep in mind there are several missteps that can rob you of successfully igniting a love of science in students. If you keep these errors in mind, however, you can avoid programmatic problems that typically lead to failure.

1. **Outline clear, achievable goals that present students with rigorous, relevant, and fun activities.** When possible, connect activities to a central theme or problem to be solved. Without hands-on experiences, students are far less likely to internalize what you teach them. If you let them collect data or build something, you will have created a lasting memory.

2. **Be inclusive with your instructors.** Bring in science teachers and scientists who are experts in their field. Not only will they bring extensive content knowledge to the activities you plan, but their presence will also give students a first-hand experience with what career scientists do.

3. **Make the science relevant to everyday life.** In many instances, your program participants will be students who have had very little exposure to science throughout their lives. To spark an enduring interest in science, find a way to connect your program content to their routines or community issue. Provide opportunities for students to present their work.

4. **Be open-minded about your partners.** Reach out to the community or area universities to find other stakeholders who can help you reach K-12 students throughout the state. Scientists from collegiate environments or community volunteers with scientific interests can bring fresh ideas for engaging these young learners.

5. **Think about how to keep your program going not simply for next year, but for the next five or 10 years.** Certainly include information about future funding sources in your applications, but don't forget to outline the intended outcomes for and impacts on your students.

6. **Remember your student audience.** Not every activity is appropriate for every age group. Work with your science experts and teachers to design curricula and activities that will engage your program participants at their own level. If your activities are too simple or too advanced, students will quickly lose interest.

7. **Student participants are certainly your main focus, but never forget that they aren't your only audience.** Find ways to include parents and members of the community in your program. If these individuals play a role in bring science to young learners, they will have a vested interest in seeing the program succeed in the long term.

8. **Keep your older student participants' future goals in mind. Integrate into the program information about how the science activities directly correlate to future career options.** Many of these students are already starting to consider their ultimate professions or at least a college major, so be sure to highlight how the program's science content connects directly to their vocational goals.

Appendix

Basic Grant Writing Checklist

Credit: Shirley Malcom, Ph.D. Education Directorate for the American Association for the Advancement of Science and Chuck Eilber

Methods

- Flows naturally from problems and objectives
- Clearly describes program activities
- States reasons for the selection of activities
- Describes sequence of activities
- Describes staffing of program
- Describes clients and client selection
- Presents a reasonable scope of activities that can be conducted within the time and resources of the program
- Anticipates and describes logistical concerns that should be addressed in budget

Evaluation

- Presents a plan for evaluating accomplishment of objectives
- Presents a plan for evaluating and modifying methods over the course of the program
- Tells who will be doing the evaluation and how they were chosen
- Clearly states criteria of success
- Describes how data will be gathered

- Describes how evaluation will be supported
- Explains any test instruments or questionnaires to be used
- Describes the process of data analysis
- Describes any evaluation reports to be produced

Future Funding (Sustainability)

- Presents a specific plan to obtain future funding if program is to be continued
- Describes how maintenance and future program costs will be obtained (if a construction grant)
- Describes how other funds will be obtained, if necessary to implement the grant
- Has minimal reliance on future grant support
- Is accompanied by letters of commitment, if necessary

Budget

- Tells the same story as the proposal narrative
- Is detailed in all aspects
- Project costs that will be incurred at the time of the program may differ slightly from the time of proposal writing
- Contains no unexplained amounts for miscellaneous or contingency
- Includes all items asked of the funding source
- Includes all items paid for by other sources
- Includes all volunteers
- Includes all consultants
- Separately details all non-personnel costs
- Details fringe benefits, separate from salaries
- Includes indirect costs where appropriate (*BWF does not support*)

- Is sufficient to perform the tasks described in the narrative
- Equipment and capital costs (*review SSEP guidelines*)
- Incidentals
- Travel expense guidelines
- Spreadsheet and narrative
- Reasonable and necessary
- Agency sign-off
- Donor's allowable costs
- Activities supported adequately
- Each item relates to an activity
- Calculations for each item
- Salaries
- Consultants
- Participants

Some basic principles to follow are:

- Make proposal neat, clean, easy to read
- Write in simple terms—no jargon
- Make proposal brief
- Be positive
- Use good grammar and check spelling
- Avoid unsupported assumptions
- Put citations in the body, not in footnotes
- Follow directions
- Ensure continuity:

    needs » objectives » methods » evaluation » budget

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