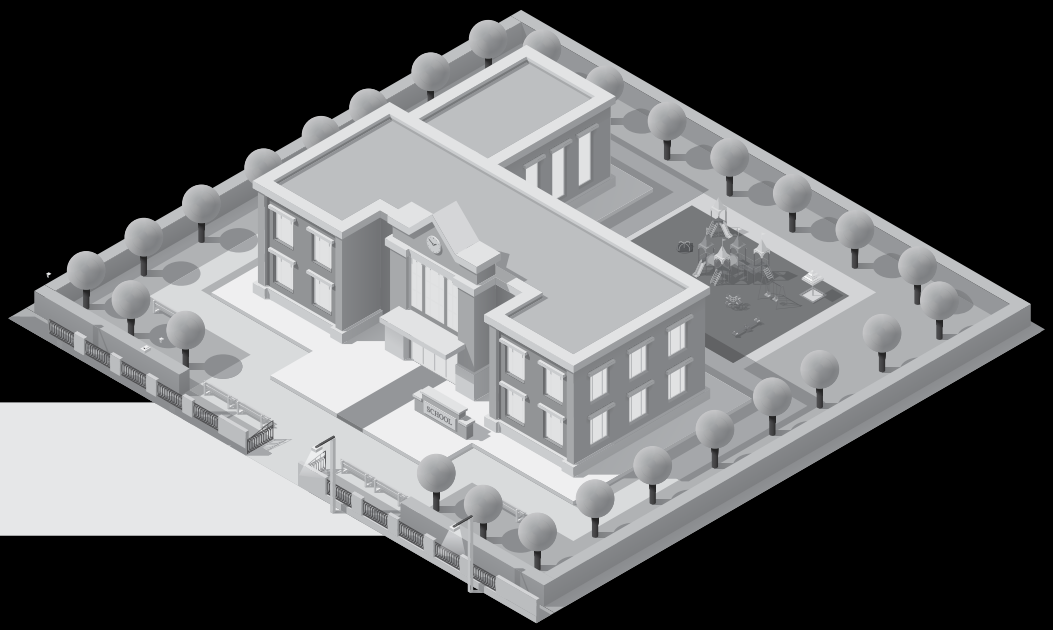
STAGING FAMILY SCIENCE Nights

DONNA GOVERNOR
DENISE WEBB

NSTA press
National Science Teachers Association

Staging Family Science Nights



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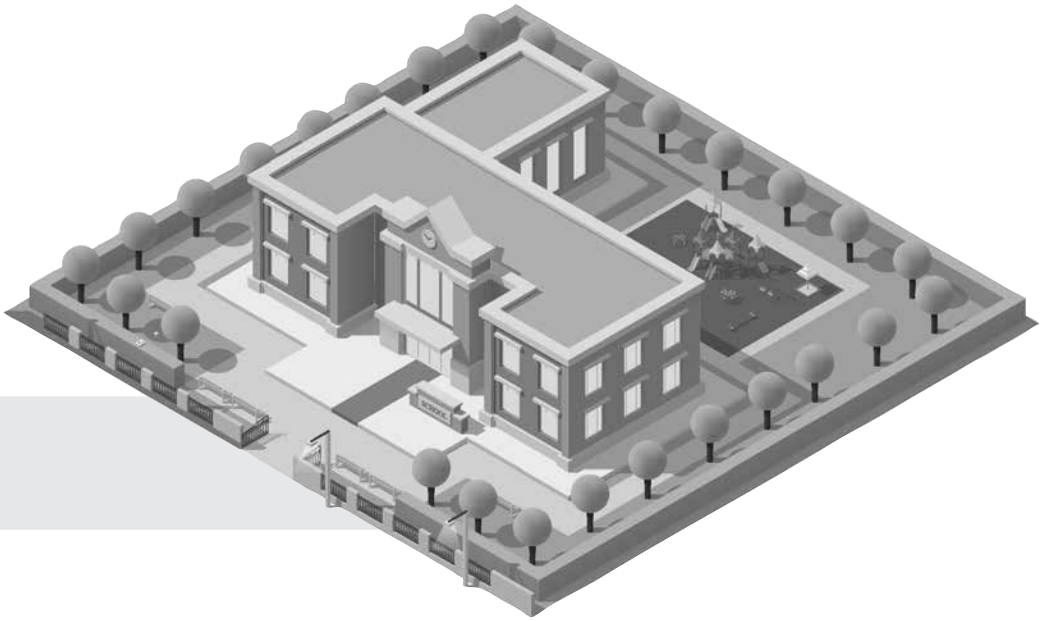

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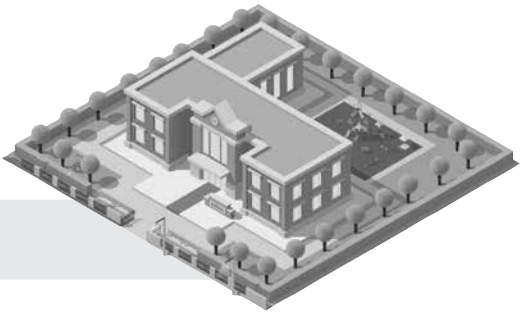
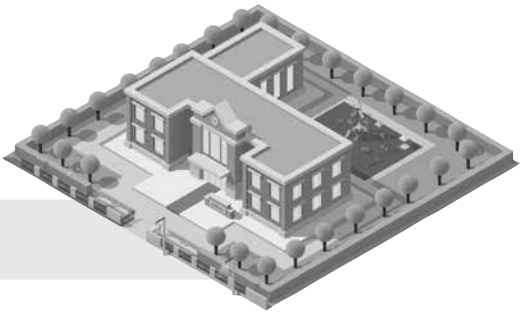
Table of Contents



Preface



It Takes a Community

There's an ancient tradition in the Western world called *community theater*. In classical Greece, it was common for extended dramatic festivals to bring young and old together. Families brought food to the agora and camped out for days, both watching and participating in dramas that explored human behavior, natural history, and philosophy. The informal environment of the community theater allowed generations to learn together and communicate big ideas. Many historians believe that theater was an essential building block to the growth of democracy.

The model of a community theater is a great analogy for Family Science Nights like those described in this book. Lights and cameras may be optional, but the interactions that occur during an event like this are electrifying. The official program for Family Science Night is just the start. Intergenerational exploration allows learners of every age to discuss and ask questions. Like centuries of community theater, Family Science Nights emphasize communication. It's the talk that counts.

Family Science Nights Are Rooted in Research

This is a book for pragmatic planners. But the events described in the pages that follow are firmly rooted in a significant body of research on the efficacy of informal education. Family Science Nights break down walls between institutional curricula and the world around us, creating a dynamic with enormous potential. Much of what we know about the importance of community involvement is summarized in *Learning Science in Informal Environments: People, Places, and Pursuits* (NRC 2009). This publication describes a number of ways that families interact outside of the official K–12 program for STEM discovery. Some examples are totally serendipitous: a chance encounter with an animal on the walk to school, a fishing trip, or a night sky observation. Sharing a great book or nature documentary might light a spark that ignites a passion for discovery.

But *Learning Science in Informal Environments* also documents the value of everyday and family science learning that occurs in settings "designed for learning … museums, science centers, school experiences and the like" (NRC

2009, p. 127). The authors of the study admit that the distinction between everyday learning and learning in designed settings is "blurry and imperfect." A question that is raised in the classroom might be asked again on the walk home. A homework assignment might start a dinner-table argument or inspire a Saturday trip to a nature center. The possibilities are endless.

A Family Science Night combines the convenience of a resource-ready venue and the potential of a relaxing, welcoming social environment to generate communication. The literature that this publication summarizes includes a number of sound studies on the efficacy of outside-of-school intergenerational experiences. In schools, museums, and centers, gatherings that are scheduled outside of the normal school day encourage a special sort of communication. Through enhanced interest, time is multiplied because the conversations that begin at the classroom, museum, or café door never end. "Reflection on those experiences often extends after these experiences and is observed in future family activities" (NRC 2009, p. 96).

It's worth admitting at the outset that a Family Science Night will take time, talent, and even a little funding. But both research and experience show that family events are well worth the effort. Data document both higher in-school achievement for students who participate with their families and higher support for STEM in communities overall.

Like the community theater of ancient times, a Family Science Night can become the foundation of community spirit and democracy. In these settings, young and old share their cultures and ways of knowing in a way that respects diversity. By recognizing cultural perspectives outside of the narrow school curriculum, a family event can become an important tool to enhance equity and empower citizens in ways that go far beyond just learning science content. Learners in informal environments "experience excitement, interest and motivation … reflect on science as a way of knowing … think about themselves as science learners and develop identity as someone who knows about, uses and sometimes contributes to science" (NRC 2009, p. 4). STEM thinking empowers individuals and communities to become personally invested in problems and problem-solving in all areas of life. This book describes the sense of self-efficacy that results when learners of all ages are empowered.

But Don't Be Fooled

When you see a great theatrical production, you may come away with the impression that it was easy to create. A great performer's chief talent might be to make it seem that he or she is "in the moment" and what you see comes naturally.

But we know that what occurs on the stage is the result of countless contributors and attention to endless detail. That's why this book will be invaluable.

Authors Donna Governor and Denise Webb have created a playbook that includes a tremendous number of resources and practical tips. This is the result of their combined experience and their pragmatic approach to making great events happen. From the "Overture"—an idea in the making—to the final applause, the path to success is well defined. Here you'll find dozens of details you might wonder about and a dozen more that you might never have considered. There are concerns you must address (such as funding, supplies, safety, and security) and things that might provide added value, from costumes to snacks.

Attention to detail not only contributes to success but also reduces the potential stress that a major production might otherwise generate. Knowing in advance that you've considered most of the eventualities will allow you to relax and enjoy, to become part of the community dynamics. And knowing that two experienced mentors like Governor and Webb are on your team will help you at each step of the way.

It's a pleasure to share with you this playbook for a successful Family Science Night. The set is prepared, the footlights are lit, the invitations are ready to be issued. Break down your classroom walls. There might be no "Tony Award" for the best Family Science Production, but there are many side benefits to these productions. What you will gain will multiply your educational space and your impact in a way that will amaze you. The unanticipated profits—from student achievement to community support for the school STEM program—will be great.

Follow the practical pathways to success in the pages that follow and then sit back and enjoy.

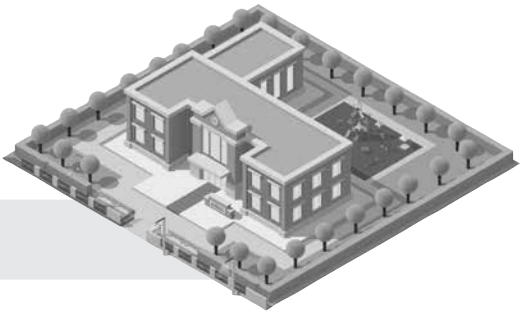
Lights, Camera … Science.

Juliana Texley
Past President
National Science Teachers Association

Reference

National Research Council (NRC). 2009. *Learning science in informal environments: People, places, and pursuits*. Washington, DC: National Academies Press.

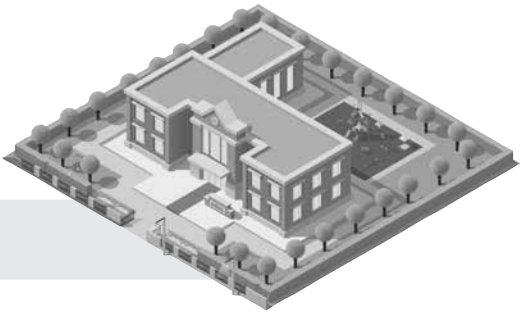
Acknowledgments



We would like to acknowledge the wonderful support we've received from the students, parents, staff, administration, and our colleagues at Liberty Middle School, Coal Mountain Elementary School, and North Forsyth High School over the years that we've held our Family Science Night events. These events never would have been successful without the generosity of scores of people who have given of their time, talents, and resources to help make these programs successful.

We would also like to thank our husbands, Larry Morris (Donna) and Christopher Webb (Denise), who have encouraged and enabled us each year to pour so much into these events. They have often become willing participants in making the science happen.

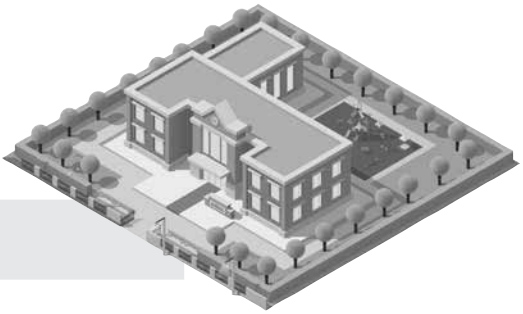
About the Authors



Donna Governor is an assistant professor of science education at the University of North Georgia. She has 32 years of K–12 experience in Florida and Georgia.

Denise Webb is an elementary science and engineering teacher at Coal Mountain Elementary School in Cumming, Georgia. She has been teaching grades K–6 since 1993.

Introduction



Our experience with hosting Family Science Nights has been one of the most exciting aspects of our teaching careers. We launched a successful partnership organizing these events in 2013 while teaching in adjacent schools. We met serving on the board of the state science teachers association, and one of our discussions turned to our joint interest in planning a Family Science Night. Denise was trying to find a way to bring science nights to her elementary school, while Donna was looking for a way to get high school students involved in hosting science nights, after successfully organizing these events at the middle school level for the prior seven years. A productive and enduring partnership (and lasting friendship) came out of those early discussions. That partnership resulted in successful events for thousands of families at multiple schools over the past several years.

We both were products of the same preservice teacher program for elementary educators at the University of West Florida, although Donna completed the program 10 years prior to Denise. We lived and taught in different cities, and our paths wouldn't cross for more than two decades after Denise's graduation. When we began teaching, neither one of us dreamed that we'd eventually become teachers of science, as we both started our careers as elementary teachers. Yet today Denise is a STEM specials teacher at an elementary school where she provides hands-on labs and engineering activities for every student in the school on a weekly basis. Donna is now teaching preservice teachers at the university level, after having taught elementary school for 15 years, middle school science for 14 years, and high school science for 3 years.

For both of us, our early vision of a Family Science Night event was rooted in hands-on science events hosted by teachers at our respective elementary schools during the school day in the 1990s. How that experience evolved into organizing successful Family Science Night events, hosting thousands of students and their families each year, was very different for each of us. For Denise, these events started with teacher-led curriculum nights where she enthusiastically took charge of science activities. Denise saw students are naturally curious about the world, and science not only excited children about learning, but also inspired them to read and write more. Her interest gravitated to science based on the enthusiasm she saw when students engaged in STEM activities at these events.

Donna's path was more complex. After hosting a successful Star Party for her own middle school students in 2005 (with the help of a local astronomy club), the school parent-teacher-student organization asked her to host a similar event for the entire school in the following year. Although three attempts were made at holding the event, each was canceled due to cloudy skies and bad weather. The following year (2007), Donna tried again, this time with a different twist. Instead of relying on clear skies, she made the decision to include make-and-take activities, bring in a portable planetarium, and have the amateur astronomers prepared to "show and tell" their telescopes, should the skies not cooperate. Rather than relying on teachers to run the hands-on activities, she asked her eighth-grade students to take charge. Once students became involved, the plans began to snowball and more than 15 sessions ended up on the schedule. The skies cooperated, hundreds of students and their families showed up, and a new tradition at the middle school was born. These events continued to grow and evolve, until Donna made the move to teaching high school in 2013.

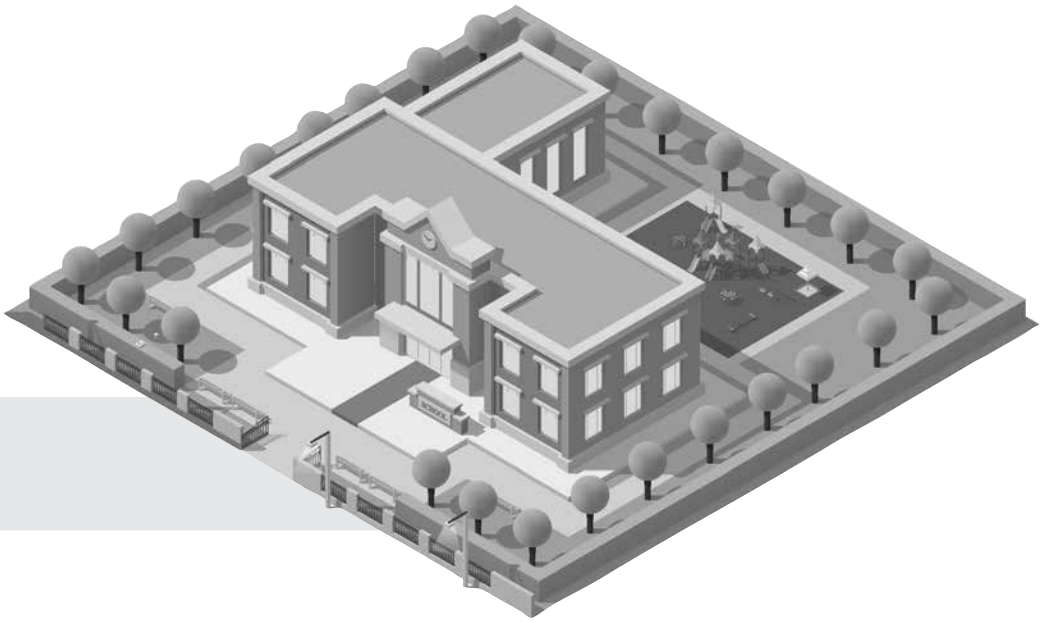
The partnership begun by Donna and Denise in 2013 started with a single school. Donna's former middle school students, now at the high school where she taught, asked to find a way to continue to sponsor Family Science Night events. Denise wanted to bring a Family Science Night to her school but needed volunteers to run the sessions. It was a match made in heaven. Our first collaborative event was held in January 2014 at Denise's elementary school, where several hundred students showed up with their families. In the same way that Donna's middle school nights evolved, the joint program took on a life of its own and continued to expand. Within two years, our high school students were hosting events at a half dozen local elementary schools for thousands of students and their families.

We want to make it clear, this book is not just for elementary teachers who want to host a Family Science Night at their own school. This book is for teachers of all levels—elementary teachers, secondary teachers, and teachers of preservice teachers. Through our collaboration, we found that Family Science Night events are great for our youngest students, but are important for older students as well. Middle school and high school students who are put in charge of running these events get as much, if not more, out of hosting Family Science Nights as the elementary students who attend. We've seen older students develop a sense of self-efficacy in science in ways that never would have happened in the classroom. If you are a secondary teacher interested in building a love of science in your students, this book is for you, as much as it is for the elementary teacher who wants to organize an event at his or her school.

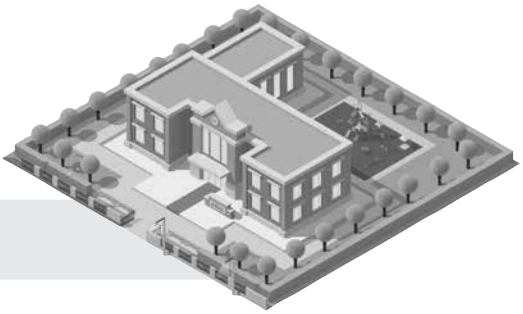
Over the years, we've learned a great deal about how to host a Family Science Night. Throughout this book, we hope to share what we've learned and provide insights that can inspire you to organize an event in your school that truly excites learners of all ages about science.

Section 1

Producing the Event



Chapter 1



Overture

Overview

In this chapter, we will introduce you to Family Science Night events and discuss the benefits of holding an event at your school.

- The Case for Family Science Nights
- Building a Culture of Science
- Our Audience: Who Is This Book For?
- Evolution of Family Science Nights
- Summary

On March 22, 2007, aliens invaded Liberty Middle School in Cumming, Georgia. Approximately 40 students from Donna's eighth-grade science classes organized and hosted an Astronomy Night, which was to become our school's first Family Science Night event. Originally, the program was supposed to be small, with just a few telescopes borrowed from the local astronomy club scheduled to show students the stars. Hot chocolate and warm cookies were planned to keep things toasty and cozy. But, worried about the potential for bad weather, Donna scheduled a few extra activities to make sure the event could be held regardless of weather. She arranged for a portable planetarium from the local nature center and added a few make-and-take sessions to the program, such as making star clocks and planispheres.

Donna asked her eighth-grade students to help with the hands-on activities. That's when things exploded.

As soon as word got out, students started coming to Donna asking to participate. It was great to see students interested in hosting an after-hours event, and Donna started finding roles. Sessions were added to the plan, including activities on phases of the Moon, spectroscopy, exoplanets, and stellar evolution, as well as a "tour" of our Solar System. Students started coming up with additional ideas: How about T-shirts? What about a cookout? Where can we put an art show? What about music? By the night of the event, we had acquired over 1,000 Oreos, a dozen bags of marshmallows, inflatable planets, thousands of glow-in-the-dark stars, gallons of hot chocolate, and a dozen blow-up aliens. One very supportive parent even made over 1,000 candy stars for one of the activities!

We invited families from the local elementary school as well as those from our school. Students organized and hosted 17 different activities, including a performance by the school chorus, a local storyteller with myths about the night sky, and a hamburger dinner. Teachers were asked to participate as room monitors, and many chose to bring their own families. Six 25-minute sessions were held, with guests choosing the activities that interested them the most. The event went off almost flawlessly (although in all honesty, it was a bit of a whirl!). The students who led sessions were amazing! They knew their science, and they managed each event with a minimum of assistance from monitoring teachers. An estimated 600 people attended that first event. (See Figure 1.1.)

Figure 1.1. Donna and Denise at a Family Science Night Event

It was at the end of the evening that Donna realized what had occurred: a perfect coming together of informal science learning, student leadership, community support, and schoolwide excitement. Some of the comments made by the students who hosted the event will never be forgotten, such as "I couldn't believe how much fun it was!" and "I didn't realize how hard it was being a teacher!" It was immediately clear that this wasn't a one-time event, but the beginning of a new tradition that would evolve and grow. The event took on a life of its own and became a favorite for the school and community.

When Donna eventually transferred to teaching at a high school and met with Denise, a teacher at the neighboring ele-

mentary school, a new collaborative adventure began. We brought Donna's high school students to Denise's school to be ambassadors at our Family Science Nights.

The Case for Family Science Nights

Family Science Nights such as these are considered an "informal" science learning environment—settings where children and adults can engage in and learn science beyond the classroom. The National Science Teachers Association's (NSTA's) official position statement on Parent involvement in Science Education states that "by sharing science experiences, parents demonstrate that learning is an important and enjoyable process. The parents also become more aware of the importance of science in their own lives" (NSTA 1994). We've found that science nights are one of the best ways to get students excited about and parents engaged with science. While participating in these events, students and their parents build science literacy, learn more about careers in STEM fields, and participate in scientific practices.

Family Science Nights are a relatively new phenomenon. They are first referenced in the professional literature beginning in the 1990s, which is when Denise and Donna were first exposed to them as teachers. The research tells us that Family Science Night programs can improve both knowledge and attitudes about science. For students who attend events, science literacy, general knowledge, and attitudes about science are improved (McDonald 1997). In a study published by Mike Watts (2001), the author found that benefits go far beyond impacting individuals who attend and extend into the community as well.

> As former PTO [Parent-Teacher Organization] president, I can confidently say that Science Night is one of the most important events of the year. It promotes family participation and the awareness of STEM. Everyone, no matter what the age, is highly engaged and leaves with a smile. Our PTO board always received positive feedback from the community on how much they enjoyed participating.
>
> **—Kim Hickman**
> *Former PTO President*

In the last decade, the National Science Foundation has published a number of reports on the importance of informal science learning, including *Learning Science in Informal Environments: People, Places, and Pursuits* (NRC 2009), *Surrounded by Science: Learning Science in Informal Environments* (NRC 2010), and *Identifying and Supporting Productive STEM Programs in Out-of-School Settings* (NRC 2015). Each of these documents discusses the importance of engaging students in learning outside the classroom environment for developing science literacy. In these reports, they also discuss the importance of learning

in other informal learning environments, including museums, after-school programs, camps, and more.

We feel that student participation in a Family Science Night most closely parallels the experience of learning science in a "designed setting," as described in *Learning Science in Informal Environments* (NRC 2009). In these experiences, learners choose from multiple activities in which they can participate. The programs we present in this book fit this type of experience, as our programs are annual events that include dozens of different activities for students to choose from. Participating in these experiences can engage students, get them interested in science concepts, promote independent learning, and lead to deeper conceptual understanding of science content. For teachers, this means students who engage in learning science OUTSIDE the classroom are better prepared for learning IN the classroom.

What is written in the literature reinforces what we've seen with our own programs: participating in these events engages our students in unexpected ways. Young students ask better questions, discover new interests, and are better prepared for learning science in the classroom. Older students who run events suddenly see themselves as successful in science and as having the potential to be "good" at science. Families bond over experiences with meaningful discussions about phenomena and hands-on activities. For Donna's middle school students, the annual event became the high point of the year. With our high school collaboration model, the students who run the events not only discovered that they enjoyed working with children, but also found that their own sense of self-efficacy in science was improved. Students who never saw science as something they could "do" suddenly became active participants in the culture of science. Regardless of the age or role, these events seemed to bring out the science enthusiast in everyone who participated.

There are multiple models for running a Family Science Night. One model is to base activities on discrepant events that engage students and their parents through conceptual conflict (Lundeen 2005). Another model is for parents and students to work together at home to complete an investigation before participating in a culminating activity at a school-based evening event (Watts 2001). Some events are theme-based, such as the Astronomy Night project described at the beginning of this chapter (Governor and Richwine 2007). There is no one right way. Regardless of model, however, all events involve similar planning and preparation.

In this book, we will primarily discuss the models that we have experience with. The one described in Donna's first Astronomy Night is what we'll call a *session* model. This is much like a teacher conference, where concurrent sessions

are scheduled and participants choose which activities to attend. The other type of model presented we call a *flow* model. In this type of event, multiple activities are set up, and participants move from one activity to another as they complete each activity. Both models include a variety of activities. However, in the session model, there is time to present a brief content overview to groups of participants. During a flow model, hosts must present content on a one-to-one basis, as attendees enter and leave each activity at different times. While the events look different, they require similar planning and preparation. Chapter 2 will discuss these models in more detail.

Regardless of which model you choose, planning should begin months before you want your event to occur. Selecting a date and time is dependent on a range of variables. Community events, sports, and even the onset of daylight savings time are variables that can make a difference in an event's success (more on this in Chapter 2). These events can be expensive (although not necessarily so), and raising funds to defray costs has always been part of the preparation for us. Part of planning an event includes deciding on formats, themes, and activities, recruiting volunteers, managing supplies, and arranging facilities. However, running a successful Family Science Night event is one of the most rewarding activities of any teacher's career, and this book is designed to help you make that process easier by learning from our experiences. Whether you are a classroom teacher, administrator, scout leader, or museum director, we hope you can benefit from our experience.

Building a Culture of Science

Teaching and learning about science formally happens in the classroom. But learning about science involves interacting in the world around you. Since the beginning of the 21st century, science education has changed based on an ever-evolving body of research about teaching and learning. The release of *A Framework for K–12 Science Education* (the *Framework*; NRC 2012) and the *Next Generation Science Standards* (*NGSS;* NGSS Lead States 2013) has shaped what science education should look like in the classroom at the beginning of the 21st century. Engaging students in hands-on science experiences in a Family Science Night environment can address all three dimensions of learning identified in the *Framework*. "Three-dimensional" science activities engage students in both the content and practices of science, while emphasizing concepts that cross all scientific domains. Activities can be included in any Family Science Night event that span a variety of science and engineering practices, while engaging students in exploring patterns, relationships, system models, or causality. These three dimensions of learning are appropriate in and out of the classroom. They

are specifically referenced in all the activities we present in the second half of this book and are important considerations when planning science activities.

National Academies of Sciences presents a parallel framework for learning in informal science environments in the report *Learning Science in Informal Environments: People, Places, and Pursuits* (NRC 2009). The report presents the six broad goals, or strands, to guide learning science outside the classroom. These strands are the following:

- Strand 1: Sparking Interest and Excitement
- Strand 2: Understanding Scientific Content and Knowledge
- Strand 3: Engaging in Scientific Reasoning
- Strand 4: Reflecting on Science
- Strand 5: Using Tools and the Language of Science
- Strand 6: Identifying With the Scientific Enterprise

For Family Science Night events, each of these important goals should be addressed to make sure that learners of all ages are engaged in meaningful science learning. These strands provide insight into how to engage learners beyond the classroom. A summary of these strands and how they apply to Family Science Night events follows.

Strand 1: Sparking Interest and Excitement

> Last night I took my two children to the science event put on by the high school students. I wanted to tell you that it was incredible! The science experiments were great, and every high school student that we encountered engaged with the kids and taught them the science behind the project. Please know how impressed I was with the organization of the Science Night and the overall science program. My oldest child is going into fifth grade, so we have a few years before he goes to high school, but he is definitely looking forward to being a Science Ambassador. Thanks for your great leadership to the school and community.
>
> **—Chris Emmitt**
> *Parent*

This strand deals with issues of motivation, excitement, and interest in learning science. It is probably the easiest of all goals to address when organizing a Family Science Night event for your school. There is extensive literature that discusses the importance of emotion in learning, concluding that students who are engaged and excited learn more and retain longer. But as every teacher knows from watching her own students, science activities spark excitement! Small children and their parents are excited whether they are exploring forces and motion with a water rocket, observing the Galilean moons of Jupiter, or dissecting owl pellets. Students who get excited about science in an

after-school event are more likely to come to the classroom ready to read to find answers, write stories about their experiences, and engage in classroom science instruction. We've seen young children find a new passion for a topic because of an activity at a Family Science Night event, and older students who are hosting events suddenly feel as if they can be good at science for the first time in their educational career. Regardless of the age and role, engaging students in these events can spark interest and excitement. (See Figure 1.2.)

Strand 2: Understanding Scientific Content and Knowledge

While we admit that science content cannot be learned in depth at a Family Science Night, there are many ways in which learners can improve their understanding of scientific content while attending an event. One way is by presenting scientific models that will help clear up misconceptions. For example, participating in experiences that model Moon phases will challenge misconceptions and help lay the ground work for classroom instruction. In this setting, younger children can experience a specific concept at an earlier age (such as Newton's Laws), and with the right questions, this will prepare them for future learning. Family Science Night events can also help by providing experiences that go beyond what classroom teachers can provide, such as the opportunity to observe planets at night. Providing experiences that activate new interests can result in later learning and deeper understanding. For example, when young students participate in a simulated fossil dig at such an event, they may not only ask important questions when they return home or to class, but might also be inspired to check out books at the school library to learn more about fossils. We've seen passions lit during these events that resulted in students seeking out more information. So while many students may not actually learn a great deal of content in short sessions, they can participate in experiences that will provide a base for constructing important knowledge at a later date, discovering a new area of science they might be interested in, or reengaging in content they may have forgotten. In *Learning Science in Informal Environments*, the report confirms what we found: Not a lot of

Figure 1.2. Students Participate in a Robotics Demonstration at a Family Science Night Event

content is learned in a single event. However, these events do improve students' potential for later learning (NRC 2009).

When older students are put in charge of a Family Science Night event, their understanding of science content and knowledge increases dramatically. Students who are responsible for presenting sessions at an event DO learn content at a much deeper level because they have to be able to teach the information to attendees. Our experiences include both middle and high school students who present sessions to younger students. In both our models—session and flow—middle and high students select a topic (with guidance), identify a hands-on activity, prepare a presentation, and then deliver content to attendees. These students had to learn the science and be able to explain it to younger students and their families. They couldn't always answer every question, but they certainly became more knowledgeable and had a strong motivation for developing a deeper understanding of the content.

> I have enjoyed being involved with the students and teachers taking science into the community of our local elementary schools as Science Ambassadors. The excitement of showing the students our experiments and watching them learn and see their reaction is priceless. The high school students and their leaders watch each child, wondering how far she or he will take their love of science. There might be an astronaut, chemist or doctor who starts at that one moment."
>
> **—Lorrie Angell**
> *High School Parent*

Strand 3: Engaging in Scientific Reasoning

Scientific reasoning in this context correlates with the scientific practices identified in the *Framework* and includes observing, asking questions, predicting, experimenting, collecting data, and constructing explanations from evidence. These are at the heart of activities presented in a Family Science Night event. Discrepant events help students ask questions, engineering challenges require predicting and testing, and simple experiments involve data collection and interpretation. How much students engage in scientific reasoning will depend on the activities or stations you prepare. One of our favorite inquiry activities involves exploring potential and kinetic energy by making a "hall roller" (see p. 155 for this activity). This simple device can be constructed out of cardstock, straws, plastic cup lids, and rubber bands. The more you wind up the rubber band, the farther it rolls. Students can explore the relationship between potential and kinetic energy as they experiment with different amounts of elastic potential energy stored in the device. After constructing a hall roller, participants can collect data, manipulate variables, and measure outcomes as they compete to see which prototype is the best. By carefully selecting activities that encourage experimentation and asking

the right questions of attendees, Family Science Night events can help build an understanding of science and engineering practices.

Strand 4: Reflecting on Science

Reflection, in this setting, deals with understanding science in a broad, social context as well as one's personal reflections on learning science. Understanding how science progresses, both historically and culturally, is an important component of scientific literacy in society. Reflecting on learning promotes metacognitive awareness, which is another way in which Family Science Night events can promote this strand. We see evidence of this strand as we hear from parents how much their children enjoyed the program every event. For our older students who host sessions at these events, they seek deeper levels of understanding to be able to answer questions from younger children. Integrating historical aspects of science can be accomplished either through specific activities or by selecting a theme based on building scientific literacy. For example, one of Donna's most memorable Family Science Nights was when the theme A Night of Discovery was used for the event. All sessions revolved around discoveries in science, focusing on a specific inventor, explorer, or researcher who made a historic contribution to advance science. Sessions included in this event covered the contributions of Annie Jump Cannon, Marie Curie, Gregor Mendel, Nikola Tesla, and more. Single sessions at nonthemed events that include references to history and culture can easily be integrated into any program.

Strand 5: Using Tools and the Language of Science

This strand is perhaps one of the easiest to see in action at a Family Science Night event. Because of the nature of the program, students get to experience both tools and language that they might not be exposed to in the classroom. In our experience, many K–6 teachers don't have access to equipment that can be found in upper-level science labs. However, we've found that when organizing these events, it's easy to borrow the tools you need from a high school or ask for resources in the community. We've received donations of exam gloves from doctors, microscope slides from labs, and flowers from florists. Our local astronomy club has brought telescopes to our events, giving our students experience with the tools of science.

Perhaps the most important benefit from an event is exposing students to the language of science. Vocabulary used in various activities can connect with a wide range of science concepts. Asking, "What is your hypothesis?" before one activity, or introducing an "independent variable" during another, can help reinforce concepts students hear in class. More specific terminology can be introduced

as students dissect flowers, manipulate Newton's laws in the Balloon-Powered Cars activity, and identify fossils from different geologic eras. Family Science Night activities introduce new words in meaningful and relevant ways.

Strand 6: Identifying With the Scientific Enterprise

The focus of this strand is on "how learners view themselves with respect to science" (NRC 2009, p. 46). This is one of the strongest outcomes we have seen with holding Family Science Night events at our schools. Young children who attend these events become engaged with science and excited about new concepts. In our collaborative program, High School Science Ambassadors (more about that in Chapter 3), where Donna's high school students hosted events at Denise's elementary school, it was common for our elementary students to be overheard leaving saying, "I can't wait until I get to high school and can be a Science Ambassador!" These events make lasting impressions on the young children who attend and, we believe, foster a special relationship with science from their very first program.

It is with our older students—those who are responsible for hosting events—that we see the greatest shift in scientific identity. As these students take on the challenge of leading events for younger children, they develop a sense of confidence and love of science that they may have not developed in their classrooms. These student hosts spend months preparing for events and take great pride in their work. In becoming experts in a single topic, they develop an identity as not only a learner but also teacher of science. When working with our High School Science Ambassadors, Donna loved recruiting those who didn't necessarily have a positive self-image of their ability to learn and "do" science. It often took some encouragement to get students to attend their first event, but once they did, they were hooked!

> As a parent of a college-bound student, I appreciate the leadership opportunities Science Ambassadors provide for students. Each group is given an activity. How they teach and share is their responsibility. High school students make decisions about how to handle difficult concepts, engage young children, and involve parents. They develop experiences and make memories that will last a lifetime.
>
> **—Charlotte Stevens**
> *Teacher and Parent*

We've seen these students blossom and thrive when they become an expert that young children look up to. Additionally, as a high school teacher, Donna has seen a side of her students while participating in our Science Ambassadors program that was hard to find in the classroom. Students who don't seem to like science in class suddenly see themselves as being "good" in science, which, in

turn, improves their classroom interactions and motivation. For us, the transformation we've seen in high school students is one of the best parts of running the Science Ambassadors program.

Our Audience: Who Is This Book For?

So, who is this book designed for? Really, anyone who wants to hold a family or community science event. It is written from our experiences hosting these events in public, K–12 schools (see Table 1.1). Elementary and middle school teachers can use the information included here to run events in their own schools. High school teachers might find this book a helpful guide to organizing a student program for future teachers or a science club to sponsor events at elementary schools, as we have done. Scout leaders and youth programs may want to use this book with clubs and organizations to help improve their events. Museum directors might find some useful tips for improving their outreach programs. Homeschool networks might also find ways to implement our ideas in community spaces. Just about anyone who wants to organize a science extravaganza outside the classroom could benefit from this book. In fact, we recently implemented ideas we learned while running Family Science Nights as part of a community science festival.

Table 1.1. Who Should Use This Book and How to Use It

WHO	HOW
Elementary Teachers	As a guide to organize and prepare a program for your school, using teachers or volunteers to host activities. If you wish to use students to host activities, we recommend you partner with a high school teacher to coordinate with and oversee students.
Middle School Teachers	As a guide to organize and prepare a program for your school, using students or volunteers to plan and host activities.
High School Teachers	As a guide to organize high school students to plan and host programs at local elementary schools. It is recommended you partner with an elementary teacher at the schools you intend to visit.
Others	As a guide to organize and prepare a program in an informal learning environment. This can include museums, community centers, children's activities at science festivals, and other venues.

Depending on your current experience and program goals, you may only want to implement specific aspects of Family Science Nights or add certain features to an existing program. This book is intended to be a comprehensive resource, culminating from decades of combined experience.

Evolution of Family Science Nights

One of the biggest considerations as you begin to implement your first Family Science Night event is that over time these programs tend to take on a life of their own and grow in unexpected ways. It is important to start simple and then expand as you gain experience. The vision we present here took us years to build. We recommend that you start with a small program and a limited number of activities, picking and choosing some of the ideas that we present in this book. In successive years, plan to expand your program to include more features. Sometimes our ideas have guided our programs, but more often than not, it's a student or someone else who has brought a great idea into play. A PTSA dinner held in collaboration with our event became a regular fundraiser. The art teacher added an art show with work related to the chosen theme. One year students included a coffee shop and listening room, performing original science songs (they actually produced a CD the first year the songs were performed). We adopted mascots, and the robotics club has presented demonstrations on multiple occasions. None of these ideas were ours, but they became important components of our programs over the years.

Summary

Hopefully, by now we've built the case for why you should want to host a Family Science Night. Elementary students are engaged with science at an early age. Secondary students hosting Family Science Night events develop leadership skills and enhance their self-efficacy as learners of science. For families, these events provide a culture of science and build scientific literacy in the school and community. We've seen how they can provide a positive change for learners of all ages who participate in these events. In the next chapter, we'll talk about what you need to know to get started planning your own Family Science Night.

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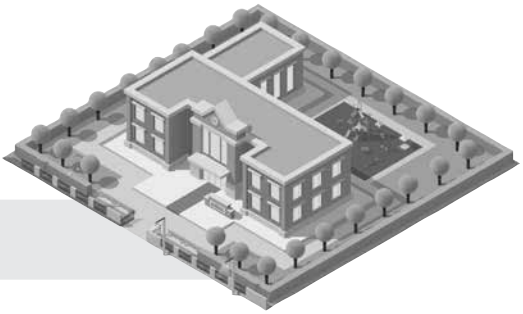
Index



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STAGING FAMILY SCIENCE *Nights*

Maybe you'd like to encourage young scientists to ask better questions, discover new interests, and be better prepared to learn science in class. Maybe you'd like to involve older students in events where they can see themselves as successful in science. And maybe you'd love to see families bond over scientific phenomena and hands-on activities—from balancing bugs to creating color slime to competing in a Bubble Olympics.

"Running a successful Family Science Night event is one of the most rewarding activities of any teacher's career, and this book is designed to help you make the process easier by learning from our experiences."

—from Chapter 1 of *Staging Family Science Nights*

If so, *Staging Family Science Nights* is the playbook for you. It provides the script you need to create an informal learning environment that will generate enthusiasm and enjoyment of science for the entire family. Written by teaching pros with years of experience directing science nights, the book is

- **PERFECT FOR PRAGMATIC PLANNERS.** You get detailed, step-by-step guidance from the earliest planning stages to the day of the event to post-production. Topics include funding, supplies, safety, costumes, and snacks.
- **DEDICATED TO GOOD SCIENCE.** The activities are designed to help learners improve their understanding of science in a setting that's fun for everyone. Activities provide a base of experiences for constructing important knowledge at a later date, discovering an interesting new area of science, or re-engaging with content participants have forgotten.
- **FLEXIBLE ENOUGH FOR STUDENTS FROM ELEMENTARY THROUGH HIGH SCHOOL.** You can also adapt the book for use with scout troops, homeschoolers, libraries, summer camps, and museums.
- **VERSATILE.** It's written to be a crowd-pleaser, whether you're a science-night veteran looking for fresh ideas or a first-time organizer asking, "Where do I start?"

As the authors write, "From our years of experience with Family Science Nights, we found that this is one of the most anticipated events of the school year." The event will bring your community together while fostering a positive attitude about science and science education. Best of all, the authors say, "Students who engage in learning science outside the classroom are better prepared for learning in the classroom."

Grades K–12

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