Training Guide for The Power of the Wind
Acknowledgements

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www.exploratorium.edu/IFI/docs/Process_Skills.pdf


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The Training Guide is a series of training activities to be conducted with youth development facilitators to increase their knowledge and skills to effectively lead *The Power of the Wind* curriculum. It provides a wealth of training experiences and resources to engage youth development professionals (e.g., 4-H agents/educators) in building the capacity of volunteers in using *The Power of the Wind* Youth and Facilitator Guides.

The training is designed to take place over 10–12 hours during two days to provide extensive time for experiencing curriculum activities, practice, and reflection. This combination provides an opportunity to deepen participants’ learning of the content and become familiar with *The Power of the Wind* curriculum. In addition, it aims to increase facilitator’s skills in the engineering design process and exploration—critical assets in the delivery of *The Power of the Wind* curriculum.

The Training Guide was developed to allow the trainer to capitalize on the interaction and expertise generated among the participating audience. Through their involvement, participants should, in turn, be able to gain new skills and knowledge that will enhance their program efforts with *The Power of the Wind*. The design includes hands-on activities and the time to process each activity for deepened learning and crucial reflection on that learning.

Each session of *The Power of the Wind* training includes activities, handouts, and often times additional training resource information. The Training Guide offers multiple opportunities for creativity. In fact, it is encouraged that facilitators of this training share their own personal experiences when presenting ideas and engaging the audience.

*Directions for the facilitator are presented in italics. The facilitator’s oral comments to participants (scripts) are in roman type. These scripts are intended to illustrate one way of presenting information and instructions to workshop participants. While the content of the scripts is crucial, the exact wording is not. After thoroughly familiarizing yourself with the scripts and noting the important points, you may decide to convey the information in your own words rather than reading the scripts to participants word for word.*
1. Most individuals with basic facilitation skills should be able to conduct the sessions of this training effectively.

2. In each training, it is expected that facilitators will consider any individual or group needs based on the actual participants. This could include accessibility issues as well as creating an environment that addresses different learning styles.

3. It is suggested that trainers read the training guide to become more familiar with each session. This will help one make decisions on various issues, such as:
   - How much of the information can be covered by one trainer?
   - Is the trainer comfortable with presenting the material?
   - How many additional facilitators will be needed?
   - If time is a factor, which sessions are most pertinent for the intended audience?

4. When considering the duration of time required, this training was designed to occur over two days. For example, the first five to six hours could be completed on the first day and the next five to six hours would occur on the second day.

5. Due to the length of the training, it is recommended that at least two people serve as trainers. This will also allow participants to benefit from the expertise and energy of more than one person and may provide:
   - the opportunity to include expertise in science or engineering,
   - reflect the participants—their position and culture/race.
6. The ideal number of participants should not exceed 20 – 25 (groups much larger may present a challenge, particularly when it comes to managing group activities). In order to have sufficient interaction for activities, it is recommended that there be a minimum of 10 participants. Whatever the size of the training, the Training Guide is easily adaptable to different size groups.

7. Refer to the questions in each section to keep the participants focused. Questions are offered as guides but often the best questions come from the discussion generated by the participants. It is through the conversations that much of the learning occurs and each activity is specifically designed to encourage the conversation in small and large groups.

**Evaluating the Training**

There are two tools to evaluate the use of *The Power of the Wind* training. The first evaluation is a retrospective (post-then pre-) self-assessment. This self-assessment is also completed by participants at the end of the training to measure knowledge, attitudes, and skills of participants.

The second is a process evaluation tool completed at the end of the entire training.

**Provide Other Learning Opportunities**

Research is clear that one-shot training will not insure transference of skills—only in 10 – 30% of the cases (Broad, M.L. 2005). Since this is the case, it is suggested that the training be followed up with some type of support or connection with the trainer. For example, there may be a check-in conference call at six and 12 months in order to surface and address the real-world challenges of implementation while also doing additional reflection on the learning that occurred during the training. There may also be a webinar that reviews key information and provides an opportunity for participants to remember critical learning.
DAY ONE – approximately 6 hours of training

Welcome/Introductions – 30 minutes

The opening workshop segment includes introducing the training, setting the context for the two days, learning more about the participants and their implementation plans. In addition, this opening segment is an opportunity to cover the different components of the training agenda, the logistics, and to make sure everyone is clear that they will be presenting on the second day of the training.

4-H SET Checklist – 40 minutes

The 4-H SET Checklist provides a time to explore the larger context of the 4-H SET Initiative, the components of what makes a project or experience “SET-Ready” and a time to apply learning to individual past experiences and training. The activity helps participants become familiar with the 4-H SET Checklist by selecting a component where they already feel prepared as well as one they hope they will learn more about during the training. They discuss each of these in both a small and large group. The discussions give both the participants and the trainers an opportunity to think through what can be learned, find out more about the participants, and provide an opportunity to tailor the training to those areas the participants need or want.

Curriculum Scavenger Hunt – 40 minutes

The Curriculum Scavenger Hunt provides an opportunity for participants to become more familiar with The Power of the Wind youth and facilitator curriculum. The participants are asked to answer questions on their own regarding the curriculum and then the entire group goes through the answers. Much of the information comes directly from the participants and the trainer can add on additional information that is important to their understanding the curriculum.
Designing a Wind Powered Boat – 45 minutes

Throughout the training, participants will get an opportunity to experience many of the activities from the curriculum—this is the first one. Participants have an opportunity through this experience to connect directly to the curriculum and the facilitator’s guide. Participants process each curriculum activity as both a learner and the facilitator.

Experiential Learning Cycle – 35 minutes

A critical component of 4-H educators’ and volunteers’ work is the Experiential Learning Cycle. This activity draws on the experience of participants while providing an overview of the cycle. In addition, this segment makes a point about the intentionality of learning and how the cycle is used to deepen that learning.

Sign Up for the Presentations – 10 minutes

Before lunch on the first day, it is important to get people to sign up for their presentations and briefly explain what will happen. This way, it does not take much time from the training and gives people a chance over lunch to review the activity and be able to make their decision. The activity they sign up to present creates their planning and implementation team.

This is a possible time for lunch in the flow of the training.

How Does a Pinwheel Use Wind Power? – 45 minutes

This is the first of three activities that will scaffold and help the participants learn more about The Power of the Wind curriculum. This and Designing a “Better” Pinwheel are from the Youth Guide.

Examining the Engineering Design Process – 20 minutes

The engineering design process is a critical learning thread that runs throughout this curriculum and this activity helps participants become familiar with the process by applying it to the Pinwheel activity they just did.
**Designing a “Better” Pinwheel – 60 minutes**

Participants experience another activity in the curriculum, use additional materials to make what they define as “better” and document the engineering design process steps as they create their pinwheel.

**Planning A Presentation – Time varies between 30 – 60 minutes depending on the flow of the day.**

At the end of the first day, participants have time during the training to begin planning their presentation. Materials are made available to the participants and they work in their small groups to prepare.

**DAY TWO – approximately six hours of training**

**Check-In – 20 minutes**

At the beginning of the second day, it is important to check-in to see if there are any questions or thoughts about the first day. In this check-in, participants each recall one thing they learned from the first day. It brings the learning back into the room and provides a foundation in which to start the second day of learning. The agenda for the second day is also reviewed.

**Science Process Skills – 20 – 30 minutes**

The science process skills or “SET Abilities” are a critical component to being 4-H SET-Ready. This activity includes stations where participants have an opportunity to experience the science process skills and determine which skill is most addressed. This activity helps participants better understand each skill, how they align with the curriculum, and how to help build these skills in middle school-aged youth.
Planning and Implementing an Activity – 30 minutes
(or more depending on the flow of the morning)
Participants have their final chance to meet in groups and plan their presentation.

Presentations – Approximately 2 hours and 35 minutes

- 90 minutes for presentations
- 45 minutes for debriefing the presentations
- 20 minutes for set-up and breaks

Each group is given 30 minutes for their presentation and another 15 minutes to process the learning. The activities build on each other for participants just as they will when they are implementing with youth. They can also begin to see where the content emerges and the importance of the engineering design process in this curriculum. By having participants lead the presentations, they are able to practice and apply their learning.

Resources, Questions, and Action Plan – 40 minutes

The trainer shares resources that are available to participants when they begin implementing *The Power of the Wind*. Ideally these could be shown online so they have a visual of the resource. This is also a time to answer any additional questions participants might have. Participants complete an action plan worksheet which allows them to begin to define and describe how they plan to implement *The Power of the Wind*. If possible copy the action plan sheets once completed and have a copy for your own documentation and follow-up purposes.

Closure and Evaluation – 30 minutes

There are three pieces to the final closure and evaluation of the training: 1) Have a closing gesture (i.e. gift) or closing question; 2) Complete the post- then pre-assessment; and 3) Complete the evaluation form. Collect the evaluations and copies of the assessments.
Welcome and Introductions
4-H SET Checklist
Curriculum Scavenger Hunt
Designing a Wind Powered Boat
Experiential Learning Cycle
Sign Up For Presentations
How Does a Pinwheel Use Wind Power?
Examining the Engineering Process
Designing a “Better” Pinwheel
Planning a Presentation
Welcome and Introductions

**Purpose:**
- To identify the purpose of the training.
- To know who else is in the training.
- To identify key components of the two day training.

**Time:** 30 minutes

**Materials:**

**Trainer Resource:**
- Agenda

**Handout:**
- *The Power of the Wind* Implementation Training Agenda
- Flip chart paper with three introductory items: Name, Function, and What participants hope to do as a result of the training
- *The Power of the Wind* Youth Guide and Facilitator Guide for each participant

**Trainer Notes:**

**STEP 1: Welcome and Introductions**

Welcome to *The Power of the Wind* training. Some of you may have more experience than others in facilitating groups of youth in their learning. The overarching goal of this workshop is to enhance your ability to successfully work with youth using *The Power of the Wind* Youth and Facilitator Guides. This training is dependent on *The Power of the Wind* Youth and Facilitator Guides and is designed to deepen your knowledge and skills on how to use those guides most effectively.

Over the next few minutes we will do introductions, go through the agenda, and talk about what you can expect over the next two days.

My name is ________________ and I will serve as your trainer for the next two days.

*If more than one trainer is present, each person should introduce themselves. Each trainer should say a little about their background as it relates to this training and what qualifies him or her as the trainer(s).*

The training is designed to meet your needs and as such it is important that if you need to get up and move around or go to the restroom, please feel free to do so. We will have scheduled breaks and lunch since those are crucial to your learning as well, but there just may be times you need to stand up or leave the room for a moment. We know based on something called Maslow’s theory that you cannot concentrate on what is happening in the room if you have other survival needs. When you have to use the restroom for example, it is all you can think about, so, please take care of your need.
Before we get started, here are some logistics (adapt logistics that are appropriate for your training).

**Explain:**

- Where restrooms are located.
- To please turn off cell phones as these can disrupt learning
- Other logistical items that may be pertinent to training.

Let’s take a few moments and find out who is in the room. We are going to do this quickly because we will have many chances to interact and learn about each other during this training, but, for now, I would like you to tell me:

**Refer to the flipchart with the items below.**

- Your Name

- Your Function (not always title—but what work do you do for 4-H/extension—your work with youth)

- What you hope to do as a result of this training (lead a middle school group; train others; etc.)

We know it is important to provide training for volunteers with new curriculum such as *The Power of the Wind*. As mentioned earlier, the purpose of this training is to prepare you to lead this curriculum with youth. In this training you will be learning more about the engineering design process and how these activities can build middle school age youth’s skills in this area. With that said, let’s look at the specific components of the training as outlined in the agenda.
STEP 2: Review Agenda

Go over the two-day training agenda with the participants, calling their attention to information that has come up in their introduction related to the agenda. Explain that this is a training designed to help them implement the Power of the Wind using the Youth and Facilitator Guides. This is one of the nationally reviewed and recommended 4-H SET curricula. Make a point of the fact that they will be leading pieces of the curriculum themselves tomorrow.

Mention that participants will have an opportunity to experience and process six activities from the curriculum as learners. Then they will discuss the activities in the context of leaders and facilitators and reflect on how they will use this with youth. In addition, it is important to make a point that they will be exploring and experiencing the actual curriculum over the next two days while they are maximizing on their own engineering design process and exploration skills.

STEP 3: Transition

This curriculum is just one piece of a much larger initiative called 4-H SET—Science, Engineering, and Technology. While 4-H members will use math in this and many other 4-H projects, 4-H chose not to commit to developing projects and activities to increase knowledge and skills in math and measuring math learning outcomes. The 4-H commitment is to science, engineering and technology—SET. Many of you may call this type of programming STEM (Science, Technology, Engineering and Math) and will find situations where it is easier for you to refer to it as STEM rather than SET. As always, be sensitive to your audience and who you are communicating with. When we talk about it here, in a 4-H context, we will be using SET. Now let’s take a look at this 4-H initiative called SET—Science, Engineering and Technology. Let’s explore what 4-H SET is by looking at its components.
As you go through the agenda, try to make references to things they said they want to do as a result of this training and point out where that will occur. This tool is just a little background. Use your own skills and expertise to determine how much depth or information you share at this point.

DAY ONE

Welcome and Introductions

4-H SET Checklist – Components of the 4-H SET Initiative

We are going to take a little time to discuss how The Power of the Wind curriculum is just one piece of a much larger initiative and meets the criteria for being SET-Ready as a piece of this national initiative. We will become familiar with those components and think about how they relate to our own expertise and things we still want to know more about.

Curriculum Scavenger Hunt

The Curriculum Scavenger Hunt gives you a chance to become familiar with a curriculum and for all of us to discuss how it is organized and how to use this when you implement The Power of the Wind.

Designing a Wind Powered Boat

Throughout the training you will participate in many of the activities in the curriculum—this is just the first one. By participating, you will have the experience and will connect this directly to the curriculum and the facilitator’s guide. You will participate in the activities as both the learner and the facilitator so they can be thought about on both of these levels.
Experiential Learning Cycle

A critical component of 4-H educators’ and volunteers’ work is the Experiential Learning Cycle. Many of you are very familiar with this and some may have never heard of it at all. This activity will give you more familiarity with the cycle and how it is critical to a young person’s learning.

Sign Up for Presentations

Each of you will be working with a small group to do a 30 minute presentation based on one of the activities in the book. Before lunch, you will choose which activity you want to lead with other participants.

How Does a Pinwheel Use Wind Power?

This is an activity out of the curriculum that you will get to experience and comment on as both a learner and facilitator.

Engineering Design Process

As mentioned in the introduction, the engineering design process is a critical learning thread that runs throughout this curriculum. It will be important for you to be more familiar with what this means in order to work with youth in their engineering design. This activity helps focus on the main components of the design process.

Designing a “Better” Pinwheel

In this activity, you will experience another youth guide activity and document the engineering design process.

Planning A Presentation

At the end of the first day, you will meet in small groups to begin the planning of your presentation.
DAY TWO

Check-In

At the beginning of the second day, there will be a check-in to see if there are any questions or thoughts about the first day.

Science Process Skills

The science process skills or “SET Abilities” are a critical component to being 4-H SET-Ready. This activity includes stations where you will have the opportunity to experience the skills and think about what each means. You will then see how they are a part of the curriculum.

Planning and Implementing an Activity

Before lunch you will have a chance to meet in your groups to plan your presentation. After lunch you will begin the presentations and each group will have 30 minutes to present and 15 minutes to debrief.

Resources, Questions and Action Plan

Time will be spent identifying where there are additional resources you might want to use when implementing the curriculum. This will also be a time to answer any additional questions you may have. Finally, there is time for developing your own plan of action for *The Power of the Wind*.

Closure and Evaluation

Feedback is critical to our learning and improving. We will take time to evaluate and close the training which promises to be a fantastic two days.
## DAY ONE

### MORNING

- Welcome and Introductions
- 4-H SET Checklist – Components of the 4-H SET Initiative
- Curriculum Scavenger Hunt
- Designing a Wind Powered Boat
- Experiential Learning Cycle
- Sign Up for Presentations

### AFTERNOON

- How Does a Pinwheel Use Wind Power?
- Engineering Design Process
- Designing a “Better” Pinwheel
- Planning A Presentation

## DAY TWO

### MORNING

- Check-In
- Science Process Skills
- Planning and Implementing an Activity

### AFTERNOON

- Presentations:
  - How Can We Use Wind to Lift a Load?
  - Which Turbine Design is Better for the Job?
  - How Can We Use Wind Power to Produce Electricity?
- Resources, Questions, and Action Plan
- Closure and Evaluation
**Purpose:**
- To identify the components that make an experience or project SET-Ready.

**Time:** 40 minutes

**Materials:**
Charts around the room with the seven components of the Checklist (each chart has one of the headers listed below)
- National Science Education Standards
- SET Abilities
- Essential Elements
- Trained, caring adult staff working as co-learners with youth as partners
- Experiential approach to learning
- Inquiry to foster creativity and curiosity
- Target SET outcomes with frequency and duration

**Trainer Resource:**
4-H SET Checklist

**Handouts:**
- 4-H SET Checklist
- 4-H SET Logic Model

**Trainer Notes:**

**STEP 1: Context**

Begin by distributing the 4-H SET Checklist and saying there are seven key areas that are necessary to make an activity, program, or initiative 4-H SET-Ready.

I want you to take a few minutes to review the 4-H SET Checklist handout and the 4-H SET Logic Model.

Give participants time to individually read through and review.

- What do you notice?
- What was new to you?
- What questions do you have about any of the areas?

Check to make sure participants understand categories and what they mean.
STEP 2: Choosing a Component and Discussion

Now, I want you to think about each of these components and decide which one you feel most comfortable with already as a facilitator/leader. You will see there are charts around the room and I want you to go stand by that chart. There is no right or wrong answer.

When you get to the chart you chose, introduce yourself to the other participants that chose the same chart. In a small group conversation, share with each other why you chose to stand there.

Give participants a few minutes to discuss. Go to each chart where people are standing and have a representative report why they chose to stand there.

Note any themes that come up as people share. Let participants know these components of SET will be discussed intermittently throughout the training. Use the “trainer support guide sheet” as needed in both the beginning discussion and as people report out. Do not read all this information but become familiar with it so critical elements can be added as people share.

STEP 3: Choose Again and Discussion

Now I want you to switch and choose another component you would like to learn more about over the next two days of our training.

When you get to your chosen component, introduce yourself to the other participants that chose the same chart. In a small group conversation, share with each other why you chose to stand there.

Once again, ask for a representative to share key items of the conversation. As items come up, refer back to the agenda about where these might best be covered. If something is not going to be covered at this training, be clear about that. Encourage sharing and raise themes or consistencies as they emerge.
STEP 4: Reflection

Have everyone take his or her seats and ask the following questions.

• What did you notice about how the different areas of the 4-H SET-Checklist were selected?

• What did you learn from this activity that tells you about how you might help each other or where the gaps might be?

• Why do you think National 4-H felt it necessary to create this type of checklist?

• How else might you use this checklist as you are working on your own SET work?

The checklist names the key components of 4-H SET. Whether it is designing and delivering curriculum, preparing staff, or evaluating the 4-H SET work, the logic model and checklist guide the 4-H SET program. Because of that, you will see them repeated in the curriculum. Throughout the training we will be going back to these key areas and intentionally taking time to notice these different components in our training.

STEP 5: Transition

Now let’s take a closer look at the curriculum to familiarize yourself with how it is organized.
4-H SET Checklist

National Science Education Standards

The National Science Education Standards outline what youth should know, understand, and be able to do in the natural sciences over the course of their K-12 education. The underlying concepts and processes in science are divided into eight categories:

- Science as inquiry
- Physical science
- Life science
- Earth and space science
- Science and technology
- Science in personal and social perspective
- History and nature of science

How many of you use the National Standards in your SET (Science, Engineering, Technology) work? How many of you also use specific state standards? We use the national standards because they provide a consistent base of quality content on which our programs design, development, delivery and, assessment is built.

SET Abilities

We have identified 30 SET Abilities or science process skills that are practiced in the areas of science, engineering, and technology. How are you, in your work, making sure children and youth are getting these and other science process skills? You will see later that the Exploratorium uses 7 Process Skills and has created a tool for us that frames these 30 in those categories.

Essential Elements

How many of you call your work youth development? 4-H is committed to a positive youth development approach that focuses on having youth walk away from their 4-H experience with a sense of belonging, increased independence, skill mastery, and a spirit of generosity—these are the Essential Elements.
Trained, caring adult staff working as co-learners with youth as partners

We will talk about this a little later as time permits. How we prepare our volunteers as facilitators and front-line youth workers is critical to the effectiveness of 4-H SET. Our commitment is to ensure that people are trained, that we are clear about our expectations, and that we provide the tools to do this work.

Experiential approach to learning

The Experiential Learning Cycle is something that is basic to how we deliver 4-H programming. This is key to moving an activity to something “fun” that youth do and making sure that there is learning occurring as young people apply that learning to the real world.

Inquiry to foster creativity and curiosity

Working with youth to pose a problem, coming up with a plan, investigating, and communicating their results are all critical parts of 4-H SET. This is about their skill development in using an inquiry approach that is youth-led.

Target SET outcomes with frequency and duration

The 4-H SET initiative builds from a logic model that is designed to reach outcomes for youth that include increased knowledge and skills, increased interest and numbers in SET careers, and increased science literacy in the general population. These and other outcomes are best reached by being very intentional about the work we are doing in 4-H SET and ensuring that we are working with the same youth frequently and for a sufficient length of time. Though we don’t have all we need to know from research, it does show that frequency and duration are key factors in reaching positive outcomes.
4-H SET Checklist

A “SET-Ready” 4-H experience is a program that is framed in SET concepts, based on SET standards and intentionally targets the development of SET Abilities, and has the outcome articulated by the 4-H SET Logic Model. It integrates the essential elements and engages participants in experiential and inquiry-based learning. In addition to the following criteria below, it also recommends that SET programs offer a sustained learning experience which provides youth the opportunity to be engaged in programs with relevant frequency and duration. Utilize the following checklist to self assess the program you deliver.

To meet the needs of children, youth and the nation with high-quality science, engineering, and technology programs.

☐ Are you providing science, engineering, and technology (SET) programs based on National Science Education Standards?

Science education standards are criteria to judge quality: the quality of what young people know and are able to do; the quality of the science programs that provide the opportunity for children and youth to learn science; the quality of science teaching; the quality of the system that supports science leaders and programs; and the quality of assessment practices and policies.

http://www.nap.edu/readingroom/books/nses/

☐ Are you providing children and youth opportunities to improve their SET Abilities?

Predict, Hypothesize, Evaluate, State a Problem, Research Problem, Test, Problem Solve Design Solutions, Measure, Collect Data, Draw/Design, Build/Construct, Use Tools, Observe, Communicate, Organize, Infer, Question, Plan Investigation, Summarize/Relate, Invent/Implement Solutions, Interpret/Analyze/Reason, Categorize/Order/Classify, Model/Graph/Use Numbers, Troubleshoot, Redesign, Optimize, Collaborate, Compare
Are you providing opportunities for youth to experience and improve in the essential elements of positive youth development?

- Do youth get a chance at mastery—addressing and overcoming life challenges in your programs?
- Do youth cultivate independence and an opportunity to see oneself as an active participant in the future?
- Do youth develop a sense of belonging within a positive group?
- Do youth learn to share a spirit of generosity toward others?

Are learning experiences led by trained, caring adult staff and volunteers acting as mentors, coaches, facilitators and co-learners who operate from a perspective that youth as partners and resources in their own development?

There is a commitment to prepare, train and support our staff and volunteers to work with youth. Youth are seen as assets and individuals who are valued resources.

Are activities led with an experiential approach to learning?

Learning is done with a hands-on approach that includes an experience and deepens learning through sharing, processing, generalizing and application to the real world.

Are activities using inquiry to foster the natural creativity and curiosity of youth?

Youth are encouraged to answer their own questions by planning, investigating and communicating their results.

Does your program target one or more of the outcomes on the SET Logic Model and have you considered the frequency and duration necessary for youth to accomplish those outcomes?

SET programs increase young people’s knowledge and skills and reach intentional outcomes by occurring frequently over a sufficient length of time.
### Description of Challenge, Problem, or Opportunity:
- Unsolved worldwide social problems need to be addressed by SET.
- In the US, shortage of scientists and people understanding SET.
- Under-representation of women and minorities in SET careers.
- Need a diverse pool of trained scientists to frame and solve problems and educate others.
- General population in the US (and worldwide) lacks basic understanding of science methods and content (“science literacy”).

### What we invest:
- Federal, state, and private funds.
- 4-H Infrastructure.
- Land Grant Univ. Support.
- County Extension administrators and agents, program coordinators, and specialists.
- Training.
- Knowledge.
- Collaborations with external researchers.
- Collaborations with SET industry leaders.

### What we do:
- Select and develop 4-H SET curricula.
- Select and train volunteers.
- Market 4-H SET to increase interest participation.
- Conduct non-formal education (learning and teaching, facilitated inquiry and discovery).
- Facilitate question formation and problem solving through guided activities.
- Provide or supplement math programming.
- Teach youth about academic and career choices, requirement.

### Who we reach (Participation):
- Extension administrators, LGU and Extension faculty and staff.
- Youth (grades 3–5, 6–8, 9–12).
- Federal, state & private funders.
- Partners.
- Public.

### What we produce:
- 4-H SET curricula.
- New instructional methods.
- Trained staff and volunteers.
- Adult participants engaged.
- Youth participants engaged.
- Partners (Other federal agencies, science museums, youth organizations, etc.) collaborating.
- Marketing materials.
- Evaluation materials.

### Knowledge
- Occurs when there is a change in knowledge or the participants learn:
  - Increased awareness of SET among youth.
  - Improved SET skills (scientific methods) and knowledge (content areas) among youth.
  - Increased awareness of opportunities to contribute to society using SET skills.
  - Increased life skills (self-efficacy) among youth.

### Actions
- Occurs when there is a change in behavior or the participants act upon what they’ve learned and:
  - Youth apply SET learning to contexts outside the 4-H courses (e.g., school classes, science fairs, invention contests, etc.).
  - Youth adopt and use new methods or improved technology.
  - Youth demonstrate use of life skills.
  - Youth express interest/demonstrate aspirations towards SET careers (career fairs, job shadowing, volunteer work or internships).
  - Youth raise questions and identify problems to be addressed using SET.

### Conditions
- Occur when a societal condition is improved due to a participant’s action taken in the previous column.
  - Increased number and more diverse pool of youth pursuing education and careers in SET related fields.
  - Increased and more diverse pool of trained teachers, educators, scientists.
  - Increased science literacy in general population.
  - Increased innovation addressing social problems using SET.

### Assumptions
- 4-H non-formal experientially based programming addresses science abilities, concepts and content under guidance of trained (scientifically able) 4-H learning facilitator; 4-H develops appropriate SET Abilities to emphasize in non-formal education; 4-H essential elements create optimal youth development context for learning; 4-H reaches diverse population; and increased awareness of SET skills, content, and career possibilities increases engagement of youth in SET careers.

### External Factors
- Youth experience in schools including [with] SET & mathematics, No Child left Behind (course content, testing, tutoring provided in school), changing landscape of schools, community and family influence (e.g., religious teaching on Creationism), population changes, immigration, global economy and competition in SET education and SET pursuits.
Purpose:
To identify the setup and key components in The Power of the Wind Curriculum Guide.

Time:
40 minutes

Materials:
 Trainer Resource: Curriculum Scavenger Hunt
Handout: Curriculum Scavenger Hunt

Trainer Notes:

Explain that this section will familiarize participants with The Power of the Wind Youth Guide.

STEP 1: Context and Instructions

In order to become familiar with the curriculum, I am going to have you do a scavenger hunt with a series of questions to find out how The Power of the Wind Youth Guide is organized. I could stand up here and tell you, but, that is not really how people learn. Unless you have your own experiences with the information and have to think about your own learning, it is less likely to happen. This is not just true of you as adults, but also of the youth you work with.

STEP 2: Activity and Discussion

You will work in small groups of three to four (or with a partner) to answer the questions on the Curriculum Scavenger Hunt Handout. This is a time for you and your team members to become familiar with the curriculum so take your time. This is not a race. Think about the answers, and if there are questions it raises for you, bring them back to the larger group for discussion. This will not point out everything about the curriculum but give you an overview to become more familiar with it.
Pass out the Curriculum Scavenger Hunt handout. Have participants work with one or more people to complete the worksheet. This may take around 15 – 20 minutes. Watch silently to see when people are finished. Allow time for participants to find the items on the Curriculum Scavenger Hunt handout. The important thing is that they are really learning how the curriculum is organized.

Have participants share answers they found to each question. Add on to what people found where there is something that is going to be specifically relevant to their understanding. See Trainer Resource – Curriculum Scavenger Hunt for background. If time permits, ask the following questions.

Let’s discuss what you found.

In addition to what the worksheet asked you to find:

- What did you notice, learn, were surprised about, etc?

- In what ways does this organization make it easier or more difficult for you as a facilitator?

- In what ways does the curriculum help you prepare to lead an activity?

The scavenger hunt activity is designed to familiarize you with the elements of the curriculum and can help you implement The Power of the Wind.

**STEP 3: Transition**

One way of becoming familiar with the guide is the activity we just did, another way is to actually experience and discuss the activities. We will now get a chance to do the first of six activities you will be experiencing from the Youth Guide over the next two days.
1. **Notice the background color in the header space that lists the “big question” for each activity. How are the colors correlated with type of activity?**

   This guide is written with an engineering approach to the lessons. What does that mean? It means it is composed of a series of challenges, investigations, and explorations. The activities are setup from an engineering perspective: Exploration – orange, Challenge – blue, Investigation – green. Take a look at page 3 of the Facilitator Guide for more information on each of these pieces.

2. **Look over a couple of lessons and specifically look at the “Talk About It” section. What is the purpose of this section?**

   After the initial “experience,” the next step in the experiential learning model is to share, process, generalize, and apply. This section is the next in the sequence. Participants record data which is a form of sharing. The questions help them process, generalize, and apply. This will be covered further in the experiential learning piece of the training.

3. **What information is presented in the blue sidebars? What do the timelines show? What can you learn from the photo captions and other sidebars?**

   Once the participants have answered, have them review pages 19 and 21 as examples of these three pieces and explain that they are all ways that infuse content into the lessons.

4. **The guide is structurally set up in the following way that uses wind energy as the content focus:**

   - How can we think like an engineer?
   - How do we study the wind?
   - How do we use the wind?
   - How do geography and community influence wind power projects?
   - How does wind inspire creativity and design?

   Where do you find these and how do they help you as a facilitator and as the learner?

   These questions are located at the bottom of each of the pages in the footer section. These questions become the purpose for doing the activities listed. It can help youth give context to the lesson and provide a sense of direction as they are working through it.
5. Most activities have a section titled, “In Your Engineering Notebook.” What is the purpose of this section?
   A place for data collection, to record thoughts, to write down investigations just like engineers do. The purpose of this is to help young people go through the investigations and model how scientists and engineers do their work.

6. What page has an activity about Wind Farms?
   Page 30 – 31. Case studies are good examples to share because it helps young people see a relevance and applicability in the “real world.” This activity might help them ask questions about their community and wind energy.

7. What section immediately follows the “What Innovative Design Can you Create” section?
   The Appendix section is where additional resources for the activities can be found. It is where handouts can be copied from. It was purposefully put there so not to take away from the learning sections within each individual lesson.

8. On what page is there an engineering design process diagram?
   The engineering design process is the foundation for which this curriculum is built. The model can be found on page eight. Think about how you might continually guide youth back to this place as a reference as they work through the book.

9. How many scientific terms are defined in the curriculum?
   There are 49 scientific terms defined in the curriculum and can be found in the Glossary. The glossary in the appendix defines the terms that appear in bold type throughout the text. What else can you find in the appendix? In the other appendices you will also find templates for some of the activities and pages for an Engineering Notebook.
1. Notice the background color in the header space that lists the “big question” for each activity. How are the colors correlated with the type of activity?

2. Look over a couple of lessons and specifically look at the “Talk About It” section. What is the purpose of this section?

3. What information is presented in the blue sidebars? What do the timelines show? What can you learn from the photo captions and other sidebars?

4. The guide is structurally setup in the following way that uses wind energy as the content focus:
   a. How can we think like an engineer?
   b. How do we study the wind?
   c. How do we use the wind?
   d. How do geography and community influence wind power projects?
   e. How does wind inspire creativity and design?

   Where do you find these, and how do they help you as a facilitator and the learner?
5. Most activities have a section titled, “In your Engineering Notebook.” What is the purpose of this section?

6. What page has an activity about Wind Farms?

7. What section immediately follows the “What Innovative Design Can you Create” section?

8. On what page is there an engineering design process diagram?

9. How many scientific terms are defined in the curriculum?
Designing a Wind Powered Boat

Purpose:
• To become familiar with an activity in The Power of the Wind curriculum.
• To identify different ways to approach leading an activity.

Time: 45 minutes

Materials:
Flip chart with the following:
- Design and build a “sailboat” that will travel in a straight line a minimum of 75 cm on a smooth surface. Your “constraints” are to use a Styrofoam tray for the body and to attach a mast with a sail to the tray.
- Small styrofoam tray, flexible straws, cardboard or index cards, tape, straight pins, scissors, tape measure, box fan, flip chart with activity directions on (see bolded statement below). Optional: pencils, stop watch with second hand, string, paper cups, paper clips, pennies, miscellaneous hardware and office supplies.

Trainee Notes:

STEP 1: Context and Instructions

Let’s get going and dig into the curriculum! In this training segment you will first be a “learner” and do an activity from the youth guide on designing boats. After you have completed the activity, I will ask you to take off your “learner hat” and put on your “leader” or “facilitator hat.” We will then spend some time debriefing the activity.

Refer to flip chart with instructions for this activity.

STEP 2: Activity and Discussion

We are going to work on designing a wind powered boat. The challenge is a design problem. In this activity, you will build your own sailboat and test it to see how far and straight it goes when you use a fan as the source of wind. Feel free to test, adjust your designs, and test again.

Please work with a partner to complete this activity. You will have about 20 minutes to complete this activity. Materials are located _________ (tell participants where materials are located).

As participants are doing the activity, move around the room and check in with groups to identify progress and challenges they are having. The activity can take about 20 minutes after participants begin; however, if the majority of participants are done early or need extra time, the length of time

spent on the activity can be adjusted. Notify participants when they have 5 minutes left. This cue will help them wrap up the activity.

Now let’s discuss your designs and models. Let’s do a “show and tell” and highlight your designs.

Have participants walk to each group as they give a short overview of their boat. When the overview is completed, ask the group selected questions from below. Do this for each group after they highlight their design.

Questions to ask groups as they discuss their design:

- How far did the sailboat travel? How does the wind move a sailboat?
- What was something you learned by building this sailboat?
- Where else in your life do you see wind used to move things?
- How might you use what you just learned in other designs?

**STEP 3: Review as Facilitators**

Now let’s break this apart as facilitators that would be leading this activity ourselves.

Please open your *The Power of the Wind* curriculum to pages six and seven.

Give them some time just to familiarize themselves with the page and read the different sections.

Notice the piece of the activity you just did “How Can We Design a Wind Powered Boat?” Let’s review the setup of each lesson. Can someone point out the key pieces or headers for this lesson?

Have participants share the specific sections below.

- The “Design and Build” section gives you the challenge or task that needs to be completed.
- The “Try It” section gives you ideas and specific directions of HOW to complete the task.
- The sidebar on page six lists the materials you need.

There are a lot of great ideas in the youth and facilitator guides. This training is designed to deepen your learning of these great resources and how you might use these and other ideas while you implement.

- What similarities and differences did you notice in how you completed the activity versus what the guide says?
- What did you just learn about how this activity is done by doing it?
- How will this help you implement?
- Based on the activity you did, what challenges do you anticipate with leading this activity?

Please turn to the Facilitator’s Guide on pages six and seven. Take a couple of minutes to read through the facilitators tips for this activity.

- Can you identify how I, as the facilitator, used these tips in facilitating the lesson?
- What additional helpful hints do you see in the Facilitator’s Guide for this activity that you will want to use as a facilitator?
- What SET Abilities were you intentionally working on as you completed this activity?

**STEP 4: Transition**

In the next section, we will be learning more about the Experiential Learning Cycle. You have been experiencing this since you walked in the door, but now we are going to look at its parts and think about your role as facilitator in using this technique.
Purpose:
To be able to identify the different components of the experiential learning cycle.

Time:
35 minutes

Materials:
Trainer Resource:
• Designing a Wind Powered Boat
Handout:
• Experiential Learning Cycle
• Flip chart labeled with Experiential Learning Cycle
• Large Post It Notes (1/2 sheets) with: What? So What? Now What?

STEP 1: Context

Let’s take a few minutes to explore the Experiential Learning Cycle: what it is, why we use it, and how you will be using it when you facilitate The Power of the Wind.

Start by asking if anyone knows what the Experiential Learning Cycle is and the different parts of the process.

• Does anyone know what the Experiential Learning Cycle is?
• Can anyone name the different parts of the process?
• It is a part of our SET Checklist and basic to what we do in 4-H. Can anyone tell me why?

STEP 2: Overview of Cycle

We are going to spend the next few minutes getting familiar with the Experiential Learning Cycle and how you might use it as you lead The Power of the Wind. One of the most important pieces of the cycle is the purpose—“what is your intent?” It is important that you are clear about your purpose and use the Experiential Learning Cycle to strengthen that purpose.

The purpose depends on the outcomes you are trying to reach—the knowledge, skills, and behaviors you are trying to address with this specific activity or experience.
What do you think was the purpose of the activity you just did with the sailboats? You begin with the purpose and then think about what activity would best accomplish that purpose.

Use the Trainer Resource as your guide to how the Experiential Learning Cycle was used with Designing a Wind Powered Boat.

Regardless, being clear on what will be different as a result of the activity is a critical first step to learning.

Experiential learning begins with hands-on learning—a chance to become familiar with the content.

Distribute the Experiential Learning Cycle handout at this point and also call their attention to the fact that this is on page five of the Facilitator Guide and the way it talks about the Experiential Learning Cycle and amplify with more specifics about each stage. In addition, having the cycle on the flipchart you can specifically refer to how it helps participants “see” where you are at while you are talking or asking questions. Have a chart, like their handouts, that has a place for purpose, activity, and the questions.

The Purpose was:
Participants will successfully demonstrate an understanding of the engineering design process by constructing a sailboat.

Experience is the opportunity to become familiar with the content.

• What experience or activity did you do?

Share explores a deeper meaning of the content. Some think of the share as “what happened or the What?” There is not a right or wrong answer; it is whatever the person perceived as what happened.

Post the What? ½ sheet on the flipchart of the Experiential Learning Cycle by Share.

• In the last activity, how did you share?

Process and Generalize is getting into the “So What?” Now you did it, you shared what you did, but what does that mean? This is your chance to explore the deeper meaning of the content. This is where you start thinking for yourselves through analyzing, as well as explaining what it means beyond the activity.
Place the So What? ½ sheet on the flipchart of the Experiential Learning Cycle by Process and Generalize.

• What questions did the trainer ask at this point?

Apply can be thought of as “Now What?” So now what are you going to do with this information, how is it going to help you, your life, and/or your community?

Place the Now What? ½ sheet on the flipchart of the Experiential Learning Cycle by Apply.

• What did you do in the last activity to apply what you had learned?

• In The Power of the Wind, how does what you learned lead to other learning?

Let’s move on to apply this learning and try to use it ourselves with activities from The Power of the Wind.

STEP 3: Small Group Activity

We are going to focus again with the same purpose and activity—Designing a Wind Powered Boat—and even though we already have great questions in the guide—and you can refer to them, this is your chance to think of your own, try to deepen your own understanding of what questions get developed for where and how to constantly think about the cycle as we help others learn. In addition, we are asking you to stretch. It may not be questions but other ways of representing the learning that has occurred.

We are going to break into groups and each group is going to do one component of the Experiential Learning Cycle. One or two groups will do Share, one or two groups will do Process and Generalize, and one or two groups will do Apply. Using the same purpose and the experience as we just did in the board activity, I want you to come up with a different way, or different questions you could use to get youth to share, process & generalize and apply in order to reach that same purpose.

Often we come up with questions for each of these steps but you can also do this in other ways.

How would you have people share? Examples may include questions the facilitator might ask, a skit or picture drawn by the participants, or something else.
Each group will determine how they will do their segment of the Experiential Learning Cycle.

I would like you to break into groups of three to four people per group.

If you have 20 people that might mean you have 6 groups of 3-4 people. Two groups would do each step: two groups doing sharing; two groups doing processing & generalizing and two groups doing applying. You might want to have the right number of cards prepared labeled with the names of the three groups and then just have people pick a card and join together based on whether their card said sharing; processing & generalizing or applying.

Provide time for groups to work through this exercise. Move around the room to answer questions participants might have.

**STEP 4: Report and Discuss**

Have each group report out on what they would have their youth do in order to get us to Share, Process & Generalize, or Apply the Wind Powered Boat Activity.

• What is important about this type of practice?

• How might you use what you learned in your own facilitation?

What I find most important about this is that you began thinking about how to reach your purpose. We will cover this in many different ways. For example, tomorrow morning we will look at what your purpose might be in terms of what process skills you might want to focus on with young people as you move forward. Doing the activity is not enough so we need to make sure we choose ways, sometimes questions, that help youth think about and apply what they are learning.

**STEP 5: Transition**

Let’s continue our learning about the curriculum and the activities so tomorrow we can practice (or apply) what we have learned. To begin that process we are going to have you sign up for different activities that you will present.
Designing a Wind Powered Boat Activity

**Purpose:** To become familiar with an activity in *The Power of the Wind* Curriculum

**Experience:** Designing a Wind Powered Boat

**Share:** Each group highlights their design
How far did the sailboat travel? How does the wind move a sailboat?

**Process & Generalize:** Where else in your life do you see wind used to move things?

**Apply:** How might you use what you just learned in other designs?

**Other:** What else did the trainer do to reach the purpose?
Youth describe the experience and their reaction.

Youth share how they will use the project and life skill practiced in other parts of their lives.

Youth relate the project and life skill practiced to their own everyday experiences.

Youth do before being told or shown how.

Youth discuss what was most important about what they did.

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Sign Up for Presentations

**Purpose:**
To determine the activity they wish to present.

**Time:**
10 minutes

**Materials:**
Trainer Resource:
Sign-up Sheet on Flip Chart

**Trainer Notes:**

However you divide the groups, you want to make sure they are small enough so each person gets a chance to be an active creator or presenter for the activity. In addition, this model is based on about 18 participants divided into two rooms with a trainer in each room so the time is figured according to that configuration. You may need to adapt this arrangement based on the numbers and facilities for your training. Note: The necessity of two rooms and having two groups present each lesson can be adapted based on number of participants. If there are 10 participants, it is recommended to have two groups of three and one of four and utilize only one room.

You will be able to choose one activity you will present with two other team members. For now, I just want you to choose the activity you want to do and sign up on the chart. You will see on the chart the name of the activity and the page number so over lunch you can check it out.

Before we leave today, these teams will meet together and begin to plan their activity and all the materials will be made available to each team. Each room will have about ten people: the three-person team leading the activity; six participants, and one trainer who will also be a participant when the activities are being presented.

Please sign up during lunch and we will start again in 30 minutes.
### On a flipchart, post:

<table>
<thead>
<tr>
<th>ROOM A</th>
<th>ROOM B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>How Can We Use Wind to Lift a Load?</strong>&lt;br&gt;Page 18</td>
<td><strong>How Can We Use Wind to Lift a Load?</strong>&lt;br&gt;Page 18</td>
</tr>
<tr>
<td>1.</td>
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<td>2.</td>
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<td>3.</td>
<td>3.</td>
</tr>
</tbody>
</table>

| **Which Turbine is Better for the Job?**<br>Page 20 | **Which Turbine is Better for the Job?**<br>Page 20 |
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |

| **How Can We Use Wind Power to Produce Electricity?**<br>Page 22 | **How Can We Use Wind Power to Produce Electricity?**<br>Page 22 |
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |
How Does a Pinwheel Use Power?

Purpose:
• To become familiar with a new activity from the curriculum.
• To become competent in completing an engineering-based lesson.
• To identify ways content can be embedded in lessons.

Time:
45 minutes

Materials:
Internet connection, computer, LCD projector, scissors, straight pins, pencils with erasers, pinwheel pattern from Appendix A or B

Trainer Notes:

STEP 1: Context

Explain to participants that they will complete investigations using the engineering design process, learn about the process itself, and redesign a “product.” This is the first of three workshop segments that will scaffold and help them become competent in leading this curriculum based on engineering design principles.

STEP 2: Activity

Let’s get going! You will have an opportunity to create a pinwheel, a form of a turbine. You will have 30 minutes to complete the activity “How Does a Pinwheel Use Wind Power?” on pages 14 –15 in the Youth Guide. Please work with someone who you have not yet worked with. Materials are located__________(tell participants where materials are located).

As participants are doing the activity, the facilitator should move around the room and check in with groups to identify progress and challenges they are having. The activity can take about 30 minutes but if the majority of participants are done early or need extra time, the length of time spent on the activity can be adjusted. Notify participants when they have 5 minutes left. This cue will help them wrap up the activity.
STEP 3: Discussion

Have participants walk around and see what each group did. Have each group share a little about their process. As groups are sharing, choose some of the following questions.

- When the wind blows straight into the front of the pinwheel, it turns. What happens when the wind blows into the back of the pinwheel or if it blows into the sides? Try both sides and see what happens.

- What adjustments can you make in the design to make your pinwheel turn better?

- How does the pinwheel use the power of the wind?

- The pinwheel and your boat both use wind power. How are they similar? How are they different?  

STEP 4: Video Clip and Discussion

Great! Thanks for sharing. I want to show you a brief video clip of pinwheels. It may help to ignite your thinking about your pinwheel and what you might do to make it better. (http://projects.4-hcurriculum.org/curriculum/wind/)

- What did you see in this video that was similar to what you learned when you were creating your own pinwheel?

- What is one thing you saw here that you might want to try?

- How can you help infuse content into the lessons you lead with youth?

STEP 5: Transition

Explain that through this process participants just completed a portion of the engineering design process. Tell participants that they will now spend some time working through the engineering design process and reflect on the pieces they’ve completed. When done explaining, they will have an opportunity to complete the process by redesigning their pinwheel.

Examining the Engineering Design Process

Purpose:

- To identify the components of the engineering design process.
- To identify how the engineering design process works and how it is implemented with The Power of the Wind.

Time: 20 minutes

Materials:

trainer resource:

- Engineering design process
- Flip chart with engineering design process

Handout:

Engineering design process chart

STEP 1: Context

The Power of the Wind includes the engineering design process and it is important for you to know about this process as you are working with youth. As you built an initial pinwheel, tested, and are now thinking about redesign, you are going through the engineering design process. Please turn to page eight in the Youth Guide. Let’s apply the engineering design process to the activity you did.

STEP 2: Discussion of Process

With the chart on the wall and participants referring to it in their books, walk through it briefly so they think about each component. As you do, ask participants about each step and whether they used this in their pinwheel design. Use the trainer resource sheet to discuss the components. If time allows, ask the following questions:

- What do you notice on this chart?
- How many of you have used something like this with youth already?
- How might this help young people think through their design and their role as engineers?
STEP 3: Discuss Applying with Youth

The engineering design process really is about identifying a challenge or problem, identifying solutions, testing them, getting results, and making the product better. Think about new products coming out all of the time. One product may have several models or versions. Engineers are continually improving their products.

- How would you go about making this a focal point of the lessons?
- How do you think youth will benefit from using this model?

STEP 4: Transition

In the next activity, we will use the engineering design process again, but, this time, instead of thinking about it after you have done the activity, I want you to complete the chart as you are doing each step. This is a way for you to become more familiar with the process and to make decisions as a group. Remember that the engineering design process is always circular. This handout merely gives you a place to record your thoughts and progress. Working as “teams” is another important part of how engineers design and an exciting part of this career.

Hand out the engineering design process chart and say that in the next activity they will have a chance to complete this chart for how they make the pinwheel “better”.

Remember that the engineering design process is always a circular process like the chart in the Facilitator Guide.

**STEP 1:** What is the challenge?

Engineering work is based on “challenges” or “problems.” There must be a problem for engineers to solve. Clearly identifying the problem or challenge is the first step to thinking like an engineer.

**STEP 2:** How have others solved this?

Engineers don’t think only by themselves. In order to be efficient in their work, before they attempt to find a solution, they gather information. They might look at similar problems and collect information on what others have learned. They may ask other engineers or researchers, or tap into their prior experiences.

**STEP 3:** What are the design criteria and constraints? Brainstorm possible solutions.

Before engineers can identify possible solutions, they need to know what is available to them. What is their budget? What are the materials? How much time is available? After identifying these, they can begin to brainstorm possible solutions.

**STEP 4:** Which of the possible solutions do you choose?

Engineers don’t identify only one possible solution. They brainstorm several solutions and identify the pros and cons of each. During their identification of pros and cons, they take into consideration what they know from steps two and three. After careful thought, they can select the best solution for the problem.
STEP 5: **Build a prototype.**

A prototype is a first design of the solution. Engineers know that their work will be refined and the product made better, but they always need to start with an initial design.

STEP 6: **How does it work? Try it and test again.**

After the prototype is built, it must be tried and tested. Engineers will do several tests to ensure reliability. During the testing phase they will note what works well and what parts of the product need to be improved. They observe and record carefully.

STEP 7: **How do you learn from the designs of others?**

It is likely that others are working on similar problems or challenges. By sharing those problems and challenges with other engineers, they can get additional ideas for their design and products.

STEP 8: **How can you use your new ideas to improve your design?**

Looking closely at the initial prototype, data records from initial trials, and learning from others, engineers will redesign and refine to make their products better.
Remember that the engineering design process is always a circular process like the chart in the Facilitator Guide. This handout merely gives you a place to record your thoughts and progress.

<table>
<thead>
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<th>Engineering Design Process</th>
<th>Pinwheel</th>
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<td>How have others solved this same challenge?</td>
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<td>What were the design criteria and constraints?  How did you brainstorm possible solutions?</td>
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<td>How did you go about building your prototype?</td>
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<td>What did you learn from the design of others?</td>
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<tr>
<td>How can you use your new ideas to improve your design?</td>
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Designing a “Better” Pinwheel

Purpose:
- To become competent in completing an engineering-based lesson.
- To become skilled at leading engineering based lessons.
- To increase ability to lead an activity from The Power of the Wind.

Time: 60 minutes

Materials:
- Scissors
- Straight pins, pencils with erasers, paper (various weights), pinwheel patterns, paper plates, aluminum pie plates, paper clips, coffee stirrers, popsicle sticks

Trainer Notes:

STEP 1: Context and Introduction

Now that you have constructed an initial pinwheel, watched the video, and talked about the engineering design process, I have one more challenge for you. In the business world, scientists and engineers are always trying to find ways to improve products and refine their work. Now you will have a chance to make your pinwheel even “better” than we did the first time. Your challenge is to design and construct a “better” pinwheel than your current one.

Someone may ask what “better” means. In this case, groups can decide HOW they want to make their pinwheel better. Possible ideas include: turn faster, turn for a longer period of time, bigger, smaller, etc. You may want to ask: What are ways you can think of to define better? What would make it better for your team?

Using the handout for the engineering design process, I want your groups to document what it is they are doing. Take each step and think as a group about how you want to proceed and what it is you want to be able to accomplish. Not unlike other things we have done, this is the intentional aspect of the engineering design process—what do you want to accomplish and how will you figure that out?
STEP 2: Activity

You will have 30 minutes to design and construct a “better” pinwheel. Materials are located _________________. (Tell participants where materials are located).

As participants are doing the activity, the facilitator should move around the room and check in with groups to identify progress and challenges they are having. This may be a time when the facilitator encourages the learning with open-ended questions about what is happening, what they have done, what they want to do. Remind people about the handout of the engineering design process. Ask them to make notes on each step of the process as they build a “better” pinwheel. The activity can take about 30 minutes.

STEP 3: Discussion

Now that you have each completed the activity, let’s share with the group. Remember, we are doing this as though we were “learners” so share as though you were a youth going through this activity. Each small group needs to describe their design and redesign to the large group.

**Ask the following questions of each group after they share about their model:**

- What element of the design did you choose to to make “better”?
- How did you go about doing it (what was the process)?
- What did you learn through doing this?

STEP 4: Review as Facilitators

It is now time to once again take off your “learner hats” and put on your “facilitator” or “group leader hats.” Let’s spend some time thinking about what you did and consider what it means to you as a leader working with youth.
Please turn to pages 16 – 17 in *The Power of the Wind Youth Guide*. The activity “How Can We Design a Better Pinwheel?” is essentially the same activity you completed. Let’s look closely at the lesson and see what additional ideas are included that might help you as a leader or a youth complete this activity.

*Have participants look at the lesson in both Youth and Facilitator Guides. Have them share additional items that they had not thought about in their activity.*

**STEP 5: Video Discussion**

You were also given content in a video to help you make your design better.

- How did the video (content information) help you either in the design or implementation phase?
- Other than video, how else can content be infused throughout this curriculum?
- How do you plan to infuse content into the lessons you lead with youth?

As you can see, content can be embedded into learning experiences, and specifically by using *The Power of the Wind* curriculum in a number of ways. While some youth may search more or less for content, knowing how to help them find what they are looking for can help foster their learning, and continue their interest in this area. You are not expected to have all of this content knowledge, nor do you need to have it, to provide rich learning experiences for youth.
**STEP 6: Review the Process**

We had you document what you were doing at each step of the engineering design process so you could become familiar with the steps and think about what this meant to implementing *The Power of the Wind*.

- Why do you think we had you use that tool?
- In what ways did it help you become familiar with the steps in the process?
- What was it like to document what you were doing?
- How might this work with the youth you work with?
- How might you want to do this differently?

**STEP 7: Transition**

You will now take all of this experience and knowledge and plan with other team members to lead an activity yourself.
Planning a Presentation

**Purpose:**
- To increase ability in leading an activity from *The Power of the Wind*.
- To identify how they would implement one of the activities from the curriculum.
- To identify what learning needs to take place from one of the activities.

**Time:** 30 minutes

**Materials:**

**Handout:** Presentation Planning Worksheet

**Activity: How Can We Use Wind to Lift a Load?**
Pennies, cardboard or index cards, round pencils, straws, cardstock, string, paper or plastic cups, paper clips, tape, box fan, stop watch, rubber bands, poster board, plastic beads for spaces, miscellaneous hardware and office supplies

**Activity: Which Turbine Design is Better for the Job?**
Pennies, pencils, straws, cardstock or index cards, box fan, string, paper cups, paper clips, tape, tape measure, stop watch, aluminum pie plates, and miscellaneous hardware and office supplies

**Activity: How Can We Use Wind Power to Produce Electricity?**
Cardstock or index cards, paper clips, tape, cork, multimeter, box fan, small motor, LED, wire stripper, plastic drink bottles or aluminum pie plates, rubber bands, string, paper cups, and miscellaneous junk, hardware and office supplies

**Trainer Notes:**

**STEP 1: Context and Introduction**

During this portion of the training we will begin to design an activity from *The Power of the Wind*. Your team will plan and teach the lesson to a small group. All of the materials listed in the Youth Guide are available for you to use (*point out where you have placed the supplies*). You will only have 30 minutes to present so you will need to cut back the activity accordingly. We have purposefully chosen hands-on activities. There are three group members so you will have to divide responsibilities. Remember what you have learned through this training and incorporate the following into your lesson:

- What is the purpose of this activity?
- How is the engineering design process used in your lesson?
- How are you including the Experiential Learning Cycle into your lesson?

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STEP 2: Planning the Presentation

You will work in groups of three to plan and present the lesson. You will have 30 minutes to present, and an additional 15 minutes will be spent processing with the people that participated in your activity.

*Have the participants break into the activities they have signed up for at lunch and hand out the planning sheet for them to use.*
Name of activity and page number:

Purpose of the activity (As a result of this activity, participants will be able to__________?):

How does this connect to the engineering design process?

What are the key steps in your presentation?

Who is responsible for which step in your presentation?

How will you model the Experiential Learning Cycle?
Check-In
Science Process Skills
Planning and Implementing an Activity
Presentations
Resources, Questions, and Action Plans
Closure and Evaluation
Check-In

Purpose:
• To answer any questions about the training and implementing The Power of the Wind that has surfaced thus far.
• To identify key learning that has occurred.
• To review learning from the first day.

Time:
20 minutes

Materials:
Flip chart with Day 2 Agenda

Trainer Notes:

STEP 1: Context

Begin the day by welcoming people back and thanking them for a great first day. Ask if there are any questions that they have at this point that we could spend some time discussing.

Step 2: Review Learning

What is one thing you learned or re-learned from the training yesterday.

Give them time to think and let them know that this is a question you are going to ask each person to answer.

STEP 3: Review Day’s Agenda

Once people have all answered, go through what will happen during this day’s training either referring to something you have prepared on the flipchart or ask them to pull out their agenda again.

STEP 4: Transition

As you see from the description, the first thing we will spend time on this morning is understanding process skills better. As was said in the beginning of this training, we are not only experiencing activities from The Power of the
Wind curriculum so you can better implement those activities, but we are trying to prepare you for what it takes to facilitate. We have done this with the Experiential Learning Cycle and the importance of deepening learning. We have done this with two activities: “Designing a ‘Better’ Pinwheel” and how to think through the approach to the activities in order to encourage youth to use the engineering design process. Now, as facilitators, you are going to experience and even struggle a little perhaps with seven key process skills. This piece of the training is critical to your ability to understand these skills, and, actually be better at helping youth improve their skills while we implement The Power of the Wind. As you increase your skill as facilitators, you might also take a curriculum like this and continue to strengthen the science process skills based on the needs and interests of your youth.
Science Process Skills

Adapted for 4-H by the Institute for Inquiry®
from the original:
www.exploratorium.edu/IFI/docs/Process_Skills.pdf
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Purpose:

• To develop a complete understanding of the process skills of science.
• To see what they look like when youth use them.
• To think about how to help youth develop their process skills.

Time:

90 – 100 minutes

Materials:

Trainee Resources

Process Skills for Flip Chart 81
Take-Home Messages for Flip Chart 82
Preparation of The Power of the Wind Process Skills Stations 83
Process Skills at Stations – Background for Facilitators 86
Facilitation Hints for Small Group Discussion 87
Facilitation Hints for Whole Group Discussion 89
How Hypothesizing, Predicting, and Interpreting Differ 91
Task Cards 92

Handouts

Process Skills Identification Form 98
Directions for Activities at the Stations 99
4-H SET Abilities 100
Process Skills: Definitions and Examples 101
Questions for Encouraging Process Skills 105
This training introduces the science process skills. By understanding these skills and their role in learning scientific ideas, 4-H leaders will increase their capacity to facilitate 4-H SET curriculum including The Power of the Wind so that it provides youth with increased literacy and improved abilities in science, technology, and engineering. Through participating in this workshop, 4-H leaders will understand the science process skills (related to the 30 4-H SET Abilities), and will be able to identify and augment opportunities for learners to use and develop their science process skills.

In the first part of this training, participants work in pairs as they rotate through six stations where they do science activities and identify the principal process skill used in each. Afterward, first in groups of four, then as a whole group, they discuss their findings and any differences of opinion they have. Attempting to understand and resolve these differences in identifying process skills can lead to useful and important changes in the way participants understand the skills.

These discussions prepare participants to compare the way they understand the process skills with the definitions of these skills presented by the facilitator in the second part of the training. Participants sometimes find that their understandings are incomplete or incorrect, in which case they must shift or enlarge their ideas to bring them into line with the standard definitions of the skills. However, without first connecting with their prior understandings and experience, they are unlikely to change their thinking. Providing them with definitions too early in the process could lead participants to merely accept or reject what they’ve been told rather than developing their own understanding of the skills. In small group discussions, participants work to reconcile their own understandings of the process skills with the definitions they’ve been given.

In the third part of the training, participants are given two resources for applying ideas about process skills to facilitating The Power of the Wind curriculum. The first resource aligns the seven process skills with the 30 4-H SET Abilities. The second resource provides examples of facilitation questions that target specific process skills. Using these resources, participants examine selected The Power of the Wind activities in order to identify targeted process skills and consider ways to increase opportunities for youth to develop their process skills when facilitating The Power of the Wind activities.
When learners do inquiry they are making observations, raising questions, planning and carrying out investigations, proposing tentative explanations (hypotheses), testing these explanations by making predictions, interpreting results, and communicating those results to others. Youth don’t use process skills merely to be using them. Instead, they use them for the purpose of learning by connecting previous knowledge with current experience. Learners use the process skills to identify and investigate novel experiences, and, from this inquiry, build new ideas.

However, according to Wynne Harlen, noted teacher educator and author, when process skills are not developed to a sufficient degree, learners may “ignore contradictory evidence in interpreting findings and hold on to their initial ideas even though these do not fit the evidence. Thus the extent to which ideas become more scientific (by fitting more phenomena) depends on the way in which the testing of possible explanatory ideas is carried out; that is, on the use of process skills. The development of understanding in science is thus dependent on the ability to carry out process skills in a scientific manner.”

Children are natural inquirers. Driven by curiosity, they will instinctively raise questions and begin to investigate things. However, in order for these investigations to lead to productive development of the understanding of science concepts, learners’ must be able to use the process skills effectively. Leaders who are charged with teaching science content must pay attention their youth’s process skills. Youth inquiry becomes a powerful means of learning science concepts only when the learners’ process skills are well developed.

This Science Process Skills section of the Training Guide is written in several sections, with each section divided into a number of steps.

The sections and their timing are as follows:

Section 1: **Introducing the Training**  
8 minutes

Section 2: **Exploring Process Skills**  
20 minutes

Section 3: **Small Group Discussions**  
10 minutes

Section 4: **Whole Group Discussion**  
20 minutes

Section 5: **Process Skill Definitions**  
10 minutes

Section 6: **Process Skills in The Power of the Wind Activities**  
20 – 30 minutes

Section 7: **Concluding the Training**  
2 minutes
Section 1
Introducing the Training / 8 minutes

The facilitator explains the purpose of the training, what participants will be doing, and how long it will take.

STEP 1: Set the context for the training.

This part of the training is on the science process skills and their relation to The Power of the Wind curriculum. Within The Power of the Wind curriculum are listed a number of 4-H SET Abilities for each activity. By participating in this training, 4-H leaders will be able to understand the 30 SET Abilities in terms of the science process skills described here, and to analyze The Power of the Wind activities for opportunities for using and developing learners’ science process skills.

The process skills of science are the tools for gathering information, generating and testing new ideas, for building new knowledge, and for learning scientific concepts and constructing scientific explanations of the world. Process skills are especially important in inquiry-based learning because they are the tools that youth use to carry out scientific investigations.

The purpose of this training is to give you the opportunity to:

• develop a richer and more complete understanding of the process skills of science
• see what they look like when youth use them
• think about how to help youth develop their process skills

There are three parts to this training.

In part one, you’ll begin by working in pairs, rotating through six very short hands-on activities that require the use of a variety of process skills. You will do just enough of each activity to identify the main process skill that it requires. Then, you and your partner will discuss your conclusions with another pair. Even though you may come into this training having used process skills language
before, you will likely find that you have differences of opinion. After groups of four talk, the conversation continues in the whole group.

We’ll begin part two by giving you the standard definitions of the process skills. We wait to give you these definitions until you have had the opportunity to experience using the process skills and to discuss with each other your own ideas about them. Those discussions are meant to help you for build your own understanding rather than just memorizing definitions handed to you.

In the third part of the training, we’ll practice applying ideas about process skills to facilitating The Power of the Wind curriculum. This will give you additional information to support the Youth and Facilitator Guides.

**STEP 2:** Call attention to flipchart you’ve prepared: “Process Skills”.

> Give the group a chance to read it. Explain that for the purpose of manageability, there are only seven basic categories and explain that the 4-H SET Abilities (30) can be collapsed into these seven areas of skills used in this training.

There are other equally valid lists with more categories, but they include skills that can be subsumed under one or another of these seven. For instance, comparing can be considered a sub skill of observing; controlling variables can be considered a sub skill of planning and investigating.

**STEP 3:** Call attention to the flipchart you prepared: “Take-Home Messages.”

You’ll be working through direct experience and discussion to develop your own understanding of the ideas that these messages express.

> Read the take-home messages aloud.

• Learners use process skills to build a conceptual understanding of science content.

• Process skills are not used separately but as intertwined, coherent sets of skills.

• Instructors can facilitate activities in ways that help learners develop stronger process skills.
STEP 4: Explain to participants why you chose to present this training, describing how the training relates to the SET initiative and The Power of the Wind curriculum.

An important part of any SET curriculum like The Power of the Wind are the process skills that youth learn as a result of experiencing the activities. This is a key component for the SET Checklist and after your experience with the stations and our discussions, we will go back to The Power of the Wind curriculum to see directly how these process skills are used. This portion of the training will help you think more deeply about how you can be intentional with these activities when working with youth.

STEP 5: Explain that this training is designed for professional development only.

Remember that this training is designed to develop and deepen your own understanding of the process skills of science. The activities at the stations are not intended to be replicated with your youth. You will find complete activities in The Power of the Wind curriculum that provide opportunities for youth to strengthen their science process skills.

STEP 6: Address the training schedule.

The entire training will take approximately 90 minutes.

Share with participants a breakdown of the training agenda.

Science Process Skills Agenda:

Introducing the Training 8 minutes
Exploring Process Skills 20 minutes
Small Group Discussions 10 minutes
Whole Group Discussion 20 minutes
Process Skill Definitions 10 minutes
Process Skills in The Power of the Wind Activities 20 – 30 minutes
Concluding the Training 2 minutes
In this part of the training, participants do brief science activities connected with The Power of the Wind that requires use of various science process skills. They do so in order to have a concrete, experiential reference for identifying, discussing, and refining their understanding of the skills in subsequent parts of the training. Doing the tasks and using the skills help participants think about the process skills in terms of actions rather than abstract definitions. One of the central aims of the training is to have participants describe skills ‘in action’. This will help them recognize the process skills when they see youth using them.

There are six activities in all. At each station, there are simple materials the activity requires and a “task card” with directions for doing the activity. It’s important that participants focus on process skills, not on learning about the scientific phenomena the activities address. After doing each activity, participants fill in the handout “Process Skills Identification Form,” indicating the primary process skills required by the activity.

**STEP 1:** Tell participants that they will be working in pairs to identify the main process skills used in the underlined parts of each of the six tasks.

You can go to the six stations in any order, but it’s important that you keep moving quickly so that you get to all of the activities. It isn’t necessary to finish doing each activity. Just do enough to get a good idea of the main skill that’s required.

**STEP 2:** Distribute the “Process Skills Identification Form” handout.

Use this form to indicate the main process skill required by the underlined part at each station. There may be several skills you use at each station, but indicate the main skill by circling it.
STEP 3: **Tell participants that they’ll have about 20 minutes to sample the six activities.**

Have them choose partners and go to their first station.

STEP 4: **Remind participants to concentrate on the main skill required of each activity.**

Circulate among groups. If you see participants identifying more than one skill, remind participants to focus on the underlined part of the task card to identify the main skill required. Identifying the primary skill demands that participants think more carefully about what they understand that skill to be.

Participants may find the activity at a particular station very engaging and want to remain at that station. However, encourage them not to linger at any one station.

STEP 5: **Give a five-minute warning.**

About five minutes before time is up, let participants know how much time they have to complete their work.

STEP 6: **Announce when time is up.**

Go on to the small group discussion.
Section 3
Small Group Discussions / 10 minutes

Participants meet in groups of four to discuss which main process skills they’ve identified for the six activities. Grounding the discussion in the concrete experience at the stations encourages participants to discuss process skills as they are actually practiced, rather than in the abstract.

Differences in identification may arise for a number of reasons. First, many people may have incorrect or incomplete understandings of how to define the process skills. In addition, when you do any activity, you inevitably use a number of skills, often simultaneously. For instance, observing is part of just about anything you do. Therefore, it may be difficult to “pull apart” the skills being used in order to identify the primary one. Finally, people may have legitimate differences of opinion about what actions actually indicate the use of particular skills.

Participants’ disagreements prompt them to probe their own thinking about process skills as they try to articulate their reasons for choosing the skills they did.

STEP 1: Have participants compare their findings in groups of four.

Ask each pair to join another pair, then distribute the handout “Directions for Activities at the Stations” to help participants recall the six activities. For your preparation for this section, you might want to review the Facilitation Hints for Small Group Discussion Training Resource.

Tell participants to take 10 minutes to discuss what they identified as the main process skill at each station, noting areas of agreement and disagreement.
During the whole group discussion, the facilitator takes on a more central role: guiding the conversation, eliciting opinions about the skills, asking participants to explain their thinking, inviting expression of differences of opinion, and encouraging participants to compare their views with those of others. Through this whole group dialogue, participants begin to experience changes in their own thinking. In some instances, they shift from defining process skills abstractly to describing them in action. In others, they may actually change their understanding of the meaning of the process skill terms. In both cases, participants develop a more complete and accurate understanding of the science process skills, preparing them to adopt commonly held definitions of the process skills that will be presented later in the training.

For your preparation for this section, review the Facilitation Hints for Whole Group Discussion and the Process Skills at the Stations Training Resources.

STEP 1: Discuss the main skill for each station.

We will discuss each station, not just to come up with the “answer,” but also to identify skills that were most difficult so we can discuss them. To do this, we’ll go through each station asking for what someone identified as the main skill and why, and then if anyone else identified different skills and why. Out of these disagreements, we’ll try to sort out the hallmarks of each skill and why some are difficult to distinguish. Let’s start with station 5, which probably had a lot of agreement.

Begin with station 5 (Pinwheels and Scissors) on questioning. Then, move through each of the stations, asking:

What did you identify as the main skill at (a particular station)? Why did you identify it as ________ (e.g. questioning)?

Ask for a show of hands if others agree.
Did anyone identify a different main skill for this station, and why?

If people mention skills that are not the intended main skill, try to acknowledge how you think the skill they mentioned could be involved in the activity. If it is part of the activity that is not underlined, articulate where it could be part of the activity, but then emphasize that the underlined part asked for something different. If the skill mentioned is closely related to the intended main skill, articulate how the skill mentioned is involved in the activity but not the main skill.

For example, “Interpreting is involved in this activity (station 6B, the # of blades station) because you have to interpret your findings in order to be able communicate them. However, communication was designed as the main skill because you were asked to make a drawing that shows your ideas, and the ‘showing to others’ part emphasizes the communication aspect in this task.”

In the process of going through each station and articulating why it was designed to be one skill rather another, you are likely to need to address the differences between specific skills, especially between hypothesizing, predicting, and interpreting. See the Training Resource – Facilitation Hints for the Whole Group Discussion for tips.

STEP 2: Wrap up the discussion.

It’s not surprising when there are disagreements or difficulties in identifying individual process skills. Sometimes it’s hard to identify a single process skill for each of the underlined directions because in practice, process skills are not used one at a time. The science process skills are not applied separately from each other in a prescribed step-by-step order.

In actual practice, what we call process skills are not individual skills but combinations, or blends, of several skills. But, as leaders, we need to address the skills separately so that we can identify where youth are in their development of each skill in order to focus on helping them strengthen particular skills.

You’ve discussed your own understandings of the process skills and have seen how difficult it can be to define them. Next, we will look at standard definitions of the process skills. Those definitions can help us resolve any remaining disagreements and lead to some new understandings of process skills.
All of the discussion and activity to this point has prepared participants to think deeply about process skills and to consider whether their previous understandings of these skills are accurate or need to be reconsidered. In this part of the training, the facilitator presents standard definitions of process skills, and participants spend time discussing the definitions and comparing them to their ideas. Doing this helps participants develop a common language about process skills, and to develop deeper understanding that they will apply to the rest of the training and to the work they’ll do when they implement The Power of the Wind.

STEP 1: Explain why a common language for the process skill is important.

You’ve done a great deal of thinking and talking so far, exploring your own and each other’s ideas about process skills. In doing so, you have likely come to a deeper understanding of their meaning. However, in order to work effectively with process skills when you facilitate and to discuss process skills productively with other facilitators, it’s important to develop a common language when we describe these skills.

STEP 2: Distribute the “Process Skills: Definitions and Examples” handout and have participants discuss.

These definitions and examples that we are handing out represent commonly accepted uses of the process skills terms. They are based on a number of sources, including the National Science Education Standards, the American Association for the Advancement of Science Benchmarks for Science Literacy, noted science educator Wynne Harlen’s book *The Teaching of Science in Primary Schools*, and others. In some cases, these definitions will simply expand your current understanding. In other cases, they may challenge you to reconsider your views.
Now in your groups of four, spend five minutes discussing these definitions and examples.

- How do these definitions fit with your own understanding of the skills? In your discussion, pay particular attention to those skills where you had disagreements or confusion.

**STEP 3:** Reconvene the whole group and have participants share ideas and questions from their groups of four.

- Do you have any questions or differences of opinion remaining about any of these skills?

*If so, say*

- Can anyone help resolve these differences or answer these questions?

**STEP 4:** Distribute the handout “How Hypothesizing, Predicting, and Interpreting Differ”.

*It’s very common for people to have questions about the definitions of hypothesizing, predicting, and interpreting or the differences among them. Distribute and review the handout, “How Hypothesizing, Predicting, and Interpreting Differ” to address any remaining questions.*
In this section, participants have an opportunity to apply their understanding of the science process skills to The Power of the Wind activities. Participants are first asked to analyze an activity to identify opportunities for youth to use specific process skills. Then, participants try to think of ways to increase opportunities for using science process skills by adding a question that encourages the use of a process skill to an activity. Participants are given two resources to support them in identifying opportunities for using process skills in The Power of the Wind activities: the Aligning 4-H SET Abilities to Process Skills, and the Questions to Encourage Process Skills handouts.

The Power of the Wind curriculum provides many opportunities for youth to use (and thereby develop) their science process skills. These opportunities come from the design of the activities themselves and from many questions written into the activities. Instructors who can analyze which process skills are encouraged, as well as which are not, by the activities and questions in each The Power of the Wind activity can effectively choose questions to highlight, reinforce or add to promote a balanced use of process skills and to tailor the activities to the abilities of the group they are facilitating.

STEP 1: Explain how the process skills apply to The Power of the Wind curriculum.

Now we want to look at selected The Power of the Wind activities to look for opportunities for youth to use their science process skills. Once we understand which process skills are encouraged in an activity, as well as which are not, we can facilitate in a more effective way. For example, many of the activities include lists of questions for youths to consider. We can identify which skills those questions encourage and emphasize those questions that provide a balanced variety of process skills. We can also consider adding questions that encourage skills that are not evident in an activity.
To help us in looking for process skills in the activities, we’ll look at two resources. A handout aligning the 30 4-H SET Abilities referred to in *The Power of the Wind* curriculum with the seven science process skills we’ve discussed, and a handout showing examples of questions that encourage particular process skills.

**STEP 2:** Distribute the handout: “4-H SET Abilities Related to the Science Process Skills”.

This handout shows the 4-H SET Abilities listed under a related science process skill. Remember that some skills are a sub skill of another skill. You can see that there are many sub skills involved in Planning and Investigating. *The Power of the Wind* Facilitator’s Guide lists which 4-H SET Abilities each activity encourages. This document is meant to help you align what is written in the curriculum with the skills we’ve just discussed.

**STEP 3:** Distribute the handout: “Questions that Encourage Process Skills”.

This handout shows a number of ways that you can word a question to encourage a particular process skill. Although these questions are written in the context of an activity involving youth planting seeds, they are meant to provide you with ways of wording questions that can be used in any topic. Let’s use these to help us look at the questions in a *The Power of the Wind* activity to identify which process skills are encouraged.

**STEP 4:** Identify opportunities for process skills in a *The Power of the Wind* activity.


Let’s start by analyzing what skills these questions encourage. Can you find a question that encourages observation skills?
Give participants a minute or two to find examples of questions that encourage observation skills. Share the examples below if participants don’t mention them.

- What happens when you blow into the back of the pinwheel or if you blow into the sides?
- What happens when you make another pinwheel from a larger square?
- Does it turn faster or slower? 

Then ask,

- Can you find an example of a question that encourages communication skills?

Give participants a minute or two to find examples of questions that encourage communication skills. Share the examples below if participants don’t mention them.

- How can you help younger children to design pinwheels?
- How can you teach them how pinwheels work?
- Can you create a short lesson for children in your neighborhood?

**STEP 5: Add questions to encourage additional process skills.**

Now that we’ve practiced analyzing what skills the questions in the Guide provide opportunities for, we can consider adding questions that provide additional or richer opportunities for learners to use their process skills. We’re not doing this because the lessons are necessarily in need of improvement; it’s because when a facilitator understands how to encourage the use of process skills, they can take advantage of opportunities that arise during the lesson to deepen learners’ thinking.

For example, if someone expresses that something is interesting, you can ask if they have any questions about it. If they have a question or hypothesis such as “I wonder if this is happening because …?”, you can ask them if they can plan an investigation to answer their question or test their hypothesis. Once they’ve done an investigation, you can ask them what they concluded. By asking questions that encourage process skills, you can help youth become more skilled at finding answers to their own questions.

Let’s look again at the Pinwheel activity on page 15. The skill of questioning isn’t explicitly encouraged. Can you design a question that encourages learners to ask questions about pinwheels? Work with a partner and use the handout on Questions that Encourage Process Skills if you need help.

**Give participants a few minutes to design a question that encourages youth to use their questioning skills. Share the examples below if participants don’t mention them.**

- What questions do you have about pinwheels?
- What else do you want to know about pinwheels?
- What questions could you answer by making different pinwheels?

These are questions that you could use after learners have some experience with making pinwheels that would tell you what they were interested in. Once you know their interests, you can ask them what they could do to try to answer their questions. Let’s try another.


In this lesson, learners are given a procedure for comparing low and high solidity windmills and to fill out a data table. Can you think of a question to ask or some other way to encourage learners to use their investigation planning skills?

Have partners or groups talk for two to three minutes and then take responses. Share the examples below if participants don’t mention them.

- What could you do to find out whether a low or high solidity windmill spins faster or lifts weight better?
- How could you determine the relationship between the solidity of a windmill and its speed or the solidity of a windmill and how much weight it can lift?

**Have learners follow the “Try-It” procedure but make their own data table. (Make clear to participants that there are a lot of skills youth can learn by completing this data table and it gives them great ideas about recording data. This promotes planning skills because, to make a data table, they need to determine what to observe or measure and how many trials to run).**
This brings us to the end of this training on Science Process Skills. So far, we’ve tried to understand the science process skills and distinguish them from each other through doing and discussing activities that were designed specifically to emphasize particular skills. Then, we practiced analyzing The Power of the Wind lessons for the opportunities for encouraging process skills. Finally, we practiced adding questions to lessons to increase opportunities for using process skills.

This training was meant to help you create greater opportunities for learners to develop their SET abilities and increase their science literacy.

**Transition**

Now it is your chance to work with your team to determine how you will present 30 minutes of one of the activities from The Power of the Wind. As you continue to plan with your team, consider some of the key things we have covered in this training. What is the role of the engineering design process in your work; how will you make sure you include the Experiential Learning Cycle; what specific science process skills do you want to make sure and have us work on? You may use the time now and during lunch to prepare your presentations.
Observing
Questioning
Hypothesizing
Predicting
Planning and Investigating
Interpreting
Communicating
Learners use process skills to build a conceptual understanding of science content.

Process skills are not used separately but as intertwined, coherent sets of skills.

Instructors can facilitate activities to help learners develop stronger process skills.
Process Skills Stations

1. Pinwheel And Cup Turbine

Materials needed:
- scissors
- straight pins
- pencil with eraser
- pinwheel pattern from Appendix A or B
- 5 oz. paper cup
- masking tape
- drinking straw
- bamboo skewer
- copy of station 1 task card

Set-up:
Make the pinwheel following the directions on page 16 of The Power of the Wind Youth Guide.

To make a “Savonius” cup turbine

- cut a 5 oz paper cup in half, cutting down the side and across the bottom of the cup
- tape the edge of one of the half cups to the straw
- tape the other half cup, upside down along the opposite side of the straw so it appears “s”-shaped when viewed from above
- Put the bamboo skewer through the straw, hold either end of the skewer, and blow

Set up both assembled turbines and the task card at the station.
2. Big And Small “Boats”

Materials needed:
- one 8 oz. paper cup and one 16 oz. paper cup
- ruler or meter stick
- copy of station 2 task card

Set-up:
- Place the cups upside down on the table with the ruler and task card at the station

3. Pinwheel And Straw

Materials needed:
- scissors
- straight pins
- pencil with eraser
- pinwheel pattern from Appendix A or B
- drinking straws
- copy of station 3 task card

Set-up:
- Make the pinwheel following the directions on page 16 of The Power of the Wind Youth Guide.
- Set up the assembled pinwheel, enough drinking straws for each participant, a trash can, and the task card at the station.

4. High Speed Turbine

Materials needed:
- copy of station 4 task card

Set-up:
- This station only needs a task card
5. Pinwheel And Scissors

Materials needed:
• scissors
• straight pins
• pencil with eraser
• Pinwheel pattern from Appendix A or B for each pair
• copy of station 5 task card

Set-up:
• Make one pinwheel following the directions on page 16 of The Power of the Wind Youth Guide.
• Set up the assembled pinwheel and the pinwheel materials so each pair can make their own pinwheel to compare to the pre-made one. Also, set up a trash can and the task card at the station.

6. Number of Blades

Materials needed:
• scissors
• straight pins
• pencil with eraser
• Pinwheel pattern from Appendix B and Appendix C for each pair
• extra paper for participants to draw on or to make additional pinwheels
• copy of station 6 task cards

Set-up:
• Make two pinwheels following the directions on pages 16 and 18 of The Power of the Wind Youth Guide. Set up the assembled pinwheels and the pinwheel materials out so each pair can make additional pinwheels. Also, set up a trash can and the task card at the station.
Background for Facilitators

Facilitation Hints for Exploring Process Skills

Knowing the tasks and the intended main skill at each station will help you facilitate both the work at the stations and the subsequent discussions.

Participants, however, may identify different skills, either because of inaccurate understandings of the process skills or because of legitimate differences of opinion about which process skills are actually required to complete these tasks. Since the point of this part of the training is to uncover participants’ initial ideas, it’s not important that they identify the process skill needed exactly as they appear below.

1. Pinwheel And Cup Turbine
   Intended main skill: Observing
   *Other skills:* Planning and Investigating

2. Big and Small “Boats”
   Intended main skill: Predicting
   *Other skills:* observing

3. Pinwheel And Straw
   Intended main skill: Hypothesizing
   *Other skills:* Observing, Planning, and Investigating

4. High Speed Turbine
   Intended main skill: Interpreting

5. Pinwheel And Scissors
   Intended main skill: Questioning

6. Number of Blades
   A. Intended main skill: Planning
   B. Intended main skill: Communicating
   *Other skills:* Interpreting
Listen for Interesting Conversations

Circulate among groups, assist any that need help, and listen for interesting discussions or disagreements that you can refer to during the whole group discussion. You may want to make notes as you move around the room.

Keep Discussions Going

Groups sometimes finish their conversations very early. They may say that they agreed on everything. To get their conversations restarted, you can ask:

Was there anything you initially disagreed about? If so, how did you come to agreement?

You can also ask:

What did you do at (a particular station) that indicated you were using the process skill you identified?

Asking about actions participants took helps move their thinking about process skills out of the abstract and also encourages them to examine the reasoning behind their choices.

Uncover Reasons for Opinions

If groups are stuck in disagreement, encourage each group member to articulate the thinking underlying his or her opinion.

Defer Giving Definitions

Sometimes groups will ask you for a definition of one of the process skills. Remind them that at this point in the training, you want them to clarify and examine the ideas they bring to the discussion from their previous experiences. Giving them a definition would short-circuit that process. Ask them to note their ideas and differences of opinion so they can bring them to the whole group discussion where they can work at coming to some resolution.
Expect Some Agreement with the Process Skills in Action

Participants may recognize elements of the “Process Skills in Action” that confirm their own views but are stated in a different way (e.g., “Make use of several senses in exploring objects or materials” will agree with most people’s idea of observing). They may also find descriptions that expand their thinking (e.g., “Distinguish from many observations those which are relevant to the problem in hand” clearly has to do with observation, but will not have been considered previously by most people). For many people, the “Observing Process Skills in Action” handout gives them a way of thinking about describing process skills with more precise and concrete language.

Also Expect Some Disagreement

On the other hand, participants may find that they disagree with the way certain behaviors are described (e.g., “Use patterns in information or observations to make justified interpolations or extrapolations” is given as a prediction skill, but many participants may regard using patterns as an interpretation skill). Whether they agree or disagree with the descriptions, participants will have examined their current thinking in light of the new information presented in the handout.
Be Prepared

Typically, the conversation and the confusion in the large group discussions center around the skills of hypothesizing, predicting, and interpreting. It is essential that the facilitator of this conversation have a firm grasp of these terms beyond simply how they are defined, so that he or she can help deal with any confusion that arises.

Address the Term Hypothesis

The term hypothesis may be confusing for participants because there are differences in how science educators use it. Simply put, hypothesizing is an attempt to answer the question “Why . . . ?” In other words, a hypothesis is a tentative explanation of an event or phenomenon. A hypothesis is not necessarily correct, but it should be reasonable in terms of available evidence and science concepts. In addition, a hypothesis is testable—there must be a way to prove it wrong. Some people refer to a hypothesis as an “educated guess.” Although that’s technically correct, using the word guess tends to confuse people about how much knowledge and evidence is required to form a good hypothesis.

Address the Term Predicting

There may also be a good deal of confusion about the meaning of predicting. Many people regard a prediction as “just a guess,” in contrast to a hypothesis as an “educated guess.” In fact, a prediction is based on knowledge about what has happened before, a pattern of evidence, or a hypothesis. It is a response to the question, “What will happen in this particular instance if . . . ?” When a prediction is based on a hypothesis, it can serve as a test of that hypothesis. An incorrect prediction demonstrates that the hypothesis is incorrect. A correct prediction strengthens confidence that the hypothesis is valid. But it does not prove conclusively the validity of the hypothesis because further predictions based on the hypothesis may turn out to be incorrect.
Address the Term Interpreting

Interpreting can get confused with hypothesizing since sometimes interpretations lead to tentative explanations. Interpreting is distinguished by the assessment of data, checking for reliability, and looking for patterns or other meaning. Interpreting may involve organizing, analyzing, and synthesizing data using statistical analysis, tables, graphs, and diagrams. Although interpreting data may result in a set of facts that lead to a hypothesis, it is not the formation of a hypothesis.

Distinguish between Predicting and Hypothesizing

Making the distinction between predicting and hypothesizing clear generally requires a good deal of discussion with reference to the particular activities that use those skills. In general, a prediction refers to a particular case. A hypothesis is a proposed explanation that can be applied to a broad range of cases.

Distinguish between Hypothesizing and Interpreting

As mentioned above, there is often confusion between hypothesizing and interpreting. It is important to bring to light what people think about different sorts of evidence (or data) and different uses of that evidence in the process of doing science. In general, interpreting involves finding a pattern or other meaning in a collection of data.
## Hypothesizing

**Answers the question**
*Why...?*

*(E.g., Why does the sweater keep me warm?)*

A hypothesis proposes an explanation (based on observation, evidence, and past experience) of events or phenomena. (A hypothesis may or may not be correct.)

**EXAMPLE:**
Sweaters and other warm things keep me warm because they make heat.

## Predicting

**Answers the question**
*What will happen in this particular instance if...?*

*(E.g., What will happen if I put a thermometer in my sweater and let it sit there for several hours?)*

A prediction takes experience into account and is often based on a hypothesis.

**EXAMPLE:**
If I put a thermometer in my sweater and leave it there for several hours, it will show an increase in temperature.

## Interpreting

**Answers the question**
*What do my data tell me?*

*(E.g., What does the fact that the temperature did not go up after several hours tell me?)*

An interpretation is a conclusion based on analysis and assessment of the data.

**EXAMPLE:**
The fact that the temperature did not go up after several hours tells me that either there was a flaw in my experiment or sweaters don’t make heat.
Station 1 TASK CARD

1. Pinwheel And Cup Turbine

What is the main process skill you would use to carry out the directions in the underlined phrase?

Blow on both turbines soft and hard.

Can you think of other ways to compare the two turbines?

What similarities and differences do you notice between the two turbines?
Station 2 TASK CARD

2. Big and Small “Boats”

What is the main process skill you would use to carry out the directions in the underlined phrase?

Place the cups face down on the table.
Blow on the big boat as hard as you can and measure the distance it travels.

How far do you think the small boat will go if you blow on it the same way?
Station 3 TASK CARD

3. Pinwheel And Straw

What is the main process skill you would use to carry out the directions in the underlined phrase?

Blow on different parts of the pinwheel with a straw.

What do you notice?

Use your observations to explain which parts of the pinwheel you think are most responsible for making it turn in the wind?
Station 4 TASK CARD

4. High-Speed Turbine

What is the main process skill you would use to carry out the directions in the underlined phrase?

A farmer wondered if her turbine was working well at high speeds. Here is a chart showing her energy output at different wind speeds.

<table>
<thead>
<tr>
<th>Wind speed</th>
<th>Energy output</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 mph</td>
<td>10 KW/H</td>
</tr>
<tr>
<td>10</td>
<td>80 KW/H</td>
</tr>
<tr>
<td>20</td>
<td>640 KW/H</td>
</tr>
<tr>
<td>40</td>
<td>1020 KW/H</td>
</tr>
</tbody>
</table>

Do you think that there might be any problem at 40 MPH?
Station 5 TASK CARD

5. Pinwheel and Scissors

What is the main process skill you would use to carry out the directions in the underlined phrase?

Cut any shape out of one pinwheel pattern and make a pinwheel. Blow on it and compare it to the assembled pinwheel.

Given your observations, what more do you want to know?
6. Number of Blades

What is the main process skill you would use to carry out the directions in the underlined phrase?

You want to find out the impact of the number of blades on the speed of a pinwheel (using a triangle, square, pentagon, etc.)

A. How many blades would you try?
   How big would each shape be?
   How many tests would you do?
   How hard would the wind be?

B. Think about what you found out from your investigation on the impact of the number of blades on the speed of a pinwheel. Make a series of drawings with labels that shows the results of your investigation.
Identify the main process skill needed to complete the underlined directions in each activity.

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<td>Interpreting</td>
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</tbody>
</table>
1. Pinwheel And Cup Turbine
Blow on both turbines soft and hard.
Can you think of other ways to compare the two turbines?
What similarities and differences do you notice between the two turbines?

2. Big And Small “Boats”
Place the cups face down on the table. Blow on the big boat as hard as you can and measure the distance it travels.
How far do you think the small boat will go if you blow on it the same way?

3. Pinwheel And Straw
Blow on different parts of the pinwheel with a straw. What do you notice?
Use your observations to explain which parts of the pinwheel you think are most responsible for making it turn in the wind.

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A farmer wondered if her turbine was working well at high speeds. Here is a chart showing her energy output at different wind speeds.

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</table>

Do you think that there might be any problem at 40 MPH?

5. Pinwheel And Scissors
Cut any shape out of one pinwheel pattern and make a pinwheel. Blow on it and compare it to the assembled pinwheel.

Given your observations, what more do you want to know?

6. Number of Blades
You want to find out the impact of the number of blades on the speed of a pinwheel (using a triangle, square, pentagon, etc.)

A. How many blades would you try?
   How big would each shape be?
   How many tests would you do?
   How hard would the wind be?

B. Think about what you found out from your investigation on the impact of the number of blades on the speed of a pinwheel. Make a series of drawings with labels that shows the results of your investigation.
4-H SET Abilities Related to the Science Process Skills

The 30 4-H SET abilities are listed below each underlined process skill.

**Observing**
- Observe
- Compare

**Questioning**
- Question
- State a problem

**Hypothesizing**
- Hypothesize
- Troubleshoot (can also be a planning skill if done systematically)

**Predicting**
- Predict
- Test (a prediction can be used to test a hypothesis)

**Planning and Investigating**
- Plan an investigation
- Use Tools
- Develop Solutions
- Design Solutions
- Problem Solve
- Measure
- Draw/Design (can also be a communication skill)
- Build/Construct
- Collect Data
- Invent/Implement Solutions
- Redesign
- Optimize (can also be interpreting when related to how the data points to the best solution or design)

**Communicating**
- Model/Graph/Use Numbers
- Summarize/Relate
- Demonstrate/Communicate to Others
- Collaborate (can also be planning if it involves working together to solve a problem)

**Interpreting**
- Categorize/Order/Classify
- Organize
- Infer
- Evaluate
- Research a Problem
- Interpret/Analyze/Reason
- Optimize (can also be planning if it involves planning what to do to find out the best design or solution)
The science process skills are the tools that students use to investigate the world around them and to construct science concepts, so it’s essential for teachers to have a good understanding of these skills. However, identifying and defining the process skills is not always a simple task.

The first problem is that the skills aren’t practiced discretely. When you look at a real-life situation, you’re likely to find several related skills being used more or less at the same time. Consider, for example, trying to explain why water drops appear on the outside of a can filled with ice: You’re observing the phenomenon, you’re interpreting what your observation means, and you’re proposing a hypothesis, or explanation. It can be challenging to tease out separate skills because to a certain extent the boundaries are artificial. But it’s necessary to be able to distinguish individual skills in order to work effectively with students.

The second problem concerns how broadly or narrowly the skills should be defined. The skill of classifying, for example, while often found listed as a separate skill, can also be viewed as a subskill of observing. Because it can be quite cumbersome to work with a long list of narrowly defined skills, this document presents seven broadly defined skills and indicates subskills where appropriate.

The definitions and examples given below are based on a number of sources and represent commonly accepted uses of the process skill terms.

**OBSERVING**
Using the senses and appropriate tools to gather information about an object, event, or phenomenon.

**SUBSKILLS** include collecting evidence, identifying similarities and differences, classifying, measuring, and identifying relevant observations.

**EXAMPLE:** Listing the similarities and differences of a cube of ice and a ball of ice.
QUESTIONING
Raising questions about an object, event, or phenomenon.

**SUBSKILLS** include recognizing and asking investigable questions; suggesting how answers to questions can be found; and turning a noninvestigable question into a question that can be acted upon.

**EXAMPLE:** Asking “Will ice melt faster with or without salt sprinkled on it?”

HYPOTHESIZING
Giving a tentative explanation, based on experience, of a phenomenon, event, or the nature of an object. A hypothesis is testable. A hypothesis is not the same thing as a prediction, which is the expected outcome of a specific event. However, a hypothesis can be used to explain specific events.

**SUBSKILLS** include inferring, constructing models to help clarify ideas, and explaining the evidence behind a hypothesis.

**EXAMPLE:** Increased surface area causes faster melting. (This explains why crushed ice will melt faster than a block of ice of the same mass.)

PREDICTING
Forecasting the outcome of a specific future event based on a pattern of evidence or a hypothesis (an explanation). A prediction based on a hypothesis can be used in planning a test of that hypothesis. **NOTE:** A prediction is not a wild guess.

**SUBSKILLS** include justifying a prediction in terms of a pattern in the evidence, and making a prediction to test a hypothesis.

**EXAMPLE:** Water flowing from a height of eight inches will wash away more sand than water flowing from a height of six inches. This prediction is based on the pattern that water flowing from six inches washed away more sand than water flowing from four inches, and water flowing from four inches washed away more sand than water flowing from two inches.
PLANNING AND INVESTIGATING
Designing an investigation that includes procedures to collect reliable data. Planning includes devising a way to test a hypothesis. NOTE: Planning is not always formal.

**SUBSKILLS** include identifying and controlling variables, and using measuring instruments.

**EXAMPLE:** Deciding to put a teaspoon of salt on one ice cube and a teaspoon of sugar on another identical ice cube; setting them side by side, and observing their relative melting rates in order to determine if one melts faster than the other.

INTERPRETING
Considering evidence, evaluating, and drawing a conclusion by assessing the data, in other words, answering the question, “What do your findings tell you?” Finding a pattern or other meaning in a collection of data.

**SUBSKILLS** include interpreting data statistically, identifying human mistakes and experimental errors, evaluating a hypothesis based on the data, and recommending further testing where necessary.

**EXAMPLE:** After observing the melting rates of an ice cube sprinkled with salt and one without salt, concluding that salt reduces the freezing point of water.

COMMUNICATING
Representing observations, ideas, theoretical models, or conclusions by talking, writing, drawing, making physical models, and so forth.

**SUBSKILLS** include talking with a more knowledgeable person, using secondary sources, presenting reports, constructing data tables, and creating charts and graphs.

**EXAMPLE:** Describing the relationship between the melting time for an ice cube and amount of salt sprinkled on the cube by writing about it or by constructing a graph.
NOTE: These definitions are adapted from the following sources:

American Association for the Advancement of Science. “The Nature of Science.”


Process-centered questions ask students to use their process skills when exploring. These kinds of questions can be valuable in many different teaching situations. The examples here, for instance, would be appropriate to ask at different points during an exploration about planting and growing different kinds of seeds.

**OBSERVING**
- What do you notice that is the same about these seeds?
- What differences do you notice between seeds of the same kind?
- Could you tell the difference between them with your eyes closed?
- What do you see when you look at the seeds with a magnifying glass?

**QUESTIONING**
- What questions would you like to ask about seeds?
- What questions could you answer by planting and observing the seeds?

**HYPOTHESIZING**
- Why do you think the seeds are not growing now?
- What do you think will make the seeds grow faster?
- Why do you think that would make them grow faster?
- Why do you think the soil will help the seeds to grow?
- Why do you think these plants are growing taller than those?
- What do you think has happened to the seeds?
- Where do you think these leaves came from?
PREDICTING

• What do you think the seeds will grow into?
• What do you think will happen if the seeds have soil but not water?
• What do you think will happen if we give the seeds more (or less) water/light/warmth?

PLANNING

• What will you need to do to find out… (if the seeds need soil to grow)?
• How will you make it a fair test (make sure it’s the soil, and not something else, making the seeds grow)?
• What materials will you need?
• What will you have to look for to answer your question?

INTERPRETING

• Did you find any connection between … (how fast the plant grew and the amount of water/light/warmth it had)?
• Is there a connection between the size of the seed and the size of the plant?
• What made a difference in how fast the seed began to grow?
• Was soil necessary for the seeds to grow?

COMMUNICATING

• How are you going to keep track of what you did in the investigation and what happened?
• How can you explain to the others what you did and found out?
• What kind of chart/graph/drawing would
Planning and Implementing an Activity

**Purpose:**
- To become more comfortable with at least one activity in *The Power of the Wind* curriculum.
- To enhance teamwork skills to implement *The Power of the Wind* activity.
- To articulate ways to implement *The Power of the Wind*.

**Time:** 30 minutes

**Materials:**
Refer to team’s Presentation Planning Worksheet (started during the Planning Your Own Presentation session)

**Trainer Notes:**
Depending on where you end the morning, each group will have time before lunch to work on their presentation. This could be anywhere from 30 minutes to an hour. The more time they have the more learning will occur and the more comfortable they will be presenting. With lunch in between many participants will continue to work on their presentations over their lunch time. The trainers should be constantly circulating, answering any questions that emerge, making sure people have supplies and are comfortable with what participants are deciding. The facilitator should be both transparent (barely seen) and available. It is the participants’ time to learn and the facilitator’s role is to answer questions so they can continue to work effectively.
Presentations

Purpose:
- To become familiar with three of The Power of the Wind activities.
- To become more comfortable with leading at least one activity in The Power of the Wind curriculum.
- To identify new ways to implement the three activities.
- To articulate ways they will implement The Power of the Wind.

Time: 2 hours 35 minutes

Materials:
- Sign-Up Sheet (completed) with timetable

Trainer Notes:

STEP 1: Context and Instructions

As the group gets together, explain the process to them, once again. Post the sign-up sheet on the wall with a tentative timetable formulated. Let them know that at each debriefing the presenters will first have a chance to comment and then the participants. The general format is for each group, both presenters and participants, to share what they thought worked and what they might do differently. After each presentation ask those presenting to share the following:

- What worked well during your planning and/or facilitation experience?
- What would you do differently next time in planning and facilitating this activity, or other similar activities?
- What facilitator “tips” do you have for the learners in the group?

Then open it up to those who participated.

- What worked for you as a participant?
- What might you recommend that could improve the presentation?
- What is something you learned about presenting this activity?
STEP 2:  First Presentation and Debrief

How Can We Use Wind to Lift a Load? – 30 minutes
Debriefing – 15 minutes

Break (so the other team can set up) – 5 minutes

STEP 3:  Second Presentation and Debrief

Which Turbine Design is Better for the Job? – 30 minutes
Debriefing – 15 minutes

Break – 15 minutes more time to give people to take a break

STEP 4:  Third Presentation and Debrief

How Can We Use Wind Power to Produce Electricity? – 30 minutes
Debriefing – 15 minutes

STEP 5:  Large Group Discussion

If there are two groups then after the third presentation and they get back together as one large group and it seems appropriate, ask the following questions to bring the group back together as one group.

- In what ways were the planning sheets helpful—or not helpful?

- From doing these presentations, what are some key learning areas we want to make sure we remember when we go back to implement The Power of the Wind?
Resources, Questions, and Action Plan

Purpose:
• To identify additional resources to support the implementation of The Power of the Wind.
• To identify strategies for answering questions or challenges.
• To determine how The Power of the Wind will be implemented.

Time: 40 minutes

Materials:
Trainer Resource:
• Resources for Facilitators Guide Sheet
• Internet connection (optional but advisable)
• Computer, screen, LCD panel

Handout:
• Resources for Facilitators
• Action Plan Worksheet

Trainer Notes:

STEP 1: Context

There is so much we could have put in this training and it is so great to see what fun we have had and how much we have all learned from each other.

STEP 2: Resources for Facilitators

Distribute the Resources for Facilitators handout to participants. Explain that this is a starting point for where they might look for additional resources. Ask participants to take a couple of minutes to look over.

The handout you received does not cover all of the possible resources that can help you as a facilitator. Rather, if you have questions as you work through The Power of the Wind curriculum, or as you read through the Facilitator’s Guide, you may want take the participants online to review the links to provide additional information.

The first link is the main website and has many other links embedded. The rest of the links on the sheet come from the main page, but not all are listed. I purposely selected the rest of the links listed because they can be meaningful in directly supporting what you have done in this training.
See Training Resource – Resources for Facilitator’s Guide Sheet. It gives additional information of various links that can be explained to participants.

STEP 3: Questions & Answers

Before we leave, we want to make sure that if you have additional questions that we take some time to answer those. I want to pause now and make sure that there are no burning questions or comments that we still need to cover together. Write down any questions or comments you still might have. I am going to be quiet again for a couple of minutes so people just have some time to think and write.

Once people seem to be lifting their heads and not writing, ask people to share some of those questions or comments they still might have. Answer them the best you can or if you really can’t answer, tell them you will find the answer if you can and get back to them, or see if anyone in the room might have the answer.

• As you are thinking about implementing The Power of the Wind what are some questions you still have?

• What do you see might be a challenge or obstacle you might have to overcome?

• What suggestions might we have as a group for helping with those challenges or obstacles?

Remember that some of the best learning you can do is with each other. As you complete activities, or have questions, don’t be afraid to contact each other or refer to the other resources that were brainstormed in this training.

All of us are still learning how to implement this curriculum. It will happen quite differently in different places, and we can learn about those differences and similarities.
STEP 4: Action Plan

Now that you have had an opportunity to learn about and experience 4-H SET and have several experiences with The Power of the Wind, it’s time for you to think about how you will implement this with youth.

**Pass out the Action Plan Worksheet and explain that this is a way for them to be intentional about thinking and writing what they plan to do. If any participants will facilitate this curriculum together, have them work together on completing the Action Plan Worksheet.**

I’ve handed out the Action Plan Worksheet and would like you to take a few minutes to think about and write down what your plans are after you leave the training. I will be asking (some of) you to share your plans with the group.

**Explain the worksheet and give participants a few minutes to complete. Have them hand in the worksheet, make copies, and give a copy of the worksheet back to participants for their reference. If time allows, follow up with participants after a period of time to determine how they implemented their action plan and assist in strategizing about dealing with any challenges they may be having.**

**Ask for a few people to share their key action items.**

STEP 4: Transition

It is great what you will get to do as a result of this curriculum and training. It is now the time of day when we are about to close out the training and hear from you about what learning took place and your recommendations for how to improve the training.
Visit the web site (www.4-H.org/curriculum/wind) and follow the links.

**The Power of the Wind Website**

The main website that has links to Table of Contents, Facilitator Guide, Engineering Notebook, the philosophy of 4-H and much more!

This is the main website that contains all of the links below. In addition to the links below, other resources that can be found here include: overview of the curriculum, promotional posters, National Directory of 4-H materials, National 4-H Curriculum, and completion certificate. This website is specific to *The Power of the Wind* curriculum, so the support materials are very specific to the Guide.

**The Power of the Wind Facilitator Guide Website**

Provides helpful hints for facilitators. Scroll down and you will find links to content about wind energy.

This link includes many basics for 4-H facilitators such as the experiential learning process, the engineering design process, the essential elements, and facilitator tip sheet. In addition, you can find the templates that make it easy to print off copies for participants. It discusses in brief each lesson that gives you a better understanding of how the lessons are organized and arranged.

**The Power of the Wind Table of Contents**

Provides an overview of the lessons as they are sequenced in the book.

This link provides an overview of the table of contents with the order of the lessons. If you only have a few sessions with youth, or have certain learning outcomes you want to work on, it can help you in identifying which lessons might be most appropriate. Each lesson is broken down into investigation, challenge, and exploration. (See the resource sheet guide for the scavenger hunt for more information about these three types of lessons.)
The Power of the Wind Engineering Notebook
Visit the website (www.4-H.org/curriculum/wind) and navigate to the youth portion. There you'll find downloadable sheets that can be used as additional engineering notebook pages.
Provides additional sheets youth can use as they collect, record, and communicate data. Copies can be made of these extra notebook pages just like they are seen in the book!

There are sheets in the back of the Youth Guide that can serve as an engineering notebook or place for youth to record data. If more sheets are needed, they can be quickly printed off with the gridlines and provide more space for youth to write.

Grab and Go Activities
Visit the website (www.4-H.org/curriculum/wind) and navigate to the Grab and Go subpage.
If you are looking for extra activities to use, check out this link. These activities provide step-by-step directions for youth to create a device that measures wind speed, make a kite, measure air pressure, and hold a wind power debate in their community. Minimal prep needed!

The grab and go activities are stand alone and can be used in a youth setting that only meets once. More specifically, youth won’t need to complete activities prior to this one, in order to do this successfully. If participants need a reinforcement activity, these may be appropriate. Materials needed to complete the activity are also listed here.

Interactive Media
Visit the website (www.4-H.org/curriculum/wind) and navigate to the Interactive Media subpage.
Are you looking for lesson extensions, more activities, and fun games for youth to do? Check out this website for additional youth support materials for most lessons!

This site has several links within it. If youth get excited about a certain lesson and are looking for places to do further research, take online quizzes, or play online games, each lesson has links that can help them further explore their learning in that area.

Note: There are many other resources that aren’t included in this site. These are just a few that can help you have successful experiences leading youth.
Visit the web site (www.4-H.org/curriculum/wind) and follow the links.

The Power of the Wind Website
The main website that has links to Table of Contents, Facilitator Guide, Engineering Notebook, the philosophy of 4-H and much more!

The Power of the Wind Facilitator Guide Website
Provides helpful hints for facilitators. Scroll down and you will find links to content about wind energy.

The Power of the Wind Table of Contents
Provides an overview of the lessons as they are sequenced in the book.

The Power of the Wind Engineering Notebook
Provides additional sheets youth can use as they collect, record, and communicate data. Copies can be made of these extra notebook pages just like they are seen in the book!

Grab and Go Activities
If you are looking for an extra activity to use, check out this link. These activities provide step-by-step directions for youth to create a device that measures wind speed, make a kite, measure air pressure, and hold a wind power debate in their community. Minimal prep needed!

Interactive Media
Are you looking for lesson extensions, more activities, and fun games for youth to do? Check out this website for additional youth support materials for every lesson!
With whom will you implement *The Power of the Wind*?

When do you plan to implement *The Power of the Wind*?

Where will you be implementing it?

What will you be doing (how many sessions, length of sessions)?

Other things I need to consider (timeline for getting ready to implement, materials, organizational support, etc.):

Purpose:

• To bring a sense of closure to the training.
• To identify learning that has taken place.
• To provide feedback on the training for improvement.

Time:
30 minutes

Materials:

Handout:
• The Power of the Wind Competency Assessment
• Resources for Post-Pre Assessment Evaluation form

Trainer Notes:

STEP 1: Closure

As a closure activity, think of something that will be significant to the group and brings some closure. One possibility is to have each person describe the training as either a pinwheel or a sailboat and why they chose that one. This gives them a chance to express something and let’s everyone know a little more about their impression of this training. This is one of those activities that is a remark without comment and tends to go very quickly.

Throughout the last two days you were able to experience key components in The Power of the Wind. As you begin to implement this curriculum, keep in mind the SET Abilities, how to effectively include content, where to find resources, the engineering design process, and the Experiential Learning Cycle.

Thank you for taking two days to participate in this training. Hopefully this has been a positive experience for you. Please complete both the assessment and evaluation before you leave.

STEP 2: Assessment and Evaluation

We have created a post- pre-assessment for this training because it is very important to us that the training increases your knowledge and skills to implement The Power of the Wind. The assessment is a self-assessment and we hope you will share it with us in complete
confidentiality, not because we would be looking to see each individual’s progress, but, so we could do a cumulative effect and see where there was learning. This would help us determine where the training or trainers are either effective or not effective so we can improve. Please take a few minutes to complete the self-assessment.

**Give people a chance to complete the self-assessment in silence once done ask participants.**

- What is your reaction to this assessment tool?
- Were there specific areas that surprised or troubled you?
- Did this tool help you think about other learning you wish that had occurred?

**Ask each person to complete the evaluations and note it is only through this feedback that we can continue to learn what works and what doesn’t and how to make this the best learning experience possible. Collect the evaluations as people get done. Thank them as they leave.**
### About your training experiences …

We are interested in how you view your training experiences with *The Power of the Wind* Training. Please check circle in the box that best describes how much you agree with the following statements both AFTER and BEFORE the training.

<table>
<thead>
<tr>
<th>Caring Adult</th>
<th>BEFORE THE TRAINING</th>
<th>AFTER THE TRAINING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Disagree</td>
</tr>
<tr>
<td>I demonstrate shared leadership through youth/adult partnerships.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I encourage youth to think about what they are learning.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I offer praise and encouragement when youth take initiative and leadership.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I identify, build on, and celebrate the potential of all youth.</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Belonging</th>
<th>BEFORE THE TRAINING</th>
<th>AFTER THE TRAINING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Disagree</td>
</tr>
<tr>
<td>I help youth feel welcome and part of a group.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I cultivate a sense of togetherness among youth.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I initiate, sustain, and nurture group interactions and relationships.</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
## The Power of the Wind Competency Assessment

### After the Training

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sense of Hope</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I reinforce the idea that all youth can succeed.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I offer positive encouragement and support even in the face of setbacks.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Self-Determination</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I provide experiences that encourage youth to share scientific evidence.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I identify opportunities for youth to compare scientific claims with each other.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I encourage youth to articulate strategies for data collection and analysis.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I actively consult, involve, and encourage youth to contribute their ideas, expertise, and thoughts.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I provide opportunities for youth to determine program expectations and direction.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Engagement in Learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I guide youth in learning, rather than telling them what I already know.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I create opportunities for problem solving via discussion, debate, and negotiation.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I use a variety of questioning and motivational approaches.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I use multiple learning approaches to meet learner’s needs.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

### Before the Training

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sense of Hope</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I reinforce the idea that all youth can succeed.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I offer positive encouragement and support even in the face of setbacks.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
### Mastery

<table>
<thead>
<tr>
<th>After the Training</th>
<th>Before the Training</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>□</td>
</tr>
<tr>
<td>Disagree</td>
<td>□</td>
</tr>
<tr>
<td>Neutral</td>
<td>□</td>
</tr>
<tr>
<td>Agree</td>
<td>□</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>□</td>
</tr>
</tbody>
</table>

- I suggest challenges that can be explored by direct investigation
- I encourage youth to make predictions
- I assist youth in developing hypotheses related to their investigations
- I allow youth to conduct formal and open-ended tests and experiments
- I have youth discuss their findings with each other and evaluate evidence critically
- I encourage youth to share their knowledge by teaching others and leading new activities
- I help youth see setbacks as opportunities for new explorations
- I support youth to set new goals, and try new ideas and approaches
- I provide opportunity for youth to use appropriate technology

**Training Guide for The Power of the Wind**

**HANDOUT - The Power of the Wind Competency Assessment**

122
Help us improve future trainings!

1. Overall, how would you rate the training you received for *The Power of the Wind*?
   - ____ Excellent
   - ____ Good
   - ____ Fair
   - ____ Poor

2. What factors made you rate the training the way you did?

3. What do you feel was the most beneficial part of the training?

4. What, if anything, would you change about the training? If you wouldn’t change anything, please write “nothing.”

5. What could 4-H staff do to support you in leading *The Power of the Wind* activities?
6. What would you still like to know about using *The Power of the Wind* with others? What questions do you still have?

7. Now that you’ve participated in the training, how would you rate your level of disagreement or agreement with the following statements?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Somewhat Agree</th>
<th>Somewhat Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. I understand the 4-H Experiential Learning Cycle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. I feel prepared to lead <em>The Power of the Wind</em> activities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. I am confident I could apply experiential learning techniques to</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>The Power of the Wind</em> activities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. I am confident I could facilitate youth learning about <em>The Power of the Wind</em>.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. I am confident I could facilitate lessons that build SET abilities in youth.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following questions are to help us better understand the diverse experiences of 4-H leaders and volunteers. All questions are optional.

8. Including this year, how many years have you been a 4-H staff or volunteer? __________

9. Including this year, how many years have you been a staff member or volunteered with other 4-H science, engineering, or technology activities? __________

10. Do you have a professional background or experiences related to science, engineering, or technology? If yes, please explain.
Appendixes

Appendix A: Adapting the Training
Appendix B: Implementation Materials List:

The Power of the Wind
Appendix A: Adapting the Training

The Training Guide has been written with specific components, but it is also expected that trainers will need to make adaptations to address the needs of their participants, whether that is the length of time of an activity, the flow of the activities, different learning styles, accessibility issues, or language to best fit the needs of the participants. In addition, this training was designed for two days and has components in each day that will help participants better transfer their learning to be able to actually implement the curriculum. Despite that fact, many people will want to take pieces of this (because of limited time) and use it for different purposes. Below we provide a couple of agenda options that might be used as an introduction or orientation.

90 minutes (activities would need to be shortened)

I. Opening and Context Setting – 5 minutes

II. Designing a Wind Powered Boat – 45 minutes: Discussion about how this is an example out of the curriculum and have copies for them to refer to after the activity. Process similar to the way it is written in the guide but they would have less time to build.

III. Curriculum Scavenger Hunt – 35 minutes: Chance for them to become familiar with the whole guide. Might be a chance to point out specific activities and how they build on each other and the importance of the engineering design cycle.

IV. Closure and Evaluation – 5 minutes
Or **90 minutes**

I. **Opening and Context Setting** – 5 minutes: Explain that this will give them a brief taste of two of the activities in the curriculum and increase their knowledge of the engineering design process which is the core framework for the curriculum.

II. **How Does a Pinwheel Use Wind Power?** – short to 30 minutes: With some of the discussion and processing of the activity, point out key pieces of the way the curriculum is organized.

III. **Examining the Engineering Design Process** – Shorten to 15 minutes

IV. **Designing a “Better” Pinwheel** – Shorten to 35 minutes

V. **Closure and Evaluation** – 5 minutes

Or **90 minutes**

**Science Process Skills** –
90 minutes to deepen the volunteer learning on the process skills with *The Power of the Wind* examples

**3 hours**

I. **Overview – Opening – Quick walk through the Guide** – 15 minutes

II. **How Does a Pinwheel Use Wind Power?** – 45 minutes

III. **Examining the Engineering Design Process** – 20 minutes

IV. **Break** – 15 minutes
V. Designing a “Better” Pinwheel – 60 minutes

VI. Question and Answers – 15 minutes: How are you going to use it; what challenges do you see you might have; where are the resources and support?

VII. Closing Reflection – 10 minutes

**One Day**

I. Welcome and Introductions – 30 minutes

II. 4-H SET Checklist – 40 minutes

III. Curriculum Scavenger Hunt – 40 minutes

IV. Designing a Wind Powered Boat – 45 minutes

V. Experiential Learning Cycle – 35 minutes

VI. How Does a Pinwheel Use Wind Power? – 45 minutes

VII. Examining the Engineering Design Process – 20 minutes

VIII. Designing a “Better” Pinwheel – 50 minutes

IX. Resources, Questions, and Action Plan – 30 minutes

X. Closure and Evaluation – 20 minutes
## Appendix B: Implementation Materials List: The Power of the Wind

<table>
<thead>
<tr>
<th>You Will Need:</th>
<th># of Activities</th>
<th># Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small styrofoam tray</td>
<td>1</td>
<td>1 per youth/team</td>
</tr>
<tr>
<td>Round pencils with erasers</td>
<td>4</td>
<td>1 per youth/team for each activity</td>
</tr>
<tr>
<td>Straws (sturdy straws)</td>
<td>2</td>
<td>1 per youth/team for each activity</td>
</tr>
<tr>
<td>Straws (flexible)</td>
<td>1</td>
<td>1 per youth/team</td>
</tr>
<tr>
<td>Paper clips</td>
<td>3</td>
<td>1 per youth/team for each activity</td>
</tr>
<tr>
<td>Tape</td>
<td>3</td>
<td>1 per youth/team for each activity</td>
</tr>
<tr>
<td>Straight pins</td>
<td>3</td>
<td>1 per youth/team for each activity</td>
</tr>
<tr>
<td>Tape measure</td>
<td>3</td>
<td>2-3 rolls per site/share</td>
</tr>
<tr>
<td>Box fan</td>
<td>4</td>
<td>1 per site/share</td>
</tr>
<tr>
<td>Scissors</td>
<td>3</td>
<td>2-3 pair per site/share</td>
</tr>
<tr>
<td>Paper or construction paper</td>
<td>1</td>
<td>1 ream per site</td>
</tr>
<tr>
<td>Card stock or index cards</td>
<td>5</td>
<td>1 per youth/team for each activity</td>
</tr>
<tr>
<td>String (cotton or poly works best)</td>
<td>2</td>
<td>1-2 rolls per site/share</td>
</tr>
<tr>
<td>Small paper cups</td>
<td>2</td>
<td>1 per youth/team for each activity</td>
</tr>
<tr>
<td>LED (a string of tiny holiday bulbs, cut apart, works well)</td>
<td>1</td>
<td>1 per youth/team</td>
</tr>
</tbody>
</table>

Continued on next page
### You Will Need:

<table>
<thead>
<tr>
<th>Item</th>
<th># of Activities</th>
<th># Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop watch or watch with a second hand</td>
<td>2</td>
<td>1-2 per site/share</td>
</tr>
<tr>
<td>Wire stripper</td>
<td>1</td>
<td>1-2 per site/share</td>
</tr>
<tr>
<td>Aluminum pie plates</td>
<td>1</td>
<td>1 per youth/team</td>
</tr>
<tr>
<td>Small motor</td>
<td>2</td>
<td>1 per youth/team for each activity</td>
</tr>
<tr>
<td>Leads (with alligator clips)</td>
<td>1</td>
<td>1 per youth/team</td>
</tr>
<tr>
<td>AA batteries (Caution: other batteries, such as a 9V, may cause a shock.)</td>
<td>1</td>
<td>1 per youth/team</td>
</tr>
<tr>
<td>Multimeter</td>
<td>2</td>
<td>1-2 per site/share</td>
</tr>
<tr>
<td>Pennies</td>
<td>1</td>
<td>Up to 50 per youth/team</td>
</tr>
<tr>
<td>Cork (natural or synthetic)</td>
<td>1</td>
<td>1 per youth/team</td>
</tr>
<tr>
<td>Pinwheel pattern from Appendix A</td>
<td>1</td>
<td>1 per youth/team</td>
</tr>
<tr>
<td>Pinwheel pattern from Appendix B</td>
<td>1</td>
<td>1 per youth/team</td>
</tr>
<tr>
<td>Pinwheel pattern from Appendix C</td>
<td>1</td>
<td>1 per youth/team</td>
</tr>
</tbody>
</table>

Other supplies that provide additional exploration and discovery—beads, ping pong balls, aluminum foil, different sized cups; paper plates and other things that your imagination or the youth’s imagination might supply.


The Power of the Wind website http://www.4-H.org/curriculum/wind/


I Pledge my **Head** to clearer thinking,

my **Heart** to greater loyalty,

my **Hands** to larger service,

and my **Health** to better living,

for my club, my community, my country, and my world.