A PROGRAM PLANNER FOR INTERPRETERS OF NATURAL HISTORY*

By Daniel Edelstein

illustrated by Fariba Bogzaran

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A PROGRAM PLANNER FOR INTERPRETERS
OF NATURAL HISTORY

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Master of Science

By
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Introduction

Think about some of the roles you perform as an interpreter. A few of the titles and functions on your list may include:

--naturalist
--writer
--publicist
--fund raiser
--entertainer
--newsletter editor
--photographer

Your success as an interpreter when performing all of these functions depends on one crucial skill: Communication.

Successful communication in interpretive programs begins when we acknowledge diversity of our visitors--and thus plan to address each individual in our audience.

To aid you in presenting interpretive programs to family and adult audiences, this manual provides you with a model (the 4Mat System) and its application (interpretive activities).

Using some of the more than 165 interpretive activities listed in this manual, you may address the diverse interests, expectations and learning styles your visitors bring to your programs.

The objective of this manual is to help you communicate successfully in your programs. The end result will hopefully be enjoyable learning experiences for your visitors because you provided an appropriate means to communicate with them.
PART ONE

A Model For Interpreters: Designing Activities For The Diverse Learning Styles of Audiences
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CHAPTER ONE--Connecting With Audiences

"A good interpreter is a sort of Pied Piper, leading people into new and fascinating worlds that their senses never really penetrated before."

--Yorke Edwards

Analyze the above analogy. If you include yourself as an interpreter who stimulates visitors to feel the...

beauty,
variety,
complexity,
and interrelatedness

of the outdoors, then you are a participant in a process. This process includes more than simply transferring information to visitors about cultural and natural history. It extends beyond whether the visitor acts upon the lessons your interpretive message teaches. Even your choice of topic provides only another element from which the process of interpretation can begin. We can identify several key elements in the process of interpretation. The elements include:

--igniting the curiosity of your visitors,
--providing meaning to visitors,
--introducing people to new perspectives,
--allowing your visitors to interact with one another,
--involving your visitors in first-hand experiences,
--aiming your interpretive messages at diverse audiences.

Igniting the curiosity of visitors

Your first aim as an interpreter should be to ignite the curiosity of the visitor...

--to search for the greater truths that lay behind simple facts.
--to heighten awareness of the relationship between human and natural events.
--to seek new personal meaning and growth through experiences in the outdoors.

As an educator, your role in the interpretive process should be more than that of a missionary in the outdoors seeking converts. You may help enrich the visitor's experience, but you do not dictate it. You may lead a program, but do not control a visitor's response. You may even instruct the visitor but must be careful not to
You understand the true meaning of education, "to bring forth." Your visitor is not a vessel to be filled, but a lamp to be lit.

Consider the interpreters who arouse visitors curiosity when they...

--share an interesting bit of folklore about a flower.
--let every person in the group of bird watchers feed the friendly chickadee, who returns again and again to different hands offering a sunflower seed.
--present a slide program on the northern lights with only the poetry of colored images moving across the screen for the first few minutes of the program.

Providing meaning to visitors

Interpretation is of proven value in promoting appreciation and understanding of the outdoors among visitors. At its most basic level, your interpretive programs help build an awareness and sensitivity in visitors that assists them to feel at home in the environment. Only when your visitors are able to connect their lives with natural phenomena does the interpretive experience begin to bring them meaning...

--Discovery of a raccoon track can be followed by discussion of the animal's habits and distribution. Eventually, visitors may view the trend of raccoons' increased population density in and near urban areas as an adjustment to living among human communities.
--A sighting of a flock of gulls leads to discussion of their increased numbers due to recent landfill site changes in the county.
--A glowing sunset may inspire speculation on the effects industry and auto emissions have on patterns of color.

Introducing people to new perspectives

The development of perception in visitors may help them connect the relationship of events throughout the natural world with their own everyday personal experiences. The visitor places people as an ingredient in nature rather than as removed from the natural world. People, too, become part of the "web of life." Your promotion of this perspective helps visitors recognize the importance of their own behavior. Visitors begin to sense that the choices they make control the direction and quality of their lives...

--The choice of which laundry detergent to buy may become a more important decision for visitors after they understand the nitrogen/phosphorous cycle of a local lake used for swimming.
--The choice of an arrangement for a home garden is determined by a visitor after learning of the
interactions that influence plant communities.

-- A visitor chooses to volunteer time to plant trees after learning at an interpretive program of the effect cutting of trees is having on a local stream's water quality.

Meaningful activities and information provided to your visitors may raise the quality of their experiences, but they also pay dividends to you. The visitor who is enlightened about the need for a balanced relationship between the natural and human communities is more likely to support the need for your interpretive programs, and ultimately, favor the management and objectives of your agency.

Allowing your visitors to interact with one another

"People are with us mainly seeking enjoyment, not instruction."

-- Freeman Tilden

Natural history topics may interest visitors, but the interpretive program becomes more enjoyable when shared with other people. Remember that individuals and families attend your programs as a leisure activity seeking both personal fulfillment and affiliation with a group. The setting you establish should nurture an atmosphere of informality in which you are free to interact with your visitors, and visitors with each other...

-- Visitors in a small group solve the puzzle of a flower's identity through the use of a field guide.
-- A visitor helps another to squeeze water from the sphagnum moss and they then measure its absorption capacity.
-- Each family at a program works together to answer the questions on a quiz about owl adaptations.

Involving your visitors in first-hand experiences

Research has demonstrated that when visitors are involved in the interpretive program they become more interested in it and understand the subject better. Equally important, when your audience participates in a program, they enjoy it more. Witness the playful element working in concert with learning when an interpreter has...

-- Children play act the different parts of flowers as a demonstration for the audience to help them understand the concept of cross-pollination.
-- An adult mimic the behavior of a firefly by flashing a code with a penlight in search of another human.
"firefly."
--A blindfolded child role-play an owl, who uses only hearing to pounce upon a wind-up mouse that scurries across the floor.

Yet interpreters involve their audiences in many other ordinary situations...

--Hikers stoop to the fragrance of spring in the trailing arbutus.
--A taste of milkweed fritters provides visitors with a use for a common urban plant.
--Visitors distinguish one pine tree from another by counting the number of needles in each bract.

Aiming your interpretation at diverse audiences

"The more that interpreters know about the people they serve, the more effective interpretation will be."

--Donald Field and Darryll Johnson

List the diverse characteristics of visitors at interpretive programs. Your list probably includes differences in age, interests, beliefs, educational and cultural backgrounds. In addition, consider the various work, home and family experiences of your visitors. Add to this their different preferences, expectations and learning styles and you may decide the most difficult challenge is the matching of an interpretive approach with the appropriate audience. It would surely simplify your planning if you could direct all information to the "average" visitor. However, this mythical character simply does not exist. Wide diversity in cultural values of society combined with demographic factors (such as the changing age structure, changing family structure and two career families) mean an increasing diversity in the type of people you must serve.

Achieving the goal of interpretation

Making connections with your audience requires you to increase your sensitivity and understanding of communication principles. . . human interaction and behavior patterns. . . and psychology and education theories. Your proficiency in these areas, combined with interpretation that provides visitors meaning, enjoyment and opportunity to interact with one another, enhances visitors' experiences. Part One, Chapter Three introduces you to a model that correlates these principles and theories. Use of this model will help you present interpretive messages to the way each visitor is best able to learn.
BIBLIOGRAPHY


CHAPTER TWO--A Model Approach for Interpreters: the 4Mat System

To communicate well, interpreters evaluate their audiences

Like the different strategy for victory used by each runner in a race, interpreters present winning interpretation for different styles of learning.

Picture the finish line of a marathon runner's race. It is the goal of each person competing in the race.

Some participants will arrive by running a quick initial pace that powers them to the finish. Others will jog a steady pace throughout, hoping to outlast their competitors. Still others will begin with a slow pace and then attempt to increase their speed and pass runners later in the race.

No style of running can be called more correct if all the participants hit the finish line together. Each runner's style fits his/her strengths and weaknesses; no style is better or worse than another.

You may employ a similar approach when planning interpretive programs. You utilize a variety of approaches to address the personality and experiences of your audience. You plan programs after evaluation of your audience's diverse:

--ages
--interests
--beliefs
--educational background
--area of origin
--native language
--recreational goals
--physical capacities

A model for addressing different types of learning styles

To offer interpretation that corresponds to the different ways in which visitors perceive and process information, the interpreter needs an understanding of the different styles in which people learn. The 4Mat System recognizes that people learn in different ways.
The 4Mat System

Concrete Experience

Active Experimentation

Reflective Observation

Abstract Conceptualization

Style One Learners

Style Two Learners

Style Three Learners

Style Four Learners

*Excel, Inc. copyright 1980
Developed from the work of Bernice McCarthy and other educational researchers and professionals, the 4Mat System offers interpreters a model that accommodates the different styles in which people learn and, thus, may promote effective communication. (A detailed description of the 4Mat System model appears in The 4Mat System: Teaching to Learning Styles With Right/Left Mode Techniques, Excel, Inc., 200 W. Station St., Barrington, IL 60010.)

According to the model, people have four different styles of learning:

-- **Style One Learners**: Prefer to learn with experiences that directly link information with their personal life experiences. These learners need to discuss those connections with one another. These learners need to discover a reason for learning the information presented to them.

-- **Style Two Learners**: Prefer to learn through developing a foundation of knowledge to understand the information presented to them.

-- **Style Three Learners**: Prefer to learn through first-hand investigation and need to try out in a "real world" situation the information they have acquired.

-- **Style Four Learners**: Prefer to learn through self discovery "new connections" that integrate their experience with new applications related to the information presented to them. These learners need to create new ways of expressing or applying what they have learned.

An individual may learn successfully in all four styles, but usually shows a preference for one. This one style is simply the most comfortable manner for the person to learn.
The interpreter who uses the 4Mat System model says to visitors: "I'm OK, you're OK"

When interpreters use the 4Mat System model to plan their programs, each of the four learning types will get his/her chance to shine; each visitor's most comfortable way of understanding and enjoying a program will be addressed.

You perceive the differences in the personalities and experiences among your visitors as normal human behavior because you know that diversity in all life forms, including humankind, supports a healthy web of life on earth.

So it is that each visitor at an interpretive program is valued. No one is considered better or worse than another.

As a result, your use of the 4Mat System model grants each visitor the opportunity to refine his/her best style of understanding. Just as important, visitors are also exposed to understanding in alternative ways. They come to value and learn from fellow visitors while also learning in their own way.

Interpretation that addresses the whole brain

A person once described his friend's active, dynamic and growing imagination as a head which contained a "meadow of thought." More proper, each of us has not just one meadow—but two.

Two distinctly different meadows.

Since they are both meadows, they have some qualities in common—but still there are many distinct differences between them.

These meadows within us are two distinctly different halves, or hemispheres, of the brain. Each hemisphere, like the plants in one meadow that differ from the ones in the meadow it is next to, houses functions which are different from those of the other.

Extensive research on the brain in the last 25 years in the areas of psychology and neurology suggest that the left hemisphere processes information in a logical and sequential manner. The left brain houses the skills of speaking, reading and writing and is the home of rationality.

The right hemisphere processes information by looking at the whole, by focusing on the total perspective of a situation. The right brain focuses on visual pictures and has inventive capacity to quickly associate information. In addition, the right brain captures patterns and, often, simultaneously creates new meaning from ideas and concepts.
In total, the findings suggest that each hemisphere possesses specialized abilities. Research does not, however, suggest that people behave in such ways that they may be called purely "left brained" or "right brained." Rather the processing functions are integrated between the hemispheres.

Note, however, that since the left hemisphere can produce speech and the right can visualize, they must work together to describe an object such as a woodpecker. Each hemisphere is equally important; neither is superior to the other.

In sum, normal people operate with not half a brain, nor two brains, but one brain, with the ability to integrate the specialized abilities contributed from each hemisphere.

The 4Mat System developed by McCarthy, et al, recognizes the importance of integrating right and left hemisphere processing functions. Too often, our interpretive and educational approaches focus totally on the abstract, specialized abilities of the left hemisphere. For example, often we lecture to our visitors, providing them with facts, figures and concepts. If we are to integrate the hemispheric functions, we must "paint" pictures through stories, analogies, props and hands-on experiences.

The interpretive program using the 4Mat System

The foundation underlying every interpretive program must be that every visitor is given an equal opportunity to understand and enjoy the presentation of the interpreter. If you seek to lead listeners to their highest potential, your interpretive messages will be presented to the whole person because you develop and integrate all four styles of learning and right and left brain processing skills into the content of the interpretive programs (see Part One, Chapter Three).
You should also plan and conduct the activities in your programs with a sequence which allows your visitors to progress through each of the four learning style quadrants of the 4Mat System. The developers of the 4Mat System feel that the natural sequence for learning is to progress from style one quadrant through style four.

The 4Mat System

Concrete Experience

Active Experimentation

Reflective Observation

Abstract Conceptualization

*Excel, Inc. copyright 1980

In addition, your interpretation will integrate both right and left brain processing skills into the activities you present audiences.

Interpreters using this approach will enhance the experiences of visitors, who then may discover their own inner strengths and further their abilities to learn in alternative ways. At the same time, visitors can develop a healthy respect for the uniqueness of others.
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McCarthy, Bernice. The 4Mat System: Teaching to Learning Styles with Right/Left Mode Techniques. Excel. Inc., 1980, 200 W. Station St., Barrington, IL 60010


CHAPTER THREE--The Show Goes On: Presenting Interpretive Programs Using The 4Mat System

The value of combining the elements of successful interpretation in various ways

"If you love the thing you interpret, and love the people who come to enjoy it, you need commit nothing to memory."

--Freeman Tilden

Consider the chef of a restaurant who prepares a gourmet dish with different spices than a crosstown competitor. Both produce a culinary success; loyal customers return in hungry expectation of each chef's product.

Interpreters must present their programs with a similar dash of originality. Just as each chef uses a different approach to complete the dish, you should inject your own style into the program. The steps that lead one interpreter to a successful program are not necessarily traced by another who presents an equally good program.

For instance, two interpreters may present programs on the same topic and theme--a spring wildflower walk, as an example. But each interpreter retains individual control over the:

--plot and action to occur in the program.
--order in which visitors receive the interpretive message from the various activities.

Consider the examples of programs when...

--an interpreter may tell a group about folklore associated with the pasque flower and later have the visitors describe how the buttercup adapts for open field survival. Another interpreter has visitors first examine the drought resistant features of many different flowers, then later create their own versions of folklore.

--one interpreter urges a group to observe the hepatica and then speculates on why the flower exhibits variation in color--from blue to lavender to pink; they later break into small groups to find other spring ephemerals of the buttercup family. Another interpreter discusses the association of the hepatica's and other flowers common names with anatomical parts of humans; they later observe "indicator species" of flowers which grow in a variety of landforms due to variations in soil texture, pH, depth to groundwater, etc.
In sum, your success as an interpreter depends on your ability to adapt your interpretation to the various preferences of your visitors. In addition, you should remember that your style of interpretation may change the identity of an activity's learning style quadrant. The sequence with which you choose to present activities that precede or follow an activity can also modify the identity of an activity's learning style.

For example, you may use questions to allow visitors to correlate the topic to their personal lives. They would interact with one another sharing their insights based upon their own personal experiences. This is a type one approach. However, when the interpreter provides these insights, the approach has changed to a type two.

A sample interpretive program when interpreters use the 4Mat System

The activity titles which appear in bold in the following list in each quadrant indicate the choice one interpreter might include in a sample program. "What is a bird? a closer look."* described here. In addition to addressing each of the four learning styles, notice that the activities listed within each quadrant integrate both right and left brain processing functions into the experiences of your visitors.

*a two- to three-hour sample program is described here because this is the length "Bird" program most frequently offered according to the telephone survey (see Part One, Chapter Four).
**Concrete Experience**

1. Bird call making
2. Visitors share and teach
   3. Visitors create projects
   4. Visitors share their projects
   5. Visitors quiz one another
   6. Backyard habitat sketch
   7. Community awareness
   8. Bird charades

**Reflective Observation**

1. What is a bird? a closer look
2. Where do birds spend the winter?
   3. Which songs are those of birds?
   4. Matching birds with foods
   5. Which bird do you remember?
   6. Fishing like a bird
   7. Readings and writings about birds
   8. Eating like the nutcrackers

**Active Experimentation**

1. Attracting birds
2. "Bird identification" game
   3. Discover the adaptations of birds
   4. Visitors observe birds
   5. Bird seed matching
   6. Which feathers have true colors
   7. Banding birds
   8. Recording birds

**Abstract Conceptualization**

1. Visitors identify birds
2. Ask the interpreter
   3. A game for visitors
   4. Visitors see film or slide show
   5. Sonagrams
   6. Birds’ nests
   7. Bird clues
   8. Is that a fact?

---

*model adapted from the 4Mat System, Exel, Inc. copyright 1980*
TYPE ONE ACTIVITIES
--provide visitors with experiences that directly link the program with their personal life experiences. Visitors may also have a chance to discuss those connections with one another. In this initial phase of the program, visitors should discover a reason for learning the interpretive concepts.

What is a bird? a closer look

Discuss with your visitors the various adaptations of birds. Ask your visitors to break into small groups (3-7 people). Without providing them answers, ask them one or more of the following questions:
1) Why do birds have different wing and tail shapes?
2) Why do eggs have different colors and shapes?
3) Why do birds have different shapes of beaks?
4) Why do birds regurgitate food?

Then ask them to share among themselves the possible answers to the questions. Encourage visitors in small groups to work together and to brainstorm possible answers.

Where do birds spend the winter?

Individuals or families answer questions that you present them. You may either ask visitors to write down their answers on paper or question them verbally. For instance, you may pass out a card typed with the words "northern oriole" to visitors and instruct them to record on the card where (i.e. the country or continent) they believe orioles stay for the winter (many winter in Colombia, South America) or ask them to verbally express their answers.

If you decide to let visitors write down their answers, pass out one card per individual or family. Collect the cards and discuss the answers, concentrating on such concepts as what benefits and disadvantages birds experience when migrating; why some birds travel only a few hundred miles (various species of owls, blue jays, robins, etc.) and others thousands of miles (arctic tern, shorebirds, etc.); why one region is selected by a bird species and not another; and even why some birds do not migrate.

Allow the visitors to share with the entire group their knowledge of migration habits of several bird species. Some interesting examples include whistling swans (east to west migration in the spring), ruby-throated hummingbird (non-stop travel over the Gulf of Mexico) and arctic tern (11,000 mile one-way migration from South America to Alaska).
TYPE TWO ACTIVITIES
---focus on what visitors need to know in order to understand the concepts in the program. The visitor should acquire information from the interpreter, handouts, slide shows, films, supplemental readings, or experts, etc. in order to develop a foundation of knowledge to understand the interpretive concepts.

Visitors identify birds

After the interpreter uses a video tape, slides, mounted birds or photographs to introduce visitors to some of the birds which they may observe in the area, the interpreter leads them on a hike to identify birds. During the hike with the interpreter, visitors list the birds they see and hear. The interpreter periodically leads discussion that stimulates visitors to identify what birds they are seeing and hearing. The interpreter may also use an Audible Audubon, mechanical bird calls and other devices to entice birds near to the trail which visitors hike.

Ask the interpreter

During discussion sessions with the group (inside or outside your nature center) provide information to visitors and answer any questions they ask you. Encourage further inquiry into a concept through questioning techniques.

TYPE THREE ACTIVITIES
---provide visitors firsthand investigation and activities for visitors to try out in a "real world" situation the information they have acquired.

Attracting birds

The interpreter divides the large group into small groups of three to five people. The interpreter leads groups to a variety of habitats. Visitors in each group then call birds through voice mimicry and sound effects made by other means (i.e. pursing the lips on the back of the hand, Audubon Bird Call, etc.) They then use field guides to identify the birds they see.

You may purchase various bird call devices (e.g. owl, hawk and crow calls) from Wing Supply, Greenville, K.Y.

"Bird Identification" game

The interpreter provides each participant a safety pin and a 3 x 5 inch picture postcard of a bird. The interpreter instructs visitors to pin their postcards on another person's back, without showing the person the postcard, so that each participating person has a postcard pinned to his/her backside.
Visitors then ask questions of one another in order to guess the identity of his/her own bird. All players must respond with only a “yes” or “no” answer.

The interpreter should be sure that children are pinned with the most familiar birds. The interpreter should give children and adults clues and advice, if that will help the game proceed smoothly and rapidly.

**TYPE FOUR ACTIVITIES**

Encourage visitors to self discover “new connections” that integrate their experiences with new applications related to the interpretive concepts. Visitors are encouraged to teach others what they know or to create new ways of expressing or applying what they have learned.

**Bird call making**

Visitors make a bird call instrument. The interpreter provides each visitor with a blade of grass. The interpreter demonstrates how to make the “grass blade squeaker” work (i.e. insert four to six inches of grass tautly between the thumbs (see drawing), blowing gently between the thumbs to produce a vibrating sound.). The interpreter explains how many birds will actually search out and be attracted (blue jays, black capped chickadees, catbirds, house wrens) to the high pitched monotones which may be heard when a person blows softly on the grass blade inserted between his/her thumbs.

In addition, the interpreter shows visitors how to use the back of their hands to produce a similar sound. To do so, a person must purse the lips and lightly touch them to the moistened back of a hand. Sucking in, the visitors should vary the tone by alternating the inhalation of air. This method may produce a wide range of pitches, and often attracts birds more effectively than when using the grass blade.

**Visitors share and teach**

Visitors both share with others and teach others the experiences they enjoyed at the program and information they have learned during the program.

To accomplish this task the interpreter designates small groups to brainstorm and write down opinions and thoughts. The small groups then create one or two questions that may test the knowledge of other groups. A volunteer is then selected to serve as a spokesperson to speak on behalf of each small group.

In general, this activity encourages visitors to discuss the personal significance they feel about their experiences at the program and to teach themselves and others concepts related to birds.
Applying the 4Mat System model to programs with different lengths

Programs on "Birds" may vary in length from a two-hour morning bird hike to a weekend bird workshop. In the case of the weekend workshop, the interpreter may have the opportunity to include more activities that address the needs of all four learning types in the audience. Due to time constraints, the interpreter leading the morning bird hike may not be able to draw activities listed from each learning style quadrant. The interpreter should, however, use as many activities from as many quadrants as possible.

Summary

The bird sample program described in this chapter applies the basic tenets of the 4Mat System. Each of the four learning style quadrants are addressed in sequence, and each activity integrates processing functions of the right and left hemispheres. This system is employed throughout Part Two in the five program topic areas most often offered by interpretive centers. Part One, Chapter Four presents the survey results which determined these topics.

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CHAPTER FOUR-- Determining the Program Topics to Apply to the Model

Surveying the program topics interpreters present at nature centers

Fifty interpreters at Midwest nature centers were queried in a telephone survey about the interpretive programs (workshops, classes, seminars, etc.) which they had presented to family audiences and adult groups during the previous year.


A summary of the program topics offered by interpreters

The "general topic" categories that follow list the number of groups to which interpreters said they provided programs (among the three programs which they offered most often to “family” groups and the three programs which they offered most often to “adult” groups).
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<th>Adult Groups</th>
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Describing the activities which interpreters offer in programs

Interpreters were asked to describe the activities that occur during the programs they listed. For instance, in the topic category “Birds,” the interpreter at the Eden Valley Nature Center in Grand Mount, Iowa provides a woodcock “Sky Dance” program.

-- A 10-minute slide show discusses the woodcock’s natural history and its spring “sky dance.”
-- The group then sings a song together about the woodcock.
-- Later, they proceed to the woodcock’s territorial ground where people sit, watch and listen. Some small groups then stalk to as close as 15-20 feet from the “peenting” male.

Another interpreter at the Ellwood May Environmental Center in Sheboygan, Wisconsin leads an after-dark walk that investigates the sounds, smells and creatures of the night.

Participants...
-- discuss the evolution of animals’ senses.
-- take part in an activity to test their ability to detect changes in light intensity in the forest.
-- play a “sound-off” game in which they role-play predators and prey.
--call owls through voice mimicry and taped recordings.

A maple sugaring program at the Riveredge Nature Center in Newburg, Wisconsin invites families and individuals to spend an afternoon tapping, tasting, singing and eating. Visitors...

--watch a slide show about the lore and history of sugaring.
--make spigots together, choose a tree to tap and carry the sap to the evaporator.
--sing a "maple syrup cheer" written by Pete Seeger before they pour syrup over pancakes.

Analyzing the program topics interpreters most often present

According to the survey of interpreters at 50 nature centers, the topics interpreters most frequently listed as one of their top three programs include:

Birds
Wildflowers
Phenology/Seasonal Programs
Nature Crafts
Nature Photography

For a more detailed account of the responses interpreters listed corresponding to each program see the appendix.

"BIRDS"

Listed by interpreters as a "most frequently offered" program topic at 23 of the 50 surveyed nature centers, "Birds" programs ranged in length from one hour to a once-a-week workshop that met for a total of 10 hours. A majority of the programs presented met for two hours. Surveyed interpreters said they presented programs on such themes as:

--"Introduction to Birds"
--"Birds of Prey"
--"Woodcocks"
--"Bird Feeding Stations"
--"Bird Banding"
--"Bird Migration"

"WILDFLOWERS"

Listed by interpreters to occur as a "most frequently offered" interpretive program at 22 of the 50 surveyed nature centers, "Wildflowers" programs ranged in length from one hour to an adult class that met for a total of 10 hours.

A majority of the programs presented to families met for an hour and one half, while interpreters listed three hours as the average length an adult audience attended a "Wildflowers" topic.
Surveyed interpreters said they presented programs on such themes as:

-- "Spring Flowers"
-- "Prairie Walk"
-- "Mother's Day Flower Walk"
-- "Keying Out Flower Families"
-- "How Plants Get Their Names"
-- "Wildflower Slide Show"

"PHENOLOGY/SEASONAL PROGRAMS"

Listed by interpreters to occur as a "most frequently offered" interpretive program at 15 of the 50 nature centers. " Phenology/Seasonal Programs" ranged in length from one hour to an ongoing weekly workshop that met for a total of 84 hours over seven consecutive months.

A majority of the programs presented to families met for one and one-half hours, while interpreters listed eight hours as the average length an adult audience attended a "Phenology/Seasonal Program" topic. Surveyed interpreters said they presented programs on such themes as:

-- "Spring Phenology"
-- "Summer Phenology"
-- "Fall Phenology"
-- "Winter Phenology"

"NATURE CRAFTS"

Listed by interpreters to occur as a "most frequently offered" interpretive program at 13 of the 50 nature centers. "Nature Crafts" programs ranged in length from one and one-half hours to an ongoing adult workshop that met for a total of 20 hours.

A majority of the programs presented to families met for two hours, while interpreters listed three hours as the average length an adult audience attended a "Nature Crafts" topic.

Surveyed interpreters said they presented programs on such themes as:

-- "Making Toys From Natural Objects"
-- "Bird Feeder Building"
-- "Natural Crayon and Candle Making"
-- "Macrame Weaving and Fabric Dyeing"
-- "Basket Weaving"
-- "Jewelry Making"

"NATURE PHOTOGRAPHY"

Listed by interpreters to occur as a "most frequently offered" interpretive program at 12 of the 50 nature centers. "Nature Photography" programs ranged in length from two hours to an ongoing workshop that met for a total of 24 hours.

While no "Nature Photography" programs were offered to family groups, interpreters listed two, three
and six hours most frequently as the lengths an adult audience attended a "Nature Photography" topic. Surveyed interpreters said they presented programs on such themes as:
- "Indoor Nature Photography"
- "Outdoor Nature Photography"
- "Introduction to Nature Photography"

BIBLIOGRAPHY

PART TWO

Activities For Interpreters
That Address The Diverse Learning Styles of Audiences
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INTRODUCTION

Each of the following five chapters contains activities that you may present to audiences when using the 4Mat System.

You may choose from the sample program outline provided in each chapter for the presentation of your programs. The sample program provides you with an outline of activities to follow in sequence when presenting a program to a family or adult group. In addition, note that the length of each sample program equals the mean length determined from the telephone survey (Part One, Chapter Four).

In addition to the sample programs, you may choose from other activities listed in each chapter that follow the sample program.

Remember from previous discussion that the activities address all four styles of learners present among your audiences. In addition, the provided activities attempt to integrate right and left brain processing functions into the experiences of visitors to your programs. However, it is important to remember that you can change the identity of an activity's learning style quadrant by modifying its presentation in your programs. The sequence you choose to present activities that precede or follow an activity can also change the identity of an activity's learning style.

Note that though many of the activities are designed for interpreters of natural history working in the Midwest, you will also find many activities that you may use with groups in other geographical settings.
Each of the activities listed throughout Part Two provide you with the following categories of information in order to help you plan your interpretive programs:

--The type of learner who is addressed...

--The title of the activity...

--The objective of the activity...

--The procedure for carrying out the activity...

--If necessary, further references that you may consult for additional information about the activity...

Bird charades

Objective: to teach

.suggest to your visitors

.for more information
"Birds"

Concrete Experience

Visitors share and teach
Bird call making
Visitors create a project
Bird charades
Visitors share their projects
Visitors draw a sketch
Visitors quiz one another
We speak for the birds
Looking like a bird

What is a bird? a closer look
Where do birds spend the winter?
Which songs are those of birds?
Which bird do you remember?
Fishing like a bird
Readings and writings about birds
Eating like the nutcrackers

Active Experimentation

4 1

Reflective Observation

3 2

"Bird Identification" game
Attracting Birds
Discover the adaptations of birds
Visitors observe birds
Bird seed matching
Which feathers have true colors?
Banding birds
Recording birds' song patterns
Whose pellet is this?
Hikers read for signs of birds
Predicting sightings of birds
Which nest is this one?

Visitors identify birds
Ask the interpreter
A game for visitors
Visitors see film or slide show
Sonagrams
Birds' nests
Bird clues
Is that a fact?

model adapted from the 4MAT System, Excel, Inc.
copyright 1980

Abstract
Conceptualization
CHAPTER ONE—"Birds"

The activities listed in bold on the preceding page form an outline for a two-hour program, "What is a bird? a closer look," intended for presentation to a family group.

You may organize and develop other outlines by selecting from the list of additional activities that appear in this chapter following the sample program.

Here is a suggested sequence for the presentation of activities to your visitors at a sample program, "What is a bird? a closer look."

Sequence of Activities

"What is a bird? a closer look"
1. What is a bird? a closer look--10 minutes
2. Where do birds spend the winter?--10 minutes
3. Visitors identify birds--30-40 minutes
4. Ask the interpreter--5 minutes
   (break in your program)
5. Attracting birds--15 minutes
6. "Bird Identification" game--15 minutes
7. Bird call making--10 minutes
8. Visitors share and teach--10 minutes

1. What is a bird? a closer look
Objective: to have visitors analyze why birds have developed regurgitation and various wing shapes, egg shapes and bills.

You may begin your program "What is a bird? a closer look" by speculating with your visitors about the various adaptations of birds. Ask your visitors to break into small groups (3-7 people). Without providing them answers, ask them one or more of the following questions: 1) Why do birds have different wing and tail shapes? 2) Why are birds' eggs different colors and shapes? 3) Why do birds have different shapes of beaks?

Then ask them to share among themselves the possible answers to the questions. Encourage visitors in the small groups to work together and to brainstorm possible answers. You may then address the entire audience, both discussing with each group their answers and revealing your opinion about correct answers.

Suggested time for this activity--10 minutes
2. Where do birds spend the winter?
Objective: to have visitors understand some of the factors that influence bird migration and choice of winter habitat.

Individuals or families answer questions that you present them. You may either ask visitors to write down their answers on paper or question them verbally. For instance, you may pass out a card typed with the words "northern oriole" to visitors and instruct them to record on the card where they believe orioles stay for the winter (many winter in Colombia, South America) or ask them to verbally express answers.

If you decide to let visitors write down their answers, pass out one card per individual or family. Collect the cards and discuss the answers, concentrating on such concepts as what benefits and disadvantages birds experience when migrating; why some birds travel only a few hundred miles (various species of owls, blue jays, robins, etc.) and others thousands of miles (arctic terns, shorebirds, etc.); why one region is selected by a bird species and not another; and even why some birds do not migrate.

You may choose to discuss with your visitors the migration habits of more than one bird species. Some interesting examples include whistling swans (east to west migration in the spring), ruby-throated hummingbirds (non-stop travel over the Gulf of Mexico) and arctic terns (11,000 mile one-way migration from South America to Alaska).

For more information:

An educational poster titled "Bird Migrations In The Americas, 1979." is available from the National Geographic Society, Educational Services, Department 81, Washington, D.C. 20036.

3. Visitors identify birds
Objective: to enable visitors to identify and learn about birds they see while on a trail hike.

Suggest that the group now join you for a hike in which visitors identify birds. Help visitors identify the birds they see and hear. Stop along the trail occasionally and lead discussion that stimulates visitors to understand new facts and concepts about the birds they see and hear.

Suggested time for this activity—30-40 minutes

4. Ask the interpreter
Objective: to increase visitors' understanding of birds and concepts related to bird ecology.
As you circle back to the nature center, encourage people to seek new information about birds by asking you questions. Review and summarize the birds identified, while also teaching visitors concepts related to information you have already discussed.

For more information:

(break in your program)

5. Attracting birds
Objective: to have visitors attract birds to the area by emitting different sounds and using recordings.

After a short break, lead small groups (3-5 people) to different spots on the trail so that the visitors may attract birds through mimicry. For the most effective results, place the small groups in clearings among trees and shrubs in a forested area or in wetlands which have either trees, shrubs or tall emergents growing in clumps near each other. Suggest that they call birds one at a time either by using the grass blade, by pursing their lips on the back of their hands, or by other means ( Audubon Bird Call, Audible Audubon, etc.).

Suggested time for this activity--15 minutes

6. "Bird Identification" game
Objective: to have visitors demonstrate their understanding of birds when they attempt to identify the 3"x5" bird photographs pinned on one another's back.

Suggest that only a few (5-7) parents and adults play the first round, and then in a second round allow everyone (including children) to play. By doing this, you allow everyone to play, but also help the children to better understand the game's rules before taking part.

Provide each participant a safety pin and a 3 x 5 inch picture postcard of a bird. Instruct visitors to pin their postcards on another person's back, without showing the person the postcard, so that each participating person has a postcard pinned to his/her backside.

Visitors then ask questions of one another in order to guess the identity of his/her own bird. All players must respond with only a "yes" or "no" answer.

Make sure, however, that children are pinned with the most familiar birds. Give children and adults clues and advice, if that will help the game proceed smoothly and rapidly.
You may make postcards by cutting photographs from magazines and gluing them on index cards or you may buy them from distributors.

Suggested time for this activity--10-15 minutes

For more information:

7. Bird call making
Objective: to have visitors make bird call devices and understand the reasons birds use songs and calls.

Provide each visitor with a blade of grass. Demonstrate how to make the "grass blade squeaker" work (i.e. stretch a four to six inch length blade of grass tautly between your thumbs and blow lightly to produce a vibrating sound) (see drawing). Then explain how many birds will actually search out and be attracted to such high pitched monotones (e.g. blue jays, black capped chickadees, catbirds, house wrens). Tell visitors to master the sound by practicing with those among them who know how to make the grass squeak. Encourage visitors to keep trying; tell them that to emit the sound may take practice.

In addition, show visitors how to use the back of their hand to produce a similar sound. To do so, purse the lips and lightly touch the moistened back of your hand to your lips. Sucking in air, vary the tone of squeak by alternating the inhalation of air. This method may produce a wide range of pitches more effectively than using the grass blade.

Suggested time for this activity--5-10 minutes

8. Visitors share and teach
Objective: to summarize concepts and to enrich the understanding of your visitors about the information presented to them during your program.

Ask visitors (in small groups or large groups) to share with one another and teach one another both the experiences they enjoyed at the program and the facts they have learned during the program. To accomplish this, designate the small groups to brainstorm and record their thoughts in the form of one or two questions that may test the knowledge of other small groups.

Designate a spokesperson to speak on behalf of each small group. This person answers questions from other groups, after first discussing with his/her own group members the possible answers.

In general, this activity encourages visitors to discuss the significance they feel about the experiences in the program and to teach themselves and others concepts related to birds.

Suggested time for this activity--10 minutes
The list of additional activities that follows is intended to help you organize and develop your own program outlines:

**TYPE ONE ACTIVITIES**

These activities provide visitors with experiences that directly link the program with their personal life experiences. Visitors may also have a chance to discuss those connections with one another. In this initial phase of the program visitors should discover a reason for learning the interpretive concepts.

**Which songs are those of birds?**

**Objective:** to have visitors recognize through listening to tapes of songs and calls of various organisms the ones which originate from birds.

Visitors listen to various songs of birds, frogs and crickets (six to eight songs in total) that you play from a pre-recorded cassette. Ask them to silently choose as they listen which songs they believe are those of birds. Of the songs you play, three to five should be those of birds.

After having them listen to the songs on the cassette, identify for visitors the name of each of the organisms they heard. Discuss with your visitors the various characteristics most birds possess that distinguish them from those of frogs and crickets (i.e. birds' songs usually are more complex in rhythm and form a recognizable pattern in time. In contrast, most frogs' and crickets' voice patterns are mono- or disyllabic, and usually emit few notes of different frequencies while often continuing their calls as long as environmental conditions require).

You may also wish to discuss the importance of song to birds, such as its use in reproductive, social and individual functions of birds.

**For more information:**


Voices of the Night—the calls of the frogs and toads of eastern North America, Library of Natural Sounds, Cornell University, 1982.
Which bird do you remember?
Objective: to have visitors write down and discuss their first experiences with bird watching.

After individuals or families write or describe the memories of their first experiences with bird watching, discuss the growth of bird watching as a leisure activity among North Americans, and the achievements by some “birders” who search the globe for new species to record on their life lists.

Discussion of these topics will expose visitors to the trends involved in bird watching and provide them with a perspective on how bird watching connects to their lives.

Encourage visitors to discuss why they remember the sighting of various birds as memorable experiences.

For more information:

Matching birds with foods
Objective: to have visitors analyze and understand the foods various birds primarily eat.

Visitors (individually, as couples or as a family) match various birds you have put on display with the foods the birds primarily consume. For instance, if you exhibit four species of birds (photographs or mounted specimens), place a food on your observation table that corresponds to each bird who prefers the food in its diet. For example, an observation table might display:

--American robin—earthworms;
--great blue heron—fish;
--kestrel—grasshopper or mouse;
--black capped chickadee—sunflower seed.

For more information:

Fishing like a bird
Objective: to have visitors simulate how great blue herons catch their prey when visitors use a fishing method similar to that of great blue herons.

Discuss and brainstorm with your visitors the various ways waterfowl capture their food, using as an example the way a great blue heron captures its fish. After you ask your visitors to speculate how a great blue heron captures fish, have them use one of their arms to suggest the stabbing movement of the heron’s vertebrae snapping downward toward the water.

Then challenge your visitors to catch minnows and other small fish that you place into a flat-bottom barrel or an inflatable or plastic children’s wading pool. Water depth should be about one foot.
Allow your visitors (one to three at a time) to enter the water (without shoes and socks) to capture fish with dip nets you have provided them before they return the fish to the water.

Readings and writings about birds
Objective: to encourage reflection and enjoyment among visitors when you read or recite quotes, poetry or prose passages by various authors.

Speculate and discuss with your visitors their thoughts about the writings that you read or recite. For example, discuss with them some of the messages and purposes of the writings.

Pick quotations and excerpts that present both detailed information and ecological concepts about birds. This activity often works best with adult groups.

For more information:


Eating like the nutcrackers
Objective: to have visitors analyze and simulate the various methods seed eating birds use to open seeds.

Let your visitors crack open sunflowers seeds and eat them. Then ask whether any visitors know how black capped chickadees, white breasted nuthatches and grosbeaks (pine and evening) open sunflower seeds and other seeds.

After you and your group discuss their responses, demonstrate to your visitors how a chickadee hammers open a seed after placing it between its feet; how the nuthatch wedges its seeds between bark crevices and then splits the seed case open; or how the grosbeak twists and turns the sunflower seed in its mouth before clamping downward to crack the seed.

Challenge your visitors to play act the food gathering techniques of the birds you have just described. Construct a setting with materials that simulates the requirements of the chickadees, nuthatches and grosbeaks.

Visitors may use a small hammer as a substitute for the chickadee’s beak; a piece of tape may serve as the stationary surface from which the nuthatch wedges its seeds before pulverizing them; a person’s mouth, with practice, may split sunflower seeds the way a grosbeak does.
**TYPE TWO ACTIVITIES**

The activities in this quadrant focus on what visitors need to know in order to understand the concepts in the program. The visitors should acquire information from the interpreter, handouts, slide shows, films, supplemental readings, or experts, etc. in order to develop a foundation of knowledge to understand the interpretive concepts.

**A game for visitors**

**Objective:** to have visitors recognize birds' names and understand various bird ecology principles.

Visitors (working independently or in small groups) write while seated in a comfortable setting. Provide them with a game (e.g. short quiz, puzzle, word scramble or word search) that challenges them to learn the names, new information and vocabulary dealing with birds.

Good *sources* from which to choose and develop these types of games include:

**Visitors see film or slide show**

**Objective:** to have visitors understand principles of bird ecology by watching a film or slide show.

Show your visitors a movie or slide show. You may find a list of movies that deal with birds in The Educator's Guide To Free Movies, John Diffor, Educators Progress Service, Inc., Randolph, WI 53956, 1984.

You may also assemble your own slideshows or borrow them from state or county agencies (e.g. university, library, etc.) in order to teach facts and concepts about birds to your visitors.

**Sonagrams**

**Objective:** to have visitors understand how ornithologists use spectrograph patterns (Sonagrams) to distinguish one bird's song from another's.

Begin a discussion which informs your visitors about the value of songs in the identification of birds. Tell your visitors that many experts can identify the majority of songbirds by their songs. Then introduce to them a Sonagram, a device which visually reproduces the songs of birds. Inform them that Sonagrams illustrate the pitch intervals of birds' songs. Show them examples of birds' songs which have been reproduced visually on Sonagrams. (You may find examples of
For more information:


Birds' nests

Objective: to have visitors understand the basic distinguishing factors of birds' nests.

Inform your visitors of the building materials various birds use to construct their nests. Compare and contrast the different primary building materials birds use to make their nests, such as the use of 1) mud (e.g. cliff swallows) versus branches (e.g. red-tail hawk); 2) gravel/flat ground (e.g. killdeer) versus rocks and cliff edges (e.g. different types of gulls); 3) cavity lined with a snake skin (e.g. great crested flycatcher) versus multiple cavity sites (e.g. male house wrens).

For more information:

Bird clues

Objective: to have visitors understand and recognize signs and evidence which may characterize the presence of different types of birds.

Inform your visitors of the various signs that birds leave to characterize their presence. For instance, inform your visitors that evidence of birds is often marked by the discovery of empty nests, egg shell fragments, tracks, whitewash on tree trunks, pellets (from hawks, owls, crows and gulls), molted feathers or woodpecker hole carvings and hole patterns in trees.

(If you choose to take a hike with your visitors to discover evidence that suggests the presence of birds, consult the activity in this chapter titled "Hikers 'read' for signs of birds.")

Is that a fact?

Objective: to have visitors increase their knowledge of the natural history of birds.
During various brief portions or during an extended period of time during your program, inform your visitors of interesting aspects of the natural history of birds. For instance, you may tell your visitors about some of birds which choose a mate for life (e.g. Canada geese, bald eagle); the deviation of some birds migration from the normal north-south migration flyway corridors (e.g. whistling swan, golden plover, arctic loon); and that the different species of birds which can be seen in Costa Rica (approximately 640 birds), a country the size of West Virginia, equals the number of species a person may see in North America above Mexico.

For more information:
TYPE THREE ACTIVITIES

The primary purpose of this quadrant includes first-hand investigation and activities for visitors to try out in a "real world" situation the information they have acquired.

Discover the adaptations of birds
Objective: to have visitors recognize the benefits to birds in the adaptations of pellets, wing shape, egg shape and bill type.

Invite your visitors to discover the adaptations of birds through looking at the preserved bird parts exhibited at succeeding tables. Have your visitors write answers to written questions which are placed next to the bird parts, such as:

1) What advantage does the bird receive by disposing of this object? (an owl pellet is the object observed at this table)
2) Sketch which wing of these three is best for the high lift a soaring hawk needs? Sketch the one which belongs to the bird who must maneuver through dense branches in the forest? Sketch the wing which belongs to the fast traveling bird who flies in open spaces?
   (the visitors see a red-tail hawk wing: high lift wing; a thrush or warbler wing: forest bird; a swallow wing: open space flier.)
3) What survival advantages do these elliptical eggs (on left side of table) have over the round eggs at the right? (The elliptical eggs are those of a gull which may nest on a cliff edge; the eggs may be less prone to rolling. The round eggs may be from a variety of birds—robins, warblers, etc.)
4) Circle the description that fits best as a comparison to this bird's beak (the visitor see a mallard's strainer bill).—a nutcracker; a strainer; a flower probe to suck nectar; a fish eater

For more information:

Visitors observe birds
Objective: to have visitors classify birds into categories according to the "niche" level various birds occupy at a bird feeding station.
Show visitors birds feeding at an outdoor station at your center and suggest that they both identify the birds and write the level each bird usually occupies within the bird feeder area. Ask them to then place a bird into one of four feeding level areas:

1) groundfeeder (e.g. dark eyed junco, tree sparrow)
2) horizontal platform feeder three to five feet off the ground (e.g. northern cardinal, blue jay)
3) hanging feeder from tree limb or line five to seven feet above ground (e.g. black capped chickadee and finches)
4) tree branch crotch area (downy and hairy woodpeckers, white breasted nuthatch).

At some time during the activity, discuss with your visitors the niche levels each bird occupies. You may discuss bird feeder systems which visitors may assemble in their backyards to provide seed at the four general niche levels.

For more information:

Bird seed matching
Objective: to have visitors analyze and classify various birds who prefer to eat different types of backyard bird seed mixes.

Prepare visitors for this activity by asking them to consider the type and shape of beak, bird size and the habitat where the bird usually lives before you suggest that they attempt to match the seed mixes with a bird.

Provide visitors with a visual image (mounted specimens or photographs) of birds that correspond to each type of seed mix. Suggest that individuals or groups place one kernel or one piece of each feed in a bowl set beside the bird who eats that food. Good seed mixes to exhibit include cracked corn (dark eyed junco, mourning dove); niger thistle (finch family members: American goldfinch, pine siskin, common redpolls); sunflower seeds (northern cardinal, purple finch, blue jay, white breasted nuthatch).

For more information:
Which feathers have true colors?

Objective: to have visitors evaluate, then classify feathers as either true pigmented feathers or structural/unpigmented.

Place primary feathers from four or five different male bird species in a row on a table. Challenge visitors to examine the various feathers and then decide which feathers are real colors/pigmented and which feathers are structural/unpigmented.

Suggest that visitors hold the feathers up to a light source to determine if a feather is a true color or unpigmented. Demonstrate for visitors an easy way for them to view and identify the nature of the different feathers you have put on display.

Holding the feather toward a light source one foot above eye level, move it back and forth in front of the field of view. During this process, a feather retains a constant image of one color if it is a true color. If a feather changes color during movement in the light, it is structural/unpigmented.

Feather samples that illustrate true color/pigmented feathers of mature male birds include yellow, orange and red colors. Samples which demonstrate structural/unpigmented feathers of mature male plumage include blue, green and iridescent color appearance of feathers.

For more information:

Banding birds

Objective: to have visitors observe and handle birds that are captured at a mist net bird banding station.

During a trail hike with visitors stop at a mist net set near the trail. Identify and discuss the birds your visitors see trapped temporarily in the net. Allow your visitors to gently touch and handle the birds, after you first demonstrate the correct procedure for holding them. Discuss the reasons for bird banding and--if you are a licensed bird bander--show them how to band birds.

You may wish to demonstrate how to untangle and release the birds from the mist net, and then allow a few visitors to free the birds from the mist net themselves.

For more information:
Recording birds' song patterns

Objective: to have visitors distinguish one bird's song from another's when they record on paper the spectrograph pattern image of birds' songs.

Demonstrate to visitors how they may increase their knowledge of the names of birds if they are better able to identify a songbird through its song and then diagram how it sounds.

Begin this activity by demonstrating how the audible pitch of an automobile horn would appear on a song spectrograph (an electronic device which records visually the way a sound is heard). Another common sound that is easy to represent on a spectrograph is the sound made by a ticking clock (see drawing).

Next, mimic or play on a pre-recorded cassette the two-toned call of the black capped chickadee. Demonstrate to your visitors how it appears on a spectrograph (see drawing).

Provide your visitors with graph paper and ask them to diagram the bird songs they hear on a hike you lead. You may also play from a tape or record a series of birds' songs and suggest that your visitors diagram each new song they hear on their graph paper.

For more information:

Whose pellet is this?

Objective: to have visitors analyze pellets regurgiated by birds.

Ask small groups of visitors (three to five people) to examine and dissect pellets (indigestible material that hawks, owls, crows and gulls regurgitate from their gizzards). Provide each group with one pellet and ask them to explore what types of things they find. Ask your visitors to guess which birds their pellet came from after they determine the materials found in the pellet. For instance:

--crow pellets often contain plant parts and small stones;
--barred and barn owl pellets exhibit fragments of bones, fur and feather;
--hawk pellets usually contain no bones, but fur, feathers and beaks;
--gull pellets exhibit fragments of shells, fish bones and plant parts.

For more information:
Hikers "read" for signs of birds

Objective: to have visitors report evidence that suggests the presence of birds in the area which your group hikes.

During a bird hike that you lead, encourage your visitors to sharpen their ability to identify birds through physical evidence which suggest birds visit the hiked area. For example, visitors may "read" or find evidence of a bird's presence when they discover empty nests, egg shell fragments, tracks, whitewash on tree trunks, pellets (from hawks, owls, crows and gulls), molted feathers or woodpecker hole carvings and hole patterns on trees.

Speculate with your visitors about which birds left signs of their presence, and provide them with facts related to your discoveries.

For more information:

Predicting sightings of birds

Objective: to have visitors predict which birds may appear on a trail hike after hearing a description of the habitat to be hiked.

Describe to your visitors the habitat in the area which they will walk during a group hike. Include in your description the land forms (fields, ponds, lakes, forests), types of vegetation (shrubs, trees, snags) and available food types for birds (e.g. berries, seeds, cones, etc.).

Encourage your visitors to predict which birds they will see. You should scout the area to be hiked before your visitors arrive.

Discuss with your visitors the reasons for the appearance of birds in the different habitats you walk in. In addition, mention how the time of year, fruit and seed crop abundance and predator populations may influence the presence of birds.

For more information:

Which nest is this one?

Objective: to have visitors identify various birds that use the nests that you display.

For more information:
Challenge your visitors to match the identities of birds that use the nests that you have set out on one or more observation tables (actual field specimens work well, though you may choose to exhibit photographs of nests).

Discuss with your visitors which building materials were used to construct a nest, its habitat and its maker. Integrate into the discussion concepts that relate to bird ecology, such as the influences of phenological relationships, predators and microhabitat have on the type of nests which birds build.

A few examples: Goldfinches often wait until Canada and field thistles' flowers mature into downy seed fibers and then line their nests with this material; some birds intentionally build their nests in dense thickets to guard against predator attacks (e.g. catbird, brown thrasher); cliff swallows build nests inside canyon-like wall overhang structures such as window well areas on office buildings.

For more information:


TYPE FOUR ACTIVITIES

The activities in this quadrant encourage visitors to self discover “new connections” that integrate their experiences with new applications related to the interpretive concepts. Visitors are encouraged to teach others what they know or to create new ways of expressing or applying what they have learned.

Visitors create a project

Objective: to have visitors write an outline and/or complete a poem, short story or journal entry.

Assist your visitors with ideas and perspectives that they may wish to convey in projects they create that are associated with interpretation presented during your program.

Visitors may outline a short story or article, or may create a finished product in mediums you suggest (e.g. poems, haiku, journal entry), or may choose to create their own project ideas.

Your role in this activity is to provide visitors categories of projects they may wish to construct. Encourage your visitors to work at their own pace and to finish their projects at home, if necessary.
Visitors share their projects
Objective: to have visitors (in small groups or large groups) learn and enjoy from each other's completed projects or the outlines for the projects they plan to do.

During this activity encourage your visitors to discuss the significance of their projects and express their thoughts about them. Encourage them to explain why they chose their project ideas.

Visitors quiz one another
Objective: to have visitors (working in small groups) create their own worksheet of one to three questions about birds in order to test the knowledge of other small groups of visitors.

After your visitors have had enough time to write down at least two questions, designate a spokesperson from one small group (group A) to ask another group (group B) the formulated questions. Group B's spokesperson may answer the questions after discussing them with his/her group members.

You may then designate group B to challenge group A with one or two questions. Challenge other groups to perform the same process.

We speak for the birds
Objective: to have visitors recognize the existence of environmental issues that threaten or endanger birds and then decide which actions are appropriate to address these issues.

Provide your visitors information (from handouts published by state and federal agencies) on environmental issues involving birds. Facilitate discussion about options, if any, they consider as appropriate action for any of the current issues you discuss.

Individuals and small groups may then plan a course of action to address an issue (e.g. letter writing campaign, community education, fundraiser, consumer boycott, etc.).

Visitors draw a sketch
Objective: to have visitors interpret their understanding and enjoyment of birds when they draw a sketch.

Supply your visitors with drawing paper and drawing tools. Ask them to draw a simple picture which reflects
their understanding, discovery or feeling about their experiences during your program. Afterward, you may choose to display and discuss some of the drawings and sketches.

Looking like a bird

Objective: to have visitors simulate the various facial color markings of birds when they paint one another’s faces with water soluable face paint.

Supply your visitors with paint and brushes. Suggest that individuals and families work together and that they paint one another’s faces the colors that resemble the birds of their choice or make up their own colorful facial designs.

Provide your visitors with mounted specimens or photographs of birds so that they may refer to a model, if they wish, when painting each other’s faces. In this case, provide bird models such as the painted bunting, northern flicker, blackburnian warbler and ruby-throated hummingbird—to name just a few birds the facial features of which may be enjoyable for visitors to duplicate.

For more information:

Bird charades

Objective: to have visitors recognize various birds’ behavior when visitors act out the behavior of various birds while other visitors attempt to identify which bird the actors are impersonating.

Provide small groups (three to five people) with a bird’s name and explain that they will impersonate that bird for others to see and guess its identity. Instruct your visitors to huddle and discuss how they may best act out the behavior of their birds.

Encourage your visitors to use both actions and sounds in their performances. Because of their prominent behavior mannerisms, the herons, owls, hummingbirds, woodpeckers, ducks, ostrich and woodcock make good subjects.

For more information:
"Wildflowers"

Concrete Experience

Visitors quiz one another
Prairie seed starter
Visitors create a project
Save a flower
Visitors share projects
Prairie design
Flower chains

Visitors formulate questions
Visitors discuss flowers
Plant parts people eat
A fantasy tour
Flower families
Flower art
Favorite flowers

Active Experimentation 4 1

Reflective Observation 3 2

A trail hike
Who likes this flower?
Matching flowers
How do plants grow?

What pollinated these flowers?
Flower factories
Match the flowers with their fruits
Seed transportation
Flower adaptations
Investigate a flower
Which flower field guide is best?
Why does this flower grow here?
The Hatfields and McCoys

A harvest of plants
Hikers hear heritage and folklore
Visitors learn about flowers structures
Visitors view film or slide show
Ask the interpreter
Word search for flowers
Keep away

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Abstract Conceptualization
CHAPTER TWO—"Wildflowers"

The activities listed in bold on the preceding page form the outline for a three-hour program, "Focusing on wildflowers," intended for presentation to an adult group.

You may organize and develop other interpretive program outlines by selecting from the list of additional activities that appear in this chapter following the sample program.

Here is a suggested sequence for a sample program, "Focusing on wildflowers."

Sequence Of Activities
"Focusing on wildflowers"
1. Visitors formulate questions--10 minutes
2. Visitors discuss flowers--10 minutes
3. Plant parts people eat--15 minutes
4. A harvest of plants--5-10 minutes
   (break in your program)
5. A trail hike--60 minutes
   (break in your program)
6. Who likes this flower?--20 minutes
7. Matching flowers--20 minutes
8. How do plants grow?--5-10 minutes
9. Visitors quiz one another--15-20 minutes

1. Visitors formulate questions
Objective: to have visitors increase their knowledge of flowers by having them write down one or two general questions about flowers that you may later discuss and/or answer.

When your visitors begin to arrive at your center provide each with a piece of paper and pencil. Suggest that they formulate one or two general questions they have about wildflowers.

Visitors may submit any form of question, from, for example, "Why do tulips close at night?" to "Why did Dutchman’s breeches receive such a name?"

Suggested time for this activity--10 minutes

2. Visitors discuss flowers
Objective: to have visitors brainstorm and discuss possible answers to the questions they formulated in activity number one above.

Soon after your visitors have completed writing their questions, divide them into small groups (three to five people). Encourage them to brainstorm and then list all possible correct answers to the questions they have
written. You may speculate with your visitors about possible answers as you walk from one small group to the next. Then when you reconvene as one large group offer answers to some of their questions before beginning your next activity.

Suggested time for this activity--10 minutes

3. Plant parts people eat
Objective: to test the prior knowledge of visitors by having them list common store or garden foods that correspond with a list of general categories of plant parts.

Pass out a game quiz, “Plant parts people eat.” The short quiz asks visitors to fill in the blanks common foods which correspond with the following list of general categories:

Flower:
Nectar/Pollen:
Sap:
Stem:
Leaf:
Root/Fruit:
Fungus:

In each category, visitors list the foods that apply. For example, Flower: cauliflower, broccoli; Sap: sorghum, cane syrup, maple syrup.

(An answer key is provided in the next activity. “A harvest of plants.”)

Suggested time for this activity--15 minutes

For more information:

4. A harvest of plants
Objective: to have visitors learn the answers to the categories of plants they completed in the previous activity, number three.

Provide your visitors the answers to the quiz which asked them to list common store or garden foods which people eat. The answer key follows:

Flowers: cauliflower, artichoke, broccoli
Nectar/Pollen: honey, saffron
Sap: maple syrup, sorghum, cane syrup
Stem: potato, celery
Leaf: lettuce, spinach, parsley
Root/Fruit: carrot, radish
Fungus: mushrooms

(break in your program)
5. A trail hike

Objective: to have visitors identify flowers in order to gain knowledge about individual species and wildflower ecology.

After your visitors gather again after a short break, lead them on a trail hike. Provide your visitors the opportunity to identify flowers. When they see flowers help them to identify and also discuss the natural history attributes of the flowers.

Suggested time for this activity--60 minutes

(break in your program)

6. Who likes this flower?

Objective: to have visitors identify different species of bugs and insects they shake from plants and speculate which organisms may live in mutualism.

After a short break, provide small groups of visitors (three to five people) with white sheets (regular sized bed sheets, five by seven feet). Demonstrate to your visitors how to place the sheet on the ground underneath a species of flower that grows in clumps (early goldenrod, Canada goldenrod, white sweet clover, wild bergamont, etc.).

Show your visitors how to gently grasp the stems, shaking the insects and bugs attached to the flowers to the sheet below. Have them collect the various insects and place them temporarily in glass vials.

Center a large group discussion around the flowers each kind of insect and bug prefers: try to determine if a pattern emerges (e.g. small eastern milkweed bug is often found on milkweeds) that suggests a mutualism between the traveling visitors (insects and bugs) and the hosts (flowers).

You may wish to discuss other related topics, such as the pollination process and morphological adaptations flowers exhibit in order to accommodate pollinators.

Suggested time for this activity--20 minutes

For more information:

7. Matching flowers

Objective: to have visitors recognize how flowers appear at various stages in their life cycles.

Have visitors participate in an indoor activity which challenges them to match dried flowers with this year's flowers. On one or more observation tables, place dried flowers next to field specimens in the stage of flowering or color photographs of flowers.

Suggested time for this activity--10 minutes
8. How do plants grow?
Objective: to have visitors witness the effects variations of light sources and amounts of light have on the growth of two plants.

Provide each individual, couples or family with two small dixie cups that contain soil with a citrus fruit seedling two to three inches tall. Lemon seeds are generally the easiest to cultivate, while orange, mandarin and tangerine seeds will also grow well.

Make sure the two seedlings are of relatively equal height. Ask your visitors to consider how much light is needed for their plants to grow effectively. How does the source of the light affect growth—do plants need sunlight or will they grow under light bulbs?

Ask them to experiment with the plants when they bring them home. Suggest that they first place both plants side-by-side on a window ledge for two to four days and measure their growth each day. Then instruct them to move one of the plants to another area of the house that receives less light. Visitors should measure both plants' growth again after another four days.

Suggest that your visitors also compare growth rates of the plants when one plant is given only light from a light bulb (e.g. in a closet) or have them compare how two plants grow when one is given more or less light than the normal daylight hours. Hand out step-by-step directions for your visitors to take home.

Suggested time for this activity—5-10 minutes

9. Visitors quiz one another
Objective: to have visitors create their own worksheets of one to three questions about wildflowers in order to test the knowledge of other visitors.

After each small group of your visitors (three to five people in each small group) has recorded one or two questions associated with material already presented during your program, ask a spokesperson from one small group to pose one question to the members of another small group. All members of the questioned group may wish to respond with an answer or they may discuss an answer and then designate a spokesperson to answer the question.

Repeat this procedure with other small groups.

Suggested time for this activity—10 minutes
The list of additional activities that follow may help you organize and develop your own program outlines.

**TYPE ONE ACTIVITIES**

The activities in this quadrant provide visitors with experiences that directly link the program with their personal life experiences. Visitors may also have a chance to discuss those connections with one another. In this initial phase of the program visitors should discover a reason for learning the interpretive concepts.

**A fantasy tour**

**Objective:** to create an experience of learning and enjoyment for visitors when they listen with closed eyes to a visual image you create through a story, historical anecdote or reading from an author.

While on the trail with your visitors, suggest that they sit or lay down in area near a prairie or field of flowers. Closing their eyes, visitors listen to your voice as you take them on a fantasy tour into the past. Create a visual image for your visitors through a story, historical anecdote or reading from an author. Good authors to use in the activity include Aldo Leopold or John Madson (see references below). Allow your visitors the opportunity to discuss together their thoughts about the passages you read them.

**For more information:**


**Flower families**

**Objective:** to have visitors evaluate and choose a system to classify flowers into organized families according to common characteristics.

**Using a key suggested by visitors** (working independently or in small groups), have your group classify flowers into families. Facilitate your visitors to suggest some general classification systems, such as:

--- artificial classification (e.g. by color)
--- natural classification (i.e. by plant whorl characteristics)
--- phylogenetic classification (i.e. by evolution)

Specific categories within these systems and other classification schemes include:

--- petal color
--- number of petals
--- leaflet arrangement (e.g. alternate, opposite or...
whorled)
--stamen number
--flower shape (e.g. bilateral or symmetrical)
You may also suggest your visitors combine two or more of the above categories.

For more information:


Flower art
Objective: to have visitors experiment with the natural colors they create when using as art objects materials they have collected from the outdoors.

Families "fingerprint" and smear designs on white art paper or construction paper. They do this by first collecting flowers, flowers' leaves and other natural materials. Then suggest that your visitors discover the colors that result when rubbing natural objects onto paper (soft, rough textured paper usually works best for this activity).

For instance:
--bark and burnt wood create dark outlines
--soiled and decayed wood produce gray and brown colors
--grasses and leaves create yellow and green colors
--flower petals produce various colors, depending on the flower used

Make sure that your visitors know they may pick only plants that grow in abundance (e.g. dandelions, red clover, goldenrods and mustards) and that picking is permitted just this once during your program.

Provide your visitors with other drawing utensils (e.g. crayons, markers), if they would like to draw other designs with their rubbings.

Favorite flowers
Objective: to have visitors increase their personal understanding of why they enjoy looking at and learning about wildflowers.

Begin a discussion with your group by asking your visitors to consider how they first became interested in wildflowers. Let them tell you and the group their initial experiences and memories of wildflowers. In addition, encourage them to talk about their various interests dealing with wildflowers and their expectations of what they hope to learn at your program and in the future.
TYPE TWO ACTIVITIES

The activities in this quadrant focus on what visitors need to know in order to understand the concepts in the program. The visitors should acquire information from the interpreter, handouts, slide shows, films, supplemental readings, or experts, etc. in order to develop a foundation of knowledge to understand the interpretive concepts.

Hikers hear heritage and folklore
Objective: to have visitors understand the folklore and historical perspectives associated with flowers.

When your visitors listen to folklore associated with flowers that are identified on a trail hike, encourage them to discuss with the group their own previous experiences with the identified flowers. Speculate with them about the myths that are associated with the flowers and how the flowers received their names.

For more information:


Visitors learn about flowers' structures
Objective: to have visitors recognize the morphological and anatomical structure of various flowers.

Provide your visitors with hand lens and other laboratory tools (e.g. microscope, probe, etc.) to investigate flowers' structures. Promote a conceptual understanding of flowers and their ecological interactions with other organisms.

Encourage and answer visitors' questions that arise during their exploration in order to satisfy your visitors' desire to broaden their knowledge of flowers.

For more information:

Visitors view film or slide show
Objective: to have visitors understand about flowers and flower ecology when watching either a slide show or film.

Encourage discussion and answer visitors' questions after they watch a slide show or film.

For more information:
Ask the interpreter
Objective: to have visitors satisfy their desire to understand concepts that you have presented during your program dealing with wildflowers.

Visitors seeking information ask you questions. The questions may occur at any time during your program, or you may allot a portion of your program to a question and answer period.

Word search for flowers
Objective: to have visitors locate and circle common names of flowers hidden in a word search puzzle.

Visitors (working independently or in family groups) circle the common names of flowers that are hidden in a word search puzzle. Visitors may fill out the sheet at your center or take home the worksheet if they are not able to finish in the time you allot to this activity.

You may make your own flower word search puzzle or obtain one from The Mammoth Book of Word Games (see reference below)

For more information:

Keep away
Objective: to have visitors recognize common poisonous wildflowers so that they can avoid them.

Inform your visitors of different species of wildflowers which can cause health problems for people. For instance, show them examples (dried specimens or slides) of plants which grow in your area, such as: poison ivy, poison hemlock, stinging nettle, baneberries, common tansy, water hemlock, white snakeroot and nightshades.

For more information:

TYPE THREE ACTIVITIES
The primary purpose of this quadrant includes first hand investigation and activities for visitors to try out in a "real world" situation the information they have acquired.

What pollinated these flowers?
Objective: to have visitors understand the pollination process when they observe and then match pollinating agents to various flowers on display at one or more observation tables.
Through photographs, slides or preserved specimens of butterflies, bees, hummingbirds, etc., visitors choose the pollinating agents they believe pollinate the flowers on display at one or more observation tables. For instance, on one table your visitors may see flower images of an early buttercup, a common evening primrose and a grass.

Across from these images an equivalent number of pollinating agents are displayed: flies, bees, butterflies, wind (i.e. preserved specimens, photographs or written words on cards).

At each observation station a question on an index card asks visitors to match each pollinating agent with one flower species that it pollinates. For example, visitors may match the word "wind" with an actual clump of grass (or photograph of grass); honey bee with red clover; fly with the early buttercup. The observation tables should display both common, easily recognizable matches and more difficult associations.

For more information:

The Evolution Of Plants And Flowers, Barry Thomas, St. Martin's Press, New York, 1981.

Match the flowers with their fruits
Objective: to have visitors identify flowers with their fruits after they observe specimens and photographs.

While on the trail or inside, ask your visitors to match a flower species with its fruits. If on the trail, you should carry either an image of the flower or its fruit corresponding to the observation of the same species while on the trail (e.g. rose hips from the previous season’s fruit may be brought on the spring trail hike when Rosa multiflora is in its flowering stage).

During a late summer/autumn trail walk you may carry an image (e.g. dried flower or photograph) of Rosa multiflora when field identification of its fruit occurs.

For more information:


Flower factories
Objective: to have visitors role play various flower parts in order to understand the pollination process among insects and flowers.

Ask your visitors to consider how insects successfully execute the pollination process when they visit flowers.

Designate:
one person to stand in front of the group as a symbol for the pistil of a flower;
six people to surround the pistil as symbols for stamens;
four people to surround the stamens and pistil as symbols of the flower's petals;
a few people may act as a symbol for bees and one or more people may play action as pollen.

Act out the pollination process with your visitors acting as the symbols and providing the "action." Pollen should move with the bees to the pistil of another flower or may fall on parts of the same flower. Play act the process of ovary development in the growth of the flower's final product, a mature fruit.

Flowers which display the number of parts described above include: watercress, black mustard, pepper grass or penny-cress.

Seed transportation
Objective: to have visitors evaluate how different seeds of flowers disperse and attach themselves to perpetuate the species.

Provide your visitors (who are assembled into small groups) four or five different seed shapes which possess both different appearances and dispersal structures. Visitors investigate and then speculate how the seed bodies disperse and attach themselves to perpetuate the species.

Provide your visitors with hand lens and microscopes to aid their investigation. Some examples you may choose for this activity include: milkweeds, sunflowers, cattails and burdock.

For more information:

Investigate a flower
Objective: to have visitors use flower field guides in order to learn the names of flowers they observe.

As your visitors work independently or in small groups, ask them to identify flowers with the aid of field guides. Help them become familiar with the formats of the guides you provide them.

For more information:

A Field Guide To Wildflowers, Roger Tory Peterson and Margaret McKenney, Houghton Mifflin, Boston, 1968.
Why does this flower grow here?

**Objective**: to have visitors evaluate how soil conditions influence the types of flowers that will grow in a particular site.

Using a trowel, auger and glass vials, visitors collect soil samples. Your visitors may also use pH testing equipment to find the alkalinity/acidity of the soil.

Then converse with your visitors about the individual flower species on site which have a range of environmental requirements: soil moisture, soil nutrients, soil texture, pH, available light, etc. Walk with them and identify "indicator species" that verify their findings.

The Hatfields and McCoys

**Objective**: to have visitors participate in an investigation activity, then analyze how the diversity and range of environmental factors influence the location of where flowers grow.

Divide your group into two smaller units. The "Hatfields" survey and plot on paper the common name of flowers that grow within a designated area (set off with red flagging, 200' x 200'). This area comprises an open field, including the ecotone at a forest border.

The "McCoys" lay claim to the forest and forest edge (ecotone). They survey and plot on paper flowers that grow in this flagged area (200' x 200').

"Disputes" that result between the Hatfields and McCoys because of species that grow in both territories is resolved by a judge (you, the interpreter). After you assemble all the participants into a large group, lead a discussion in the playing field area which helps visitors determine the survival needs of flowers that they have identified grow in the ecotone.

Resolve the situation of dispute by discussing how flowers possess a diversity of environmental needs; these needs often form a continuum that intergrades from one habitat (field) to another (forest), and includes an overlap area, the ecotone, where both field and forest flowers are able to grow.

Flower adaptations

**Objective**: to have visitors evaluate and distinguish the differences in adaptations of flowers that grow in open field settings with those that grow in shaded, forested settings.

Place flowers on one or more observation tables. Visitors (working independently or in small groups) list the adaptation features of flowers which grow in a sun-filled open field setting versus those that grow in a more shaded, forest setting. Place a forest dwelling flower (e.g. spring ephemerals) next to an open field species (e.g. a grass) and ask them to list the adaptations that distinguishes one from the other. Distinguishing characteristics may include:

--size of leaflets
For more information:

Which flower field guide is best?
Objective: to have visitors discuss and evaluate the advantages and disadvantages of features presented in various flower field guides.

Ask your visitors to share reasons they prefer one wildflower field guide over another. Have on hand at least three current wildflower field guides. You may include discussion and evaluation of the various field guides. Features which distinguish one field guide from others may include flower classification systems by:

--number code (e.g. Newcomb's Wildflower Guide)
--color of petals
--common family characteristics
--drawings or photographs
--geographical ranges of flowers listed in guide

For more information:


TYPE FOUR ACTIVITIES

The activities in this quadrant encourage visitors to self discover "new connections" that integrate their experiences with new applications related to the interpretive concepts. Visitors are encouraged to teach others what they know or to create new ways of expressing or applying what they have learned.

Prairie seed starter
Objective: to have visitors analyze and create plans of flower and forb species which will grow well in their backyards.

Using advice written in information sheets, books or magazines put on display at observation tables, have your visitors plan the species they would like to grow in their backyards. Suggest that your visitors choose the
types of species they would like to plant and that they consider the habitat conditions of their backyards which will provide optimal growing conditions.

For more information:

Visitors create a project
Objective: to have visitors enrich their understanding of an aspect of your program by creating an outline of a poem, short story or sketch.

Working independently or in small groups, visitors create an outline of poem, short story or sketch of a subject related to your program. Your visitors may choose to construct the project at the site, if time allows, or finish the project at a latter time.

Save a flower
Objective: to have visitors become aware of an environmental issue related to flowers and allow them to decide if action is needed to save a threatened or endangered flower.

In small groups or as one large group, visitors discuss issues concerning a threatened or endangered flower after receiving a handout of the status of various local and state flowers.

Discuss and brainstorm with your visitors the choice of actions, if any, at their disposal:
1) letters to politicians
2) community education projects
3) local campaigns in schools and local organizations
4) editorials and letters to newspapers

Visitors share their projects
Objective: to have visitors enrich their understanding of flowers when they share with the group their ideas, designs or completed projects (see activity "Visitors create a project" in this chapter).

In small groups or large groups, visitors share their completed projects or share the ideas, designs and outlines of projects they plan to do dealing with wildflowers.

Prairie design
Objective: to have visitors sketch the design and plan the species of a prairie planting for their backyards.
When your visitors have drawn the planting dimensions, ask them to consider a one, five and ten-year plan for the vegetation growth of their yards. Ask them to consider the plant species they would plant to accommodate their yard plans. Aid their planning process by providing them with handouts and articles which discuss backyard prairie planting designs and natural landscaping designs.

Flower chains

**Objective:** to have visitors comprehend the trophic levels associated with flowers when they construct chains out of construction paper and other art materials.

When visitors construct their own examples of trophic chains that begin with a flower, tell them to assemble three or four paper links together. For example, visitors may construct a food chain of common milkweed, soldier beetle, kingbird. Suggested materials that you will need: construction paper, scissors, tape and markers.
"Phenology/Seasonal Programs"

Concrete Experience

Snow people
Symbols
Snow caves
Woodcock song
Capturing snowflakes
Visitors outline/create projects
Visitors share their projects

Ice and snow mysteries
Phenology calendar
Spring arrivals
Budding mysteries
Woodcock adaptations
The migrators
Trees by their colors

Active Experimentation

Wax tracks
Winter hiding places
Frog prowl
Spring harbingers
Moth bait
Hula hoop snow study
Tracking
Sounds

Reflective Observation

The M.A.D.-ness of Winter
Snowflakes
Migration
Trees in fall
Phenological Phenomena
All about woodcocks
Spring growth
Moon cycles
Frog music

model adapted from the 4Mat System, Excel, Inc.
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Abstract
Conceptualization
CHAPTER THREE-
Phenology/Seasonal Programs

Phenology--the study of phenomena in nature that periodically reoccur.

The activities listed in bold on the preceding page form the outline for a one and one-half hour "Phenology/Seasonal Program," intended for presentation to a family group.

You may organize and develop other interpretive program outlines by selecting from the list of additional activities that appear in this chapter following the sample program.

Notice that you may apply the majority of the activities in this chapter to a specific phenological occurrence or to the general conditions (e.g. weather, moon phase) which prevail during the month or during a particular season.

Here is a suggested sequence for the presentation of activities to your visitors at a sample program. "Winter: 'tis the season to discover."

Sequence of Activities

"Winter: 'tis the season to discover"
1. Ice and snow mysteries--10-15 minutes
2. Phenology calendar--10-20 minutes
3. The M.A.D.-ness of winter--5-10 minutes
4. Snowflakes--5-10 minutes
(break during your program)
5. Wax Tracks--10 minutes
6. Winter hiding places--10-15 minutes
7. Snow people--15-25 minutes

1. Ice and snow mysteries

Objective: to have visitors analyze, then understand the different characteristics of water when they solve "mystery" photographs about water, ice and snow.

You may begin your program, "Winter: 'Tis the season to discover," by inviting visitors to observe three to five photographs at one or more observation tables. Ask your visitors to answer a question that is written on a card next to each photograph. Each photograph of an ice and winter scene depicts a "mystery" which can be solved if your visitors answer the questions.

Provide your visitors with a pencil and piece of paper to write down their answers. For instance, visitors may read the following question on a card while looking at a
photograph that shows open water at the shore next to an ice layer extending into the center of the lake:

"In the spring, a lake melts first along the shore. How come?" (Visitors who answer correctly state that the rising spring temperatures warm the land faster than the ice and water in the lake, therefore, the ice around the warming shore melts first.)

Other questions which visitors may answer when observing photographs include:
1) Next to a photograph of ice forming only on stems of plants growing in water: "What makes the water freeze around the plant stem first? (Answer: As the temperature of the air falls to 32 degrees Fahrenheit, air next to the stems freezes first because it is cooled off faster by the dense stems than by the less dense air.)"
2) Next to a snow fence which shows snow built up primarily on the right side of the fence shown in a photograph: "What direction did the wind come from? (Answer: The wind blew from the left to right. Wind blows through a snow fence and is then slowed down enough so that the snow falls on the side of the fence away from the wind.)"

After your visitors answer the questions, solve the mysteries by discussing the reasons for the ice and snow phenomena.

Suggested time for this activity—10-minutes

For more information:

Snow Stumpers, David Webster, Natural History Press, New York, 1980.

2. Phenology calendar
Objective: to have visitors recognize the natural phenomena that occur during various times of the month.

Providing your visitors with a month from a calendar that contains boxes or spaces to write information, ask them to consider various natural phenomena that occur during the weeks shown on the calendar.

For instance, you or one of your visitors may suggest that mid- to late winter (i.e. February through mid-March) is the time when some owls (e.g. great-horned owls) begin pairing up, nesting, mating and calling more frequently. Have your visitors record this phenomenon on their calendars.

You may also suggest visitors record such phenomena as:
1) the position of various stars and planets in the sky
2) the phases of the moon throughout the month
3) the beginning of mating season of various animals, such as skunks and black bears
4) the onset of weather that may induce maple trees to flow with sap
5) dates of notable snowfalls and winter storms of the past
Suggested time for this activity--10-20 minutes

For more information:

3. The M.A.D.-ness of winter
Objective: to have visitors recognize three general behavioral characteristics organisms exhibit during winter--migration, adaptation and death (the first letter of these words form the acronym "M.A.D.").

Begin a discussion which informs your visitors about the general ecological behavior of organisms during winter. Mention examples of organisms which exhibit various aspects of migration or adaptation, or simply die.

Some organisms which migrate to escape the rigors of winter include: Birds, bats, butterflies and dragonflies. Organisms which adapt to winter include: Snowshoe hares (large hind feet to promote movement through snow); black bears (accumulate fat layer before winter sleep); woodchucks (hibernation). Organisms which die when winter weather arrives include: grasshoppers, katydids and some bees and wasps.

Suggested time for this activity--10-15 minutes

For more information:

4. Snowflakes
Objective: to have visitors comprehend the varieties of snowflakes that fall and how the consistency of snowfall effects some winter activities, such as cross-country skiing and snow shelter and snow people building.

Begin a discussion which informs your visitors about some of the common snowflake shapes that fall--star, plate, needle, column, column with a cap at each end, spatial dendrite and irregular. Inform your visitors how the temperature affects the consistency and water content of snow that accumulates on the ground.

Provide your visitors with examples of how various consistencies of snow influence winter recreation activities (i.e. dried snow that falls, generally, at 20 degrees Farenheit or less is flatter and more sharply defined; as snow ages after it falls or if its falls at higher temperatures (30-32 degree Farenheit) it becomes more rounded, smooth and heavy.)

Inform them that, generally, cross-country skiers find they can ski faster and find it easier to ski when dry snow falls. The quality of snow can have a profound effect on the waxes cross-country skiers choose.
 Builders of snow people and shelters, however, usually prefer wetter snow.

**Suggested time for this activity—5-10 minutes**

**For more information:**


(break during your program)

5. Wax Tracks
**Objective:** to have visitors identify and understand the habits of animals when visitors make casts of print marks animals have made in snow.

Lead your visitors to an area where several tracks of one or more animals appear in the snow. Demonstrate how to make a wax cast of one of the prints. First, have them put a thin layer of sand over the print. Then show your visitors how to pour a thin layer of wax evenly on top of the imprints. When this wax layer dries in a minute or two, pour a second layer—and as many as are needed to cast a wax layer thick enough to extract from the snow after the wax layers dry.

Tell your visitors that if they pour too much wax into a print initially, it will melt the walls around the track too much. In addition, remind your visitors that hot wax can burn exposed skin. Suggest that parents help their children pour the wax liquid into the animal prints.

If the snow at your center is too deep or no animals frequent a suitable area for you to do this exercise, have your visitors help you pack the snow down to the ground and then simulate the shape of various animals' tracks by digging into the snow.

**Suggested time for this activity—10-15 minutes**

**For more information:**


6. Winter hiding places
**Objective:** to have visitors specify the various homes and places animals spend the winter.

After your group has returned to your center, invite them to observe photographs and objects of animals that illustrate where these animals spend the winter.
Place these photographs and objects at one or more observation tables.

Ask them to match an animal to each winter shelter they see represented in the photographs or objects. Some examples of matches you may arrange include:
1) caterpillar - cocoon
2) gray squirrel - tree cavity
3) insect - leaf litter
4) little brown bat - cave

Provide your visitors with paper and pencils to record their matches. Hang a card near the observation table which lists the names of animals that represent the animal's homes so that your visitors have a reference when they choose matches.

**Suggested time for this activity** -- 10-15 minutes

**For more information:**

**7. Snow people**

**Objective:** to allow visitors the opportunity to create their own versions of snow people using various natural objects for parts of their snow people's bodies.

Leading your visitors to an area where snow is abundant enough to make snow people, show them some of the natural objects that they may use to decorate their snow people. Suggest to your visitors that they may use the objects you provide them, such as:
- pine and spruce cones as buttons and eyes
- spruce or fir twigs for eyebrows
- carrot pieces for eyes or mouth
- vines for a necklace
- grasses and corn stalks for bracelet or skirt

Inform your visitors that they may collect their own objects to decorate their snow people. Caution your visitors that they should not strip vegetation and bark from trees.

**Suggested time for this activity** -- 15-25 minutes

**For more information:**
The list of additional activities that follow may help you organize and outline your programs.

TYPE ONE ACTIVITIES

The activities in this quadrant provide visitors with experiences that directly link the program with their personal life experiences. Visitors may also have a chance to discuss those connections with one another. In this initial phase of the program visitors should discover a reason for learning the interpretive concepts.

Spring arrivals
Objective: to have visitors identify the week in spring that animals break their hibernation, return after migration or begin their mating calls.

Ask your visitors to observe the mounted specimens or photographs of animals that you have put on display at one or more observation tables. When visitors observe these animals they should circle an answer from a multiple choice question that is located next to each specimen or photograph.

The general theme all the questions share relates to the beginning of the spring life cycle of animals who live at least part of the year in the vicinity of your center.

For instance, some examples you may display include:

1) a specimen or photograph of a redwing blackbird with the question: "When does the redwing blackbird return from its winter habitat?" (Your options for answers may vary depending on the latitude of your center. A center located at a latitude near southern Wisconsin might list these dates for visitors to choose from):
   --March 1-6
   --April 1-6
   --May 1-6.
   (The general date it returns to southern Wisconsin is March 1-6.)

2) a specimen or photograph of a woodchuck with the question: "When do woodchucks generally end their winter hibernation?"
   --February 1-6
   --March 1-6
   --May 1-6
   (Generally, woodchucks emerge from hibernation during the first week of March at latitudes similar to southern Wisconsin. Earlier or later dates of emergence may be listed as answer options in this question, depending on the location of your center.)

After your visitors have answered the questions, you may discuss the answers with them.

For more information:
Budding mysteries
Objective: to have visitors evaluate and identify various forbs, shoots of shrubs and shoots of tree branches.

When your visitors observe the various budding forbs, shrubs and trees that you have set into containers filled with water, ask them to also read the clues listed on cards next to each floral sample. Using pencils and pieces of paper you have provided your visitors, have them choose the identity of each specimen from the multiple choice answers listed on each card. For instance, when your visitors observe a pussy willow in its budding stage, they may read the following words written on a card:

"This species has a common name which is associated with the furry texture feeling of its buds. Many of its family members grow in the wild near or in water and one cultivated species has a common name which matches its 'drooping' appearance."

Your visitors then see the following multiple choices from which you ask them to choose one answer:
- -- tag alder
- -- sugar maple
- -- white oak
- -- pussy willow

After your visitors list the identity of the specimens, you may discuss the answers with them.

For more information:


Woodcock adaptations
Objective: to have visitors evaluate the benefits to woodcocks of the adaptations of their beak, sight and feather color.

Place three mounted specimens or photographs of woodcocks on an observation table. At each image of the bird, place a different question on an index card.

Ask your visitors to observe the specimens and answer the question listed on an index card at each station. The question at the first station asks: "What benefit does the woodcock derive in a beak that is flexible at its tip?" (Answer: the woodcock possesses a beak which is flexible in the upper mandible. The woodcock plunges its beak full length into soil to probe for food with its highly sensitive mobile tip with which it apparently feels for earthworms.)

The question at station number two asks: "What benefit does the woodcock derive with eyes set far back
and high in its head?" (Answer: Ornithologists believe
the woodcock can see in every direction, 360 degrees.)

The final question at the third station asks: "What
benefit does the woodcock derive from its drab, mottled
appearance?" (Answer: Since the woodcock's summer
habitat is often alder thickets many ornithologists
believe the woodcock's color blends in well with this
type of habitat and acts as camouflage against
predators.)

(After your visitors have answered the questions, you
may discuss the answers with them in the activity listed
in this chapter titled "All about woodcocks.")

For more information:
The Audubon Society Encyclopedia of North American

The migrators
Objective: to have visitors discuss and speculate about
different organisms which migrate.

Using a flipchart, write down your visitors answers
when they name the different organisms which they
believe migrate. Facilitate the discussion, if necessary,
by mentioning that birds are not the only migrating
animals. Try to have visitors identify the periodic
wanderers, such as: butterflies, squids, fishes,
salamanders, caribou, elk, bats and eels--to name just a
few.

For more information:
Animal Migration & Navigation, Philip Street, Charles

Trees by their color
Objective: to have visitors speculate the identity of
trees by observing the fall color of their leaves and, if
necessary, by their leaf shapes.

Place on an observation table four to six different
leaves of trees that exhibit fall colors. Place each leaf
inside a folded card which you have cut so that only a
one inch diameter circle of the leaf is exposed. Ask your
visitors to match each leaf's color with the species of
tree it grows on. Hang a list of the common names of
trees on a large card above the observation table so that
your visitors have a reference guide.

Tell your visitors that they may lift the top fold off
the partially hidden leaf, if they need to see the entire
leaf shape to identify the tree it grows on.

Some species of trees' leaves and their fall colors
include:
1) quaking aspen - golden yellow
2) red maple - crimson
3) white oak - scarlet
4) tamarack - brownish-yellow
5) ash species - plum
After your visitors have answered the questions, you may discuss the answers with them. Tell your visitors that the fall color of a leaf on a tree may vary from year-to-year due to differences in weather and the physical makeup of individual trees.

**For more information:**
This Green World, Rutherford Platt, Dodd, Meade Publishing, New York, 1943.

**TYPE TWO ACTIVITIES**

The activities in this quadrant focus on what visitors need to know in order to understand the concepts in the program. The visitors should acquire information from the interpreter, handouts, slide shows, films, supplemental readings, or experts, etc. in order to develop a foundation of knowledge to understand the interpretive concepts.

**Migration**

**Objective:** to have visitors understand how various animals benefit from migration.

Begin a discussion about the benefits of migration to various animals, such as birds, bats, butterflies, caribou, elk, salamanders, snakes, etc. Provide some examples of interesting behavior some animals possess when they migrate, such as:

-- the arctic tern, which travels a 22,000 mile round-trip during its annual migration route from South America to Alaska and the Arctic.

-- the monarch butterfly, which assembles in various large colonies throughout the United States and Canada just before beginning migration in the fall, then flies to and congregates for the winter in a small area of land in the Sierra Madre mountains of Mexico.

-- the nocturnal path of some species of salamanders in the spring, who travel en masse from land to ponds and ephemeral pools of water to mate before returning to their terrestrial environments for the remainder of the year.

**For more information:**
This Broken Archipelago, James Lazell, Quadrangle Publishers, New York, NY 1976

An educational poster titled “Bird Migrations In The Americas, 1979.” by the National Geographic Society, Educational Services, Department 81, Washington, D.C. 20036


**Trees in fall**

**Objective:** to have visitors understand the names of trees and concepts dealing with trees and their fall colors.
When leading your visitors on a trail hike in autumn, inform them about the names and natural history of some of the trees they observe. In addition, increase their understanding of the physiological processes that change the pigments in leaves differently in one tree species than others. Encourage them to ask you questions, and provide them with answers.

For more information:


Phenological phenomena
Objective: to have visitors comprehend the meaning of "phenology" and its application to studying natural phenomena.

Inform your visitors how various scientists correlate phenological events in the natural world to understand natural phenomena. Provide some examples of phenological events that form "phenological webs" in order for your visitors to understand the relationship among natural events.

Some events you may inform visitors about to illustrate your discussion include:

--the relationship between the time of spring ice breakup of lakes and ponds and the northward migration of canada geese.
--the cyclical relationship between meadow voles' (genus Microtus) populations and the populations of short-eared owls.
--the relationship between weather/wind patterns and the time wood warblers advance on migration routes to their summer habitats (i.e. warblers may cover long distances on their migration routes when warm, clear nights with south winds prevail).

For more information


All About Woodcocks
Objective: to have visitors recognize the benefits of various body parts and behavior patterns of woodcocks; to increase their understanding by discussing and answering the questions visitors completed in "Woodcock adaptations."

Begin a discussion which informs your visitors about the benefits of various adaptations to woodcocks, such as:

--wing shape for steering through dense vegetation.
--adaptability to living closely to human activity (agriculture, homes).
--resourcefulness at finding various foods, even when snow is still on the ground as they migrate north.

Include in your discussion the answers to the questions visitors completed in the activity listed in this chapter titled "Woodcock adaptations." In addition, encourage your visitors to ask you additional questions that they have about woodcocks and answer them.

For more information:

Spring growth
Objective: to have visitors recognize the effect of increased day length on the growth patterns of various trees, shrubs and flowers.

Using various specimens of flower, tree and shrub stems and branches as demonstration objects, inform your visitors how the increase in day length influences their initial growth in the spring.

Provide your visitors with some examples of interesting growth patterns of various forms of vegetation in the spring, such as:
--the volumes of pollen emitted by jack pines that seem to form hazy clouds above jack pine groves.
--the cotton-like seed fibers that fall from various members of the aspen tree family (e.g. cottonwood), sometimes so profusely that the fibers clog sewer drainpipes and window screens of homes.
--the red hue leaves white oak (Quercus alba) and northern pin oak (Quercus ellipsoidalis) often exhibit as they form in the spring.

For more information:

Moon cycles
Objective: to have visitors understand the monthly phases of the moon and its monthly orbit around the earth.

Using some of your audience as participants in this activity, direct a play acting situation which illustrates the size, orbit and phases of the moon each month. Have a volunteer hold a ping-pong ball representing the moon. This visitor stands next to a person holding a softball, which symbolizes the earth. Another person holds a basketball as a symbol of the sun a few feet further from the volunteer holding the objects that represent the moon and earth.
Designate other people to stand and hold other round objects (e.g., handball, wiffle ball, orange, grapefruit, etc.) that represent the relative sizes and distances of planets in their relation to the sun.

Now turn on a flashlight to symbolize the rays of the sun. Aim its beam of light toward the "moon" resting in the hand of the volunteer (Change the object that represents the moon to a volleyball so that light flashes on a greater surface area.) Keeping the beam of light focused directly on the volleyball, walk around the "moon," periodically stopping to illustrate how the light phase of the moon changes shape to observers watching from earth.

You may also provide visitors with other information dealing with the monthly cycle of the moon and its path around the earth.

(Note: this activity gives your visitors a general idea of the size differences among the planets and the sun, not a detailed scale-to-the-inch accuracy of these celestial objects.)

For more information:
1964.


Frog music*
*adapted from an activity presented at the Riveredge Nature Center, Newburg, Wisconsin
Objectives: to have visitors recognize the names of frog species by watching slides of various frogs and by playing simple objects and instruments that simulate the calls of frogs.

While you are showing slides of the various frogs that live in the vicinity of your nature center, pass out objects that will serve as instruments for your visitors to play. Then, have your visitors practice making the calls of frogs with their objects, after you designate each visitor to mimic one frog species. Now flip through slides of each frog so that your visitors recognize the appearance and identity of the frog which corresponds with their instruments.

Finally, ask each group of visitors who have one type of instrument to begin to play in chorus when you flash a slide of its species of frogs on the screen or mention its name during a slide show that includes dialogue about the natural history of frogs that live in your area.

Some materials that you may use to simulate the call of a few frog species include:
1) small bell jingled - spring peeper
2) thumb moved quickly over the teeth of a pocket comb - chorus frog
3) moist thumb rubbed over an inflated balloon - leopard frog
4) rubber band plucked when stretched taut - green frog
5) phrase "jug'orurn" repeated by a chorus
of people - bull frog

For more information:
The Frog Book, Mary C. Dickerson, Dover Publications,
TYPE THREE ACTIVITIES

The primary purpose of this quadrant includes first hand investigation and activities for visitors to try out in a "real world" situation the information they have acquired.

Frog prowl

Objective: to have visitors locate frogs and temporarily capture frogs using dip nets.

During the spring when calling frogs advertise their presence, have your group stalk them and attempt to capture the frogs. If you perform this activity at night, provide your visitors flashlights with which they may attempt to locate the frogs. Have your visitors deposit the frogs they catch (with dip nets you have provided them) into a few large glass jars filled with water.

Allow your visitors the opportunity to observe and pass around the jars filled with frogs, before they release the frogs back into the water.

For more information:
The Frog Book, Mary Dickerson, Dover Publications, New York, NY (no publishing date provided)

Spring harbingers

Objective: to have visitors recognize and discuss various signs of spring.

Leading a trail walk with all your visitors or dividing them into small groups (two to five people), ask your visitors to use all of their senses to list elements in the outdoors that suggest the beginning of spring.

(Provide your visitors with pencils and pieces of paper to list their findings).

Suggest to your visitors that they should use all of their senses when listing pieces of evidence that foretell spring. For instance one of your visitors may claim that the sight of skunk cabbage is a spring event while another proposes that the sound of soft trickle of water flowing under river ice portends the spring breakup of the river. You may suggest some other categories of spring harbingers for your visitors to notice when they walk, such as:

--migrating birds returning from winter habitats
--changes in color of shoots of branches on shrubs and trees
--the swelling and leafing out of buds
--the sounds of the drummings of woodpeckers and ruffed grouse
--the calls and songs of birds, such as mourning doves, black capped chickadees and cardinals
--the pungent smell of the soil and ground litter.

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thawing after winter

For more information:

Stalking woodcocks*
*adapted from an activity presented at The Eden Valley Nature Center, Grand Mound, Iowa.
Objective: to have visitors visit the spring territorial grounds of woodcocks and observe the rituals of male woodcocks.

If you have woodcocks performing their courtship flights in the sky during late winter and early spring at your center, lead your group toward one or more of these territorial “peenting” grounds. (A “peent” is the call a male woodcock repeats in its territory on the ground before taking off on a courtship flight; thus, a “peenting” ground is the area where male woodcocks perform courtship rites, usually at dawn and dusk hours.)

Leading small groups (three to six people) one at a time or placing small groups at various territorial grounds, stalk closer to the spots where the woodcocks land after their courtship flights. Suggest to your visitors that they should quietly and slowly move as close as possible to the “peenting” grounds of the woodcocks. Tell them it is often possible to move as close as 15 to 30 feet to a male woodcock.

Stop to observe the woodcocks when they land from their courtship flights. Count the number of “peents” a woodcock makes before it flies again to determine if a pattern emerges.

For more information:

Moth bait
Objective: to have visitors observe moths and other insects that fly to bait stations, lights and other attractant devices you place in the outdoors.

During the mid- to late summer when many species of colorful moths are most active at night, set out devices to attract them. One bait station where visitors can observe moths consists of a light and white sheet. Hang the white sheet flat or concave against a wall with the light shining downward onto the surface of the sheet. By using a black light, you may attract more different types of moths and flying insects.

To make another bait station for your visitors to observe moths and insects, use rags, tacks and fermented sweet liquid. Dip rags into the fermented liquid (a combination of beer and sugar left to sit while covered in a jar for three to five days) two to five hours before your programs begins and tack the strips of
moist rags at eye level on the trunks of trees in a forest or at a forest edge.

Then lead your visitors to these bait stations during your program, providing them with flashlights to see the moths and insects feeding on the bait on the rags.

Another bait station you may erect 12 to 24 hours before a program may attract various ground beetles and other bugs and insects. Simply bury a container (small coffee can, yogurt container) so that the rim of the container is flush with the top layer of soil. Place pieces of potatoes or apples in the empty cavity of the containers. Then lead your visitors to these bait stations during your program, again providing them with flashlights to inspect the creatures feeding at the bait.

For more information:

Hula hoop snow study
Objective: to have visitors examine snow and objects that they find in and beneath the snow in an area inside a hula hoop.

Leading your group to an area shielded from the wind, give individuals and family members hula hoops. Suggest that they toss or place their hoops on the snow and begin digging under the snow inside their hoops toward the ground. Provide your visitors with trowels or sticks to dig with and a placemat (e.g. carpet square or piece of cardboard) on which to kneel.

Ask them to observe the consistency of the snow—is it new snow, fluffy enough to see the flat, sharp point of some flakes? Or, ask them, is the snow old and compacted with the layer of snow eroded so that it is now rounded, smooth and heavy pellets of snow?

Then ask your visitors to cut the snow with a trowel or plastic knife and extract a profile that illustrates where the “firn” and “depth hoare” of the snow start and stop.

(Just below the top surface of the snow exists a layer called “firn.” This layer consists of flakes that have lost their sharp edges due to compaction and is more like an area of ice crystals than snow crystals. The “depth hoare,” located below the firn, is a layer of snow that has a compact shape due to heat radiated from the earth.)

Finally, suggest to your visitors that they explore the ground layer beneath the snow. Ask them to note the identity of objects they find (e.g. bugs, dried flowers, leaves, seeds, soil). Then inform them how these objects indicate the type of habitat your group is in.

For more information:

Tracking

Objective: to have visitors analyze animals' experiences and habits through the observation of the trails of animals imprinted in the snow.

Leading your visitors to an area where several tracks of one animal appears in the snow, observe the tracks you and your group discover. Suggest that when your visitors see a track they first attempt to identify it, using a key to prints if necessary. Pass out a sheet to visitors that illustrates the patterns of tracks of various animals. Then ask them to decide other information that they "read" in the tracks such as:

1) the direction an animal travels
2) the rate of speed an animal travels
3) the size of the animal
4) how long ago the animal made the track

You may want to inform your visitors about the general categories in which animals' tracks may be identified. This classification system groups animals in the northern North America into four groups, based on the number of toes on their hind and front feet. For more information on this classification system consult the references below.

For more information:


Sounds

Objective: to increase the awareness in visitors of the various sounds they hear during a hike you lead in spring.

At a resting point of a trail hike you lead with your visitors, ask them to stand or sit. Challenge them to count or write down all of the sounds they hear in a designated period of time. Afterward, discuss and compare the visitors' lists.

You may also experiment with this activity at different habitats where you stop (e.g. prairie, forest, lake shore). Compare and contrast with your group the different sounds you hear and the number you hear at each habitat.

TYPE FOUR ACTIVITIES

The activities in this quadrant encourage visitors to self discover "new connections" that integrate their experiences with new applications related to the interpretive concepts. Visitors are encouraged to teach others what they know or to create new ways of expressing or applying what they have learned.
Symbols

Objective: to have visitors express elements in their favorite season through drawings.

Providing each of your visitors with a piece of drawing paper and drawing utensils (e.g. markers, crayons, charcoal pencils), ask them to draw an object or design associated with the outdoors that symbolizes an element they enjoy in either spring, summer, autumn or winter.

For instance, a man in your group may draw a white-tail deer because he enjoys exploring the fields and forest for deer in summer. A woman may design an abstract drawing of clouds. Later, she explains that she enjoys watching the various cloud patterns that emerge in the summer sky.

Capturing snowflakes

Objective: to have visitors create replicas of snowflakes that they collect on glass.

Take pieces of wood (e.g. four-by-four inch pieces) and glass platforms (e.g. microscope cover slides) that have been placed for 15 to 30 minutes in a freezer. Give one of each to your visitors. Caution them to leave the glass piece on top of the wood holder because snow crystals may melt from the heat of a person’s hand holding the glass platform.

Next, spray an even coating of transparent spray on each visitor’s glass piece, tilting the glass so any excess spray runs to one edge. Have your visitors expose their glass to falling snowflakes until several have fallen on their glass platforms. You may also throw into the air a wispy handful of snow and let the snowflakes land on your visitors’ glass platforms.

Then ask your visitors to place their platforms in a cold place (e.g. outdoors under an eave, refrigerator) for 10 to 15 minutes.

The plastic spray will retain the image of the snowflakes and will be white as the original crystals were. Suggest that your visitors examine their preserved snowflakes with a hand lens or microscope before they take their preserved snowflakes home from your program. (Note: You may obtain Krylon crystal clear spray coating #1301 or another five percent transparent spray at a hardware store.)

For more information:

Woodcock song*

*adapted from an activity presented at the Eden Valley Nature Center, Grand Mound, Iowa.

Objective: to have visitors sing and amuse themselves and to learn to impersonate the “peenting” call male woodcocks emit during the spring.
Before leading your group to the spring territorial "peenting" grounds of woodcocks, sing a song with them about woodcocks.

The words to the song follow (sing to the melody of the Mickey Mouse Club theme song):

I am a woodcock, you're a woodcock,
we are woodcocks all.

And when we get together, we do the
the woodcock call.

Oh------------- oh-------------

At the end of the word sung "oh," have people cup their hands to their mouths, squat as if they are a woodcock and make "peent" call. Have them repeat the "peent" call five or six times each time you arrive at this point in the song.

For more information:

Snow caves

Introduction: to have small groups of visitors (two to five people) construct snow cave shelters, then sit and explore in them.

(Note that this activity may take your visitors one to three hours to do, depending on the ability of your visitors, snow depth and snow consistency.) If the accumulation of snow at your site is deep enough for your visitors to pile snow into drifts, inform them about the basic steps to construct a snow cave. (You may also transport additional snow from another location to the area where visitors will construct their snow caves).

After you give them directions to make snow caves, let them make their own. Walk from group to group, offering advice to your visitors if it will help them to construct their snow caves. Allow your visitors time to sit in and explore their snow caves.

For more information:


Visitors outline/create a project

Objective: to have visitors increase their understanding of your topic when they complete a poem, short story or journal entry dealing with an aspect of your program.

Assist your visitors with ideas and perspectives they may wish to convey in projects they create that are associated with interpretation presented during your
program. Visitors may outline a short story or article, or may create a finished product in mediums you suggest, such as a poem, a journal entry, a haiku.

Suggest to your visitors that they may also choose to create their own project ideas. Your role in this activity is to provide visitors categories of projects they wish to construct. Encourage your visitors to work at their own pace and to finish their projects at home, if necessary.

Visitors share their projects

**Objective**: to increase the understanding and enjoyment of visitors when they share their completed projects or the outline for the projects they plan to do.

During this activity, encourage your visitors to discuss the significance of their projects and express their thoughts about them. Encourage them to explain why they chose their project ideas.
"Nature Crafts"

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Finding natural tunes

Used toys made new
Looking for variety in nature
Finding nature's paint
Smell a flower
Scramble and search
Magnifying nature
Stony treasures
Nuts and seeds

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Where do we find nature's gifts?

Leaves: A highway of veins
Show and tell about cones
The birth of a snowflake
How do stones get flat?
White birch: Instant paper
Snow
Nature's colors
Sources of cordage

Abstract
Conceptualization
CHAPTER FOUR— "Nature Crafts"

The activities listed in bold on the preceding page form the outline for a two-hour program, "Nature crafts made easy," intended for presentation to a family group.

You may organize and develop other outlines by selecting from the list of additional activities that appear in this chapter following the sample program.

If you see an asterisk (*) in the description of how to make a craft, this means that a potentially dangerous tool must be used to construct the craft. You should suggest that parents help their children complete this step.

In addition, note that you may present some of the additional activities listed after the sample program so that they relate to one another. For instance, you may build the activity titled "Nature's coloring book" upon the activity "Finding nature's paint"—though you may present either activity independent from the other.

Here is a suggested sequence for presentation of activities to your visitors at a sample program. "Nature crafts made easy."

Sequence of activities
"Nature crafts made easy"
1. What craft is this?—5-10 minutes
2. Crafts from nature—5-10 minutes
3. Leaf hunt—20 minutes
4. Where do we find nature's gifts?—5-10 minutes
5. Leaves: A highway of veins—5 minutes
6. Finding natural tunes—10-20 minutes
7. Used toys made new—10-15 minutes
8. Leaf windows—10-15 minutes
9. Nature's music—10-20 minutes

1. What craft is this?
Objective: to have visitors evaluate the various nature crafts that can be made with natural objects.

You may begin your program, "Nature crafts made easy" by inviting arriving individuals and families to examine various nature craft items that you have put on display. Place two or three preassembled craft items on an observation table.

For example, set out a collage that your visitors may make in an activity titled "Leaf windows," or cones decorated to resemble birds, which your visitors may
make in an activity described in this chapter titled "Cone fliers."

Ask your visitors to consider the following questions when they examine the craft items:
--Which objects from nature appear in each craft item?
--What is the function of each craft item?
--Do they think the craft items are easy or difficult to construct?
--Which ones would they prefer to make?

Suggested time for this activity--5-10 minutes

2. Crafts from nature
Objective: to have visitors analyze, then list sources of natural objects in the vicinity of your center which may be used to construct nature crafts.

After you have assembled your visitors, lead a discussion that asks visitors to list objects found in the outdoors that may be used to construct crafts. Facilitate the discussion and their participation by asking them questions, such as:
--Which parts of a tree serve as ingredients for crafts? (Visitors possible answers: cones, leaves, twigs, fruits, nuts.)
--Which parts of a flower serve as ingredients for crafts? (seeds, flower head stems, etc.)
--Which objects found on a beach may serve as ingredients for crafts? (stones, sand, shells, etc.)

Aid your visitors' comprehension by writing their responses on a large flipchart or blackboard.

Suggested time for this activity--5-10 minutes

For more information:

3. Leaf hunt
Objective: to have visitors observe and collect various shapes of leaves from the ground. (Visitors will use these leaves in the activity "Leaf windows" listed in this chapter).

Ask family groups to find and collect as many different kinds of leaf shapes as they can. Without identifying the leaves, show them contrasting samples of two or three common leaves they may find on the ground when they begin their search in the outdoors.

Provide them with a small bag to collect their specimens from the ground leaf litter. Suggest that the family groups collect approximately five to seven different types of leaves. Ask them to return to your center at a time you specify.

Suggested time for this activity--20 minutes
4. Where do we find nature’s gifts?

Objective: to have visitors recognize places where they may collect natural objects in order to make nature crafts at home.

After your visitors reassemble, show and tell about some of the leaves your visitors collected. Then begin a discussion about places where people may collect other natural objects (besides leaves) without causing undue harm to the environment or trespassing. Mention that people may damage the environment by:

- picking flowers that are threatened or endangered species.
- stripping trees of their bark and leaves.

They may suggest finding:
- flowers: in gardens, florist shops or stores which sell dried flowers.
- cones: under trees in parks and in cemeteries or on discarded wreaths.
- stones: of all shapes, sizes and colors can be found most places in the outdoors (e.g. beaches, quarries, talus rock slopes, etc.)
- shells: on a beach. Some shells--clams, oysters and shellfish--can be bought at the meat departments of grocery stores; restaurants often give away shells after extracting the food from them. Hobby and craft shops often sell boxes of shells.
- twigs and branches: at nurseries and city forestry yards, both of which give away pruned branches; driftwood can be found along beaches.

Suggested time for this activity—5-10 minutes

For more information:
Designate a child volunteer from your group to help you compare a leaf to a human hand. Examine the child's hand in front of the group while visitors in the audience study their own hands. Speculate as a group about the common characteristics shared by both a hand and a leaf:

--skin
--hair
--veins that carry fluids
--lobed "fingers" (like the palmately divided leaves of horse chestnut)
--flat, horizontal shape

Discuss and compare some of the advantages these structures provide trees and humans (e.g., lobed leaves conserve water while also producing food during photosynthesis; separated human fingers distribute blood efficiently and help humans gather objects, including food).

Suggested time for this activity—3-10 minutes

For more information:

6. Finding natural tunes
Objective: to have visitors collect natural objects from which they can then create musical instruments.

Begin a discussion of objects in the outdoors that may be used to create music. Then demonstrate for visitors the sound made by pebbles when shaken in a jar.

Challenge them to collect other objects outdoors that may, similarly, be made into instruments when combined with the following objects you have put on display:

--cardboard tubing from rolls of paper and paper towels
--cellophane
--cylindrical containers
--rubber bands
--twine/string

Ask visitors to return to your center with at least two natural objects from the outdoors. (In activity number nine, "Nature crafts," directions are presented for constructing these musical instruments.)

Suggested time for this activity—10-20 minutes

(break in your program)
7. Used toys made new

**Objective:** to have visitors understand the value of “recycling” used toys by exchanging toys among each other.

After a short break, remind your visitors that in the publicity for your program, you suggested that each child bring a toy to your center to trade with other children. Allow one child at a time to select a toy from a collection placed on a table. Announce that each child will be allowed a short time (30 seconds to a minute) to select a toy from the collection to bring home. After your visitors have selected their toys, lead a discussion which provides insight to the value of “recycling” toys.

*Suggested time for this activity-- 5-15 minutes*

8. Leaf windows

**Objective:** to have visitors make a collage of leaves and other tree parts which they will take home and attach to a window.

Ask families to bring their leaf collections to the various work site areas where you have prepared materials for the construction of “Leaf windows.” At each site you should place sheets of wax paper, approximately 11”x11”.

Demonstrate how to place leaves on the surface of one sheet of wax paper. Placing another sheet of wax paper over the first and the leaves, iron over the waxed paper. After the wax has melted into the leaves, hold your leaf collage up to a window for visitors to see.

Encourage them to make their own styles of “Leaf windows.” An extension cord on your iron will allow you to walk around and iron visitors’ wax sheets together.

*Suggested time for this activity-- 15 minutes*

9. Nature’s music

**Objective:** to have visitors use natural objects and other items to make musical instruments, then play them.

Invite your visitors to make one or two instruments, using objects they have collected from the outdoors during the activity “Finding natural tunes.” Suggest that:

1) Sticks and pieces of wood may function as wood blocks.
2) A cellophane sheet stretched over a cylindrical container (hollow wood piece, oatmeal box, ice cream pail) and fastened with a rubber band may act as a drum when tapped with a small shoot of a branch or dried grass.
3) A flute-like sound may be produced by blowing through a cardboard tube in which small holes are cut.
4) A low sound resembling a tuba may be produced when blowing gently into holes of hollow wood.
5) Vibrating sound is produced when twine is stretched taut across a forked branch.
Encourage your visitors to play their instruments. Have a concert when everyone is finished making their instruments.

**Suggested time for this activity** --10-20 minutes

For more information:

The list of additional activities that follow may help you organize and outline your own programs.

**TYPE ONE ACTIVITIES**

The activities in this quadrant provide visitors with experiences that directly link the program with their personal life experiences. Visitors may also have a chance to discuss those connections with one another. In this initial phase of the program visitors should discover a reason for learning the interpretive concepts.

**Why make gifts from nature?**

**Objective:** To have visitors evaluate the reasons why they give gifts and on what occasions they give them, to have visitors understand that recycling of energy in natural systems is, in part, repeated when they make crafts out of natural objects.

Ask visitors working as individuals or family groups to write down and then tell the entire group why they give gifts to people. Suggest that their descriptions include the occasions (holidays, birthdays, etc.) on which they give gifts. Conclude this portion of the activity by asking visitors to tell the group situations when they received or bought used gifts and objects (e.g., hand-me-down clothes, pets, used books, used cars, etc.).

Then, begin a discussion that demonstrates the constant natural recycling of elements in the environment, as in the hydrologic cycle or in the life cycle of a tree—growth, death and decay into soil from which another tree sprouts.

Speculate that making nature crafts is similar to the everyday processes in nature. Relate to visitors that when they use pebbles and fallen tree cones in the construction of nature crafts they simply add another step to the energy flow that, with time, recycles all natural objects into different physical states.

**A leaf becomes a craft**

**Objective:** To have visitors speculate how various craft items can be made with leaves.

First, challenge your seated visitors to tell you ways in which leaves can become a nature craft. If necessary,
facilitate the discussion by showing them pictures or the completed art crafts made with leaves:
--rubbings on tree trunks
--leaf prints
--collages
--mobiles
--casts
--placemats

Be sure to remind them that only leaves found in the ground leaf litter should be used in the construction of crafts.

For more information:

Sachet discovery
Objective: to have visitors analyze and write down which natural objects comprise sachets that are on display at one or more observation tables.

(Later in your program you may build upon this activity by involving your visitors in the activity listed in this chapter, "Making sachets.")

Providing your visitors with a piece of paper and a pencil, ask them to walk from one sachet bag to the next, listing the composition of natural objects in each sachet. Suggest that visitors may identify and list the natural objects in any way, though they may prefer to list the common name of the objects (e.g. the visitor identifies the leaves of "tansy" in a sachet bag).

Place cards which list the names of the objects in each sachet bag near each observation table or at the last table of their route. Suggest that visitors may both smell and touch the sachet bags in order to identify the objects in them.

Crafts from snow
Objective: to have visitors identify different craft items people can make from snow.

Using a large flipchart to write down your visitors answers, facilitate a discussion which asks them to list objects or crafts which can be made from snow. Objects or crafts visitors mention may include: snow people, snow caves, snow sculptures, snow forts, igloos, geological land formations (e.g. drumlins, eskers, etc.).

For more information:

TYPE TWO ACTIVITIES
The activities in this quadrant focus on what visitors need to know in order to understand the concepts in the program. The visitors should acquire information from
the interpreter, handouts, slide shows, films, supplemental readings, or experts, etc. in order to develop a foundation of knowledge to understand the interpretive concepts.

**Show and tell about cones**

**Objective:** to have visitors distinguish one conifer tree from another by looking at the needles, cones and bark.

If coniferous tree species grow on your site, lead your visitors to one or more species, noting the distinguishing needle, cone and bark morphological characteristics of each.

Collect and bring back to your center cones found on the ground underneath the coniferous trees. Suggest that visitors collect cones of white pine and norway spruce, if these trees grow on your site. (These cones will work best in making “Cone flyers,” an activity which is described in this chapter).

If your site does not have two or three different species of coniferous trees, you may choose to present this activity inside, exhibiting the different cones to visitors.

**The birth of a snowflake**

**Objective:** In order to gain a greater appreciation and understanding of snow, visitors play act the process in which a snowflake forms in the atmosphere and then accumulates with others on the ground.

(Later in your program you may build upon this activity by involving your visitors in activities listed in this chapter titled “Snow” and “Making snowflakes.”)

Begin a discussion about the factors necessary for snowflakes to form in the atmosphere and fall to earth. Include in your discussion some general factors which influence the formation and falling of snowflakes, such as:

--moisture content of air
--temperature of air
--presence of soil, salt or dust speck to which water molecules bond

Demonstrate the influence of these factors on snowflake formation by enlisting your visitors to play act the process. For instance, designate one person to symbolize a microscopic speck of dust, one or two people to act as the water molecules which surround the particle. Six other people may stand equidistant from another to form a circle around the core of the snowflake. These people symbolize the six-sided form that characterizes most snowflakes.

Then play act the process in which bonding of snowflakes occur and how layers of snow accumulate. Do this by having your visitors link together their arms while standing or by sitting back-to-back from one another.

**For more information:**
How do stones get flat?
Objective: to have visitors understand why stones are often flat and rounded when found in the outdoors.

Allowing your visitors to both see and pass around flat stones and rocks, discuss with them the reasons the stones and rocks are flat. Use volunteers to role play the parts that wind, waves, glaciers, fire and pressure may have had on shaping the stones and rocks.

For instance, if your center is located on a lake or river, have some of the volunteers act as the currents and waves which slowly eroded away the sharp edges of rocks. If your center is located near different land forms—talus slopes, quarries, etc.—use other play acting situations related to these areas in order to educate your visitors about rocks and stone shape formation.

For more information:

White birch: Instant paper
Objective: to have visitors understand why white birch (Betula papyrifera) bark peels off the tree and how people have used the bark paper and the other parts of the tree as syrup pails, canoes, etc.

Make sure your visitors know that the white birch bark you show them is from a dead or downed tree and urge them to avoid peeling white birch bark off of live trees.

Then, facilitate a discussion about the reasons why white birch bark peels from trees as they grow (i.e. discuss the effect the growth process of trees has on bark expansion and its appearance). In addition, you may show your visitors the prominence of lenticels on the bark of white birch and inform them about other natural history of the white birch. End your discussion by speculating about historical accounts and folklore regarding people's use of white birch.

For more information:


Snow
Objective: to have visitors understand the physical qualities of snow; how snow aids animals and people; and how people may make various crafts from snow and enjoy winter sports in it.
(Later in your program, you may involve your visitors in activities in which they use snow to make "Snow people" and "Snow caves" (see Part Two, Chapter Three))

Begin a discussion about the physical structure of snow at different temperatures during the winter. Then inform visitors about how snow influences some animals' behavior (e.g. humans in winter; animals which hibernate; birds which migrate).

Some other information that you may tell visitors about snow to demonstrate these points includes:

--the consistency of snow needed to make various crafts in the snow: snowpeople, snowballs, igloos, snow caves, etc.
--the seven basic shapes of falling snowflakes: star, plate, needle, column, column with a cap at each end, spatial dendrite and irregular.
--snow's insulation properties.
--the ecological chain of life forms which depend on snow, from algae, to snow worms to ruffed grouse.
--benefits snow provides farmers in the form of fertilizer and spring water recharge.
--the various consistencies of snow which influence some winter sports, such as cross-country skiing, downhill skiing and snowshoeing.

For more information:

Nature's colors

Objective: to have visitors recognize the colors and dyes which are produced from the parts of various natural objects.

(Later in your program you may build upon this activity by involving your visitors in the activities "Finding nature's paint" and "Nature's coloring book.")

Inform your visitors about various objects in the outdoors with which people derive natural colors and dyes when making craft items. Some of these objects and the colors that people derive from them include:

--bloodroot roots—red
--pokeweed berries—purple
--strawberries—red
--blackberries—blue
--raspberries—red
--goldenrod blossoms—yellow
--sumac roots—yellow
--dandelion roots—magenta

For more information:
Dye Plants And Dyeing, Brooklyn Botanical Garden, Brooklyn Botanical Gardens, 1000 Washington Ave., Brooklyn, NY 11225
Sources of cordage
Objective: to have visitors recognize various barks, roots and forbs which provide materials for making cordage into string, rope, fishlines and lacings. (Later in your program you may build upon this activity by involving your visitors in an activity titled "Making cordage." See the reference listed below.)

Lead a discussion in which you show your visitors various barks of trees, roots of plants and forbs. Specify in your discussion which parts of these plants people use to make cordage. Some parts of plants which provide sources of cordage and which you may introduce into your discussion include:

1. the inner bark of basswood
2. white cedar bark
3. common milkweed stems
4. Indian hemp stems

For more information:

TYPE THREE ACTIVITIES
The primary purpose of this quadrant includes firsthand investigation and activities for visitors to try out in a "real world" situation the information they have acquired.

Looking for variety in nature
Objective: to have children learn how to identify and collect various natural objects (with the help of their parents).

Pass out cards to individuals and families that designate which objects they should search for in the outdoors. You may challenge your visitors to collect one or more items in the following groups:

--various types of seeds
--various colors of pebbles/stones
--various surface textures of leaves
--various surface textures of pebbles/stones
--various colors of soil collected in vials

You may incorporate the objects your visitors gather into one or more of the craft items they make in your program (e.g. Leaf windows, Nature's music).

Finding nature's paint
Objective: to have visitors discover colors which are produced from the rubbings of natural objects they collect in the outdoors (e.g. berries, flower petals, leaves, bark, etc.).
Challenge your visitors to find three to five different shades of color when rubbing natural objects on paper. Provide visitors with paper on clipboards (a soft, coarse grade of white paper works well) so that they may have a flat surface on which to crush and rub the juices out of the natural object onto the paper.

Ask that visitors use only one piece or a small portion of the objects they collect to determine their colors, then collect enough to color a design on an 8 1/2" x 11" poster later in your program (see the activity "Nature's coloring book" listed in this chapter).

Before your visitors begin to collect the natural objects, make sure that you tell them a few items that are easy to find and that cause the least amount of harm to the environment, such as:

--non-native flowers
--bark peeled from downed trees
--clumps of berries growing in large quantities (e.g. common elderberry, raspberry, blackberry, sumac berries)
--fallen leaves
--soil

For more information:


Smell a flower
Objective: to allow visitors to smell flowers and plant parts in the outdoors so they can decide which plants they might include in sachets.

Ask your visitors to smell flowers and plant parts they see along the trail. Inform your visitors that they should not pick flowers. Suggest that they stay on the marked trails at your center when searching for flowers in order to preserve the vegetation growing adjacent to the trail.

Tell your visitors to note which flowers' and plants' fragrances they enjoy, then decide which three or four plant parts they would include in a sachet. Later, bring visitors back to your nature center and provide them samples of plant parts and flowers they smelled on this trail hike.

You and your staff may want to pick the plants yourselves rather than allow your visitors to pick the flowers and, possibly, trample the vegetation. Pick the plants before beginning your program. (You may supplement this activity with "Making sachets," listed later in this chapter.)

Scramble and search
Objective: to have children experience the joy of discovery and to challenge them to find natural objects buried in a sand pile. (With these objects they may later
construct craft items in the activities "Necklaces," "Making sachets," and "Leaf windows.")

Bury and mix tree and fruit/vegetable seeds (e.g., maple, oak, hickory, locust, ash, melon seeds, squash seeds, etc.) in a four foot by four foot pile of clean sand that is six inches deep. A sand box or children's wading pool work well as containers. You may also place two-by-six inch pieces of wood at right angles to make a receptacle that holds sand.

Allow two to four children at a time to search and collect the nuts and seeds they find in the sand; the other children watch the participating children until their turn arrives.

Provide children with small bags which will hold the nuts and seeds that they collect for later use in the construction of nature crafts. Add and mix more seeds into the sand pile when the supply of seeds dwindles so that children find it too difficult to find the buried seeds.

**Magnifying nature**

**Objective:** to have visitors use magnifying glasses, magnification cubes and microscopes to learn about objects they see in the outdoors; to challenge visitors to recognize that some of the objects they see can be used to construct a craft item.

Provide your visitors with magnifying glasses, loops, or magnification cubes to examine objects in the outdoors. Suggest that visitors use their magnification devices to look at objects or divide a large group into smaller units (three to five people) to search for natural objects according to categories that you designate, such as:

--smooth versus coarse textures
--wet versus dry natural objects
--various colors of natural objects
--various shapes of leaves
--various kinds of seeds
--various species of flowers and dried flowers
--various textures of tree bark

As in the previous activity, "Scramble and search," ask visitors to collect three or four natural objects and bring them back to your center. Some or all of these objects may be used in the construction of a nature craft, as in the activity "Leaf windows." In addition, after your visitors return to your center, encourage them to examine their objects with a microscope that you have set up at an observation table.

**Stony treasures**

**Objective:** to have visitors collect pebbles, stones and small rocks from the outdoors so they can later construct craft items.
Instruct your visitors to collect 10 to 15 pebbles, stones and small rocks and bring them back to your center. Suggest that visitors may collect any shape or color of pebble, stone or rock, including flat shapes (see the activity “How do stones get flat” in this chapter). Provide your visitors with a sturdy bag or plastic container (e.g. yogurt or cottage cheese container) in which they may store their collections.

(You may construct craft items using pebbles, stones and small rocks in various ways. The books Snips and Snails and Walnut Whales and Handicraft (see references below) list various craft items that use pebbles, stones and small rocks).

For more information:

Nuts and seeds
Objective: to have visitors learn to identify various nuts and seeds on display.

(Later in your program, you may involve your visitors in the activity “Necklaces,” (see Type Four activities) in this chapter which uses nuts and seeds.)

Providing your visitors with pieces of paper and pencils, ask them to walk from one nut or seed to other stations that exhibit nuts and seeds. Ask them to list the identity of the tree on which each nut or seed grows. Place a card next to each nut or seed that lists multiple choices of answers.

Only one of the multiple choice answers correctly identifies the tree on which the nut or seed grows. For instance, an observation table may exhibit nuts and seeds from an oak, bitternut hickory and sugar maple trees and from watermelons and squashes. Written on a card located next to an oak acorn is a list of choices from which a visitor may decide the acorn’s association:
1) maple seed
2) oak tree acorn
3) bitternut hickory
4) white pine cone

After your visitors have completed listing the identity of each nut and seed, discuss the answers with them. (You may then speculate with them about the various ways in which people use nuts and seeds to construct craft items. Introduce an activity in which visitors use nuts and seeds titled “Necklaces,” described latter in this chapter.)

TYPE FOUR ACTIVITIES
The activities in this quadrant encourage visitors to self discover “new connections” that integrate their
experiences with new applications related to the interpretive concepts. Visitors are encouraged to teach others what they know or to create new ways of expressing or applying what they have learned.

Making sachets
**Objective:** to have visitors create sachets from fragrant parts of plants and other natural objects.

Provide individuals or families plastic mesh fruit bags such as the ones used to bag oranges in grocery stores. You may also use cheese cloth or flexible screen mesh that is cut into sections and strung together to make sachet containers.

Have your visitors fill these bags with objects they have already collected or with objects you have placed on display at one or more observation table. Provide twist ties or colored yarn with which to tie the bags.

Nature's coloring book
**Objective:** to challenge the ability of visitors to create designs or color drawings using the natural colors. (See "Finding nature's paint" in this chapter.)

Let visitors choose to make their designs on either blank paper or on drawings you provide them. Suggest that they first "paint" with the natural objects that they collected during the activity "Finding nature's paint." Also invite them to make designs with one or more of the following objects that you have set out, such as magic markers, crayons, colored pencils and charcoal pencils.

For more information:
*Audubon's Birds of America Coloring Book,* John James Audubon, Dover Publications, New York (no publishing year given)

Egg garden
**Objective:** to have visitors observe the growth patterns of the seeds they plant inside egg shells.

Provide each visitor with an egg shell. Make sure that each egg shell is broken in half so that visitors may plant their gardens inside the egg cavity. Suggest that your visitors place one piece of dry sponge (approximately one-by-one inch) into the bottom of each egg shell half.

After visitors saturate their sponges with drops of water—eye droppers work well to drop water onto the sponge—they should sprinkle one of the following seeds on top of their sponges: Alfalfa, grass or chia.

Instruct them to lightly spray or sprinkle water on their egg garden once daily. Alfalfa seeds should start growing in two or three days; grass and chia seeds usually begin growing after five to seven days of daily watering. Caution your visitors not to eat the sprouted
seeds, as many seeds may be sprayed with harmful fungicides.

You may purchase alfalfa and chia seeds at health and natural foods stores. Hardware stores and supermarkets sell grass seed.

**Cone Fliers**

**Objective:** to have visitors transform pine and spruce cones into craft items that symbolize birds.

Provide individuals or family groups with cones, soluable white glue, construction paper, scissors* and string. Suggest that your visitors cut out the following four shapes of construction paper:

1) one wing is oval shaped with a point at one end
2) the second wing should match the shape of the first (i.e. cut a piece of folded construction paper the outline of the wing to make two identical wing shapes).
3) the head is made by cutting a circle from the folded paper, leaving part of the fold uncut. A small slit should be made into the folded portion of the circle toward the center. Suggest that your visitors draw an eye and other features on their bird's head.
4) the beak is made by cutting a small rectangular shape from the construction paper.

Visitors may assemble their birds by following these steps:

1) gluing the wings to the sides of the cone
2) opening the cut edge of the folded circle construction paper and placing the narrow base of the paper over the cone. Visitors should then apply glue to where the base of the cone meets the paper
3) pushing the paper beak into the slit cut into bird's circular head (see drawing)

Suggest that visitors tie a string to a cone petal and hang their "Cone fliers" at home.

**For more information:**

**Necklaces**

**Objective:** to have visitors make necklaces from the nuts and seeds they collected during the activity "Scramble and search" and from seeds you provide them.

Provide your visitors with needles, thread and seeds from various trees. If they need extra seeds, you may also provide your visitors with seeds of melons and squash.

Demonstrate to them how to thread a needle with sewing thread and knot the ends of the thread. Then string a few nuts and seeds onto the thread to demonstrate an example of one necklace's construction. Show your visitors how to cut away the needle with a scissors and knot the ends of the thread together.
Now let your visitors assemble their own necklaces. You may also provide them magic markers or watercolor paints to color their nuts and seeds. (Remember to drill small holes into each nut (e.g. acorn, hickory) you provide your visitors. Use a small slender bit to drill)

Making cordage

Objective: to involve visitors in the making of cordage so that they can learn how to construct string, rope, fishlines or lacing.

Using a knife* or fingernail, remove two strips of bark from a piece of wood. Inform your visitors that any length of bark is suitable, as you may add strips to the others. The width of the bark should be the size you desire for the finished product.

Using a visitor to help you, demonstrate how to tie one end of the strips together with a knot. Now let your visitor hold both strands where they meet and twirl them in the same direction so that they interwine. Now twirl the two strands in the opposition direction, making sure that the twine remains tight and that each strand is sufficiently twisted. To add length to your cordage, add a new piece of bark to the existing twine a few inches from the point of intersection of the strands.

Use the same process to twist these strands together. When the twine is to the length you desire, trim off the ends that were created when you added new pieces of bark to the twine. Designating groups of two to four people, let your visitors make cordage.
"Nature Photography"

**Concrete Experience**

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**Active Experimentation**

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<td></td>
<td>Star pictures</td>
</tr>
<tr>
<td>model adapted from the 4Mat System, Excel, Inc. copyright 1980</td>
<td>From ordinary to original</td>
</tr>
</tbody>
</table>

**Abstract Conceptualization**
CHAPTER FIVE- "Nature Photography"

The activities listed in bold on the preceding page form the outline for a two- to six-hour sample "Nature Photography" program intended for presentation to an adult group.

You may organize and develop other outlines by selecting from the list of additional activities that appear in this chapter following the sample program.

Note that the majority of the activities in this chapter do not offer fundamental instruction dealing with cameras because many nature photography books already provide this. Instead, many of the activities provide you with photography techniques to further your visitors' understanding of natural history principles.

In addition, note that you may apply some of the activities to nature photography programs that meet for two or more programs. This procedure allows you to develop your visitors' prints and slides so they can refer to them at a later meeting of your nature photography program.

Here is a suggested sequence for a sample program, "Capturing creative images with your camera."

Sequence of Activities
"Capturing creative images with your camera"
1. Self-portrait pendant--10-15 minutes
2. Photo judging--10-15 minutes
3. Slide show or movie--15-30 minutes (break in your program)
4. How do I sell my photos?--10 minutes
5. Published photos--10-15 minutes
6. Perspectives--45 minutes
7. Shoot your favorites--15 minutes (break in your program)
8. Photos with philosophy--15-20 minutes

1. Self-portrait pendant
Objective: to have visitors make a name badge or pendant from an instantly developed photograph to identify themselves.

You may begin your program "Capturing creative images with your camera," by inviting arriving visitors to pose for a photograph. Photograph each visitor from a distance of four to six feet, or designate visitors to photograph one another. Then ask them to tell you the
possible uses and benefits of these self-portraits during
your program.

After a visitor mentions the value of pendant badges
for the group to indentify themselves, demonstrate the
steps to assemble badges so that your visitors may then
make them. Supply your visitors with markers so that
they can write their names on their badges. Suggest
that they cut an image from their newly developed
portrait to fit the dimensions of the badge making
equipment you provide them.

If your visitors use "Badge A Minit" (copyright, Badge
A Minit) equipment to make self-portrait badges, ask
them to cut a circular image. Another option is to
provide visitors with clear plastic name tag holders with
pins attached. Show your visitors how to replace the
small rectangular name cards with their self-portrait
photographs (i.e. slide out the retangular name card and
replace with self-portrait).

Provide a pattern made of sturdy cardboard so that
visitors can trace an outline around their photographs
and then cut either a circular or retangular shape with
a scissors. A safety pin attached to the backside of the
badges or plastic name card holders will allow your
visitors to attach the badges to their clothes so that they
can identify one another during your program.

You may purchase materials to make the "Badge A
Minit" badges from Box 800, Civic Industrial Park, La
Salle, IL 81301. You may buy the plastic name holders
from local stationery and office supply stores.

Suggested time for this activity--10-15 minutes

2. Photo judging

Objective: to have visitors evaluate the good or poor
aspects of photographs when they observe photographs
on display.

Display on one or more observation tables
photographs (six to ten) which exhibit principles of
skillful photography and others which illustrate
ineffective photography techniques. Ask your visitors
to observe these photographs.

Suggest to your visitors that they decide which
aspects of the photographs are good or poor. After
reconvening as one group, critique the photographs.
Have individuals express their opinions about one or
more of the photographs on display.

Some of the photography principles that you may
discuss about the photographs include:

--choice of subject
--focusing
--cropped or distant images
--composition
--depth of field
--perspective
--exposure
--light source and light quality

Suggested time for this activity--15-20 minutes
For more information:

3. Slide show or movie
Objective: to have visitors understand how to operate a camera when taking photographs in the outdoors; to increase their understanding of principles discussed in the slide show or movie.

Show your group of visitors either a slide show or movie dealing with nature photography. (You may obtain a listing of various movies which deal with nature photography from the Eastman Kodak Co. or in the reference listed below.) After the slide show or movie is completed, answer visitors questions. If you desire, begin a discussion that provides information to them about aspects of operating a camera not mentioned in the slide show or movie.

Suggested time for this activity--20-30 minutes

Suggested sources for obtaining slide shows:
libraries, universities, Camera Clubs

Suggested sources for obtaining movies:

(break during your program)

4. How do I sell my photos?
Objective: to have visitors understand procedures free-lance photographers usually follow when submitting photographs for publication.

After a short break, begin a discussion with your visitors which informs them about the procedures many free-lance photographers follow when they submit their photographs to the editors of newspapers and magazines.

Some of the procedures you may suggest your visitors follow when they submit free-lance photographs include:
--using suitable envelopes and cardboard supports when sending photographs;
--pinpointing which publications accept photographs;
--meeting the deadlines of editors;
--determining which publications are the most likely to publish the subjects of your visitor's photographs;
--formulating and maintaining contact with editors.

For more information:
5. Published photos
Objective: to have visitors understand current conditions for the publishing of photographs.

Ask your visitors to observe four to seven photographs that you have put on display at one or more observation table. Providing visitors with paper and pencil, have them match the pictures you have cut out from magazines with the names of the magazines which published the photographs. Visitors do this by observing a list of the periodicals and the money the magazines pay for photographs. Write this information on a large card and hang it near the observation table(s).

For example, one list of matches visitors may write down include:

<table>
<thead>
<tr>
<th>Photograph of</th>
<th>Magazine Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) campers in park .............</td>
<td>Wisconsin Trails,</td>
</tr>
<tr>
<td></td>
<td>$15-20, black/white; $50-100, color</td>
</tr>
<tr>
<td>2) red-tail hawk ...............</td>
<td>Audubon, $100-250 b/w or color</td>
</tr>
<tr>
<td>3) black bear ..................</td>
<td>National Wildlife, $125 b/w or color</td>
</tr>
<tr>
<td>4) oak woodlot with</td>
<td>Michigan Natural Resources, $50-200, color photo</td>
</tr>
<tr>
<td>solar home.....................</td>
<td></td>
</tr>
</tbody>
</table>

*Price according to The Photographer's Market (see reference below)

Mention to your visitors that the ultimate object of this activity is for them to understand the current market conditions for publishing photographs—not merely to correctly match each photograph with a periodical.

You may obtain other prices that periodicals pay for photographs from free-lance photographers by consulting the Photographer's Market.

Suggested time for this activity—10-15 minutes

For more information:

6. Perspectives
Objective: to have visitors photograph objects from four different perspectives.

Introduce to your visitors a subject that you enjoy photographing (e.g. an oak tree). Show them four different photographs or slides from each of the four perspectives:

1) one photograph or slides displays a close-up of the oak's bark.

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2) another image depicts an outline of the oak taken from a distance of 100 to 1,000 feet.
3) a third image presents a view looking upward from the lower branches to the branches in the canopy.
4) a final print or slide illustrates close-up a gall deposited on the underside of an oak leaf.

Discuss with visitors how each of your prints illustrates a different aspect of the natural history of the oak tree. Then challenge your visitors to explore the outdoors to photograph four different perspectives of one object or subject they encounter. Suggest that they show a different aspect about their subject in each photograph.

Suggested time for this activity--45 minutes

7. Shoot your favorites

Objective: to have visitors experiment with various aspects of outdoor nature photography.

During the same exploration in which your visitors undertake to do “Perspectives,” have them photograph other images in the outdoors. Encourage your visitors to photograph objects that interest them. Suggest that they experiment with variables that they may encounter when using their camera in the outdoors, such as:
--light source and light availability
--wind that shakes the objects they photograph
--perspectives, ranging from close-ups to distant images
--filter options
--lens types (e.g. a small diameter to telephoto)
--film speeds
--aperture opening diameter
--depth of field

Suggested time for this activity--15 minutes

For more information:

(break in your program)

8. Photos with philosophy

Objective: to have visitors create a personal understanding of the outdoors when they combine an outdoor scene and a quote.

Ask your visitors to read sayings (e.g. prose, quotes, poetry) written on index cards you have placed on an observation table. Instruct them to match the saying on a card of their choice with one of the photographs of outdoor scenes on display at another observation table.

After everyone has selected both a card and a photograph, show your visitors how to tape the quote and photograph down on a piece of paper so that the two form a composite image. Demonstrate how the composite
images can be secured under a stationary overhead camera (see drawing).

Now have visitors make and photograph their composite images. You may then either send them their slides in the mail or give them their slides at a future meeting of your photography class.

**Suggested time for this activity--15-25 minutes**

The list of additional activities that follow may help you organize and outline your own programs.

**TYPE ONE ACTIVITIES**

The activities in this quadrant provide visitors with experiences that directly link the program with their personal life experiences. Visitors may also have a chance to discuss those connections with one another. In this initial phase of the program visitors should discover a reason for learning the interpretive concepts.

**It's your choice**

**Objective:** to have visitors analyze the types of subjects they may choose to photograph when they are in the outdoors.

Using a large flipchart to write down your visitors' answers, speculate with them about the myriad subjects they may choose to photograph in the outdoors. Facilitate the discussion, if necessary, by mentioning that they consider shooting photographs which capture one or more of the following compositions:

--repetition
--detail
--geometric shapes
--free-form shapes
--bright colors

Have your visitors use their own knowledge and experiences to mention additional photographic composition themes which they may capture from scenes in the outdoors. (You may supplement this activity with other activities listed in this chapter, such as "Shoot your favorites" and "Close-up."

**Mime and critique**

**Objective:** to have visitors recognize the typical problems which may confront them when they shoot pictures in the outdoors.

Ask your group to watch a visitor you have designated play act a photographer who seeks to take a picture of an object in the outdoors. Using gestures and props, have the photographer act out one or more of the typical problems that besets a photographer who is attempting to photograph an object. Ask your visitors to guess the situation which confronts the acting photographer who is performing the mime. Some
situations you may employ to dramatize this scenario include:
--difficulty in loading film in the outdoors (e.g. cold weather, rain, etc.)
--wind that blows and rattles the object to be photographed (you may use an electric fan to simulate a breeze)
--variance in light due to passing clouds and then appearance of bright sunlight
--wet surroundings, branches or other vegetation that blocks access to the object that is to be photographed.
--inability to get close enough to photograph wildlife before they flee.

Then discuss with your visitors the factors which inhibit the nature photographer's quest for shooting pictures, such as those they play acted and other variables. Address and discuss how photographers solve these problems.

For more information:

Mystery photos
Objective: to have visitors analyze and identify various natural phenomena that they observe in photographs.

Ask your visitors to observe the two to four photographs you have put on display at an observation table. Ask them to guess the identity of the subjects or objects they see in each photograph. For instance, challenge your visitors to determine what a close-up photograph of:
--octagonal chambers represents in the natural world.
 (Answer: a photograph of a wasp's nest that you have photographed at close range.)
 Some other mystery photo possibilities include:
--pellets and their contents
--galls on leaves
--close-up images of the surface hairs on leaves and insects
--close-up image of the veins in a leaf
--close-up perspective of club mosses and mosses
--close-up shots of ice and crystal formations

Visitors formulate questions
Objective: to have visitors increase their understanding of photography principles when they write down questions about taking photographs.

Provide each of your visitors with a piece of paper and pencil. Suggest that they formulate one or two general questions dealing with nature photography.

Visitors may submit any form of question, for example, "Which slide film speed might work well when photographing a bird perched on a branch in bright sunlight?" to "What effect, if any, does prolonged
exposure of a camera and film to freezing temperatures have on their effectiveness?"

Why am I here?
Objective: to develop visitors' understanding of the reasons they are interested in nature photography.

After discussing your own interests and experiences dealing with nature photography, elicit the comments of your visitors. Allow them to share their levels of interest, experiences and goals when taking photographs in the outdoors. To facilitate your discussion you may pose some general, open-ended questions, such as:
1) What stimulated you to begin taking pictures?
2) What are some of your best memories of the outdoors when taking pictures?
3) What areas of nature photography do you hope to improve?
4) What expectations do you hope to fulfill at this program?

TYPE TWO ACTIVITIES
The activities in this quadrant focus on what visitors need to know in order to understand the concepts in the program. The visitors should acquire information from the interpreter, handouts, slide shows, films, supplemental readings, or experts, etc. in order to develop a foundation of knowledge to understand the interpretive concepts.

Organizing a slide show
Objective: to have visitors understand a few basic principles that they should follow when creating, organizing and presenting a slide show.

Since many of your visitors may be able to apply their skills as nature photographers in order to present slide shows to groups and organizations, suggest some basic principles that they should follow in preparing and presenting their slides, such as:
--to write an outline which they use as a guideline, not as a memorized script. Suggest to your visitors that they first visualize their script, then write for the "ears" of their audience, allowing the audience to hear without putting forth undue effort.
--to avoid reference to the slide on the screen. Suggest to them that a slide show talk should stand alone; the slides simply illustrate the presenter's points.
--to include pauses in the narration of their talks in order to add emphasis.
--to maintain a conversational tone throughout the slide show, avoiding a lecture approach.
--to include an introduction, body and conclusion in their presentation.
For further information about slide show presentations, consult one or more of the references listed below.

For more information:
Illustrations for Publication and Projection. The Society of Mechanical Engineers, United Engineering Center, 345 E. 47th St., NY 10017.

Eastman Kodak publications: "Producing Slides and Filmstrips" and "Effective Lecture Slides" (available at camera shops).

Critique and discuss
Objective: to have visitors recognize the good and poor photographic aspects of their work.

If your "Nature Photography" program meets at least twice, use part of a later session to evaluate some of the photographs and slides your visitors shot during your first meeting.

You may counsel your visitors about the quality of their prints and slides in various ways, such as:
1) Showing your entire group a series of the slides they have produced, then critiquing the slides as you view them one at a time on a slide screen (To avoid the possibility of hurting anyone's feelings when you critique the slides, do not mention by name individuals who photographed the slides you and your group view).
2) Providing information and offering advice to small groups of visitors (three to five people).
3) Offering advice to one individual at a time.
4) Passing some of your visitors' prints among your group for everyone to see while answering questions from your visitors about their prints.

Camera equipment
Objective: to have visitors understand the uses of camera equipment and the application of some fundamental principles of photography.

Using various types of cameras and accessories as demonstration models, describe to your visitors the application of the equipment to nature photography. For instance, discuss the four main types of camera view systems: Single lens reflex, rangefinder, twin lenses reflex and view cameras.

As you talk about each camera, hold it in front of you so that visitors can see it, then pass the model among your visitors for them to see the differences/similarities among the cameras. Some of the other equipment you may acquaint your visitors with includes:
--film types; lenses; light meters, electronic flash equipment; remote shutter releases; accessories: filters, carrying cases, etc.

For more information:
**Speed + aperture=exposure**

**Objective:** to have visitors recognize how light exposure affects the quality of photographs.

Working independently or in small groups (three to five people), have your visitors complete matches of a list of shutter speed settings with another list, the range of f/stop aperture openings.

Provide your visitors with examples of matches that let exactly the same amount of light hit the film. For example, the following combinations of shutter speed and aperture settings allow exactly the same amount of light to hit the film:

<table>
<thead>
<tr>
<th>Speed</th>
<th>Aperture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/1000</td>
<td>f/2</td>
</tr>
<tr>
<td>1/500</td>
<td>f/2.8</td>
</tr>
<tr>
<td>1/250</td>
<td>f/4</td>
</tr>
<tr>
<td>1/125</td>
<td>f/5.6</td>
</tr>
<tr>
<td>1/60</td>
<td>f/8</td>
</tr>
<tr>
<td>1/30</td>
<td>f/11</td>
</tr>
<tr>
<td>1/15</td>
<td>f/16</td>
</tr>
</tbody>
</table>

Then, give your visitors one example of a match: 1/125 - f/5.6, for example. When your visitors begin to match the speed and aperture opening scales, provide them with clues and advice, if that will help them better understand that the exposure of film is the result of the setting of shutter speed and aperture.

Afterward, inform your visitors of the answers to the matches and answer their questions, so they better learn how to operate a camera. **Caution** your visitors that when they take pictures in the outdoors they must also consider the "depth of field" when matching shutter speed with an aperture setting.

**For more information:**
Kodak Workshop Series: Existing Light Photography (available at camera/photography shops).


**Camera quiz**

**Objective:** to have visitors understand some basic principles associated with shutter speed, aperture setting, ASA setting and blurred photographs.

Hand out a sheet of four to six questions to quiz your visitors. Ask them to answer the questions, working individually or in small groups (two to five people). Some questions you may ask them are listed below, followed by the correct answers:

1) **Name two common ways in which a photographer errs to produce a blurred photograph?** (Answer: Two ways to make a photograph unsharp are to shoot motion at a slow shutter speed (e.g. 1/30th shutter speed or slower) thus causing the subject to appear blurred and to incorrectly focus the lens).
2) Place the f/stop settings in order from smallest aperture opening to the largest: f/8, f/2.8, f/4, f/16, f/11, f/5.6 (Answer: f/16, f/11, f/8, f/5.6, f/4, f/2.8.)

3) What is often the result of setting the ASA incorrectly? (Answer: Incorrect ASA setting will underexpose or overexpose photographs.)

4) What is generally the slowest speed that assures blur-free pictures? (Answer: 1/30th second is the slowest shutter speed at which most photographers can hold a camera steady. Photographers who shoot at a slower shutter speed increase the risk of a blur in their photographs, caused by movement of either camera, subject, or both.)

Star pictures

Objective: to have visitors understand the reasons for different colors, magnitudes and orbits of stars they observe by looking at photographs.

If your nature photography program takes place at night, you may interpret the stars for your visitors through photographs. Inform them about general principles of stars' life cycles by showing them photographs that illustrate the different colors and magnitude brightnesses of various stars. Star orbits may be seen when white streaks of stars circumpolar motion are captured through overexposure (e.g. 10-90 minutes) of a photograph.

(A stationary camera lens facing toward the star with an open shutter for a length of time greater than 10 minutes will capture on a photograph the orbital motion of stars.)

From ordinary to original

Objective: to have visitors comprehend how they can photograph scenes and objects that provide an illusion of movement on film.

Explain to your visitors that they may portray stationary or slowly moving objects in exaggerated images of movement and speed. Demonstrate how to do this by asking a visitor to walk across in front of your camera from a distance of 15 to 30 feet.

When the visitor crosses the path of camera pivot slightly to your left or right while snapping the photograph. Inform your visitors that the resulting image will show a blurred background, which appears to bring motion to the clear image of the subject in the foreground of the photograph. Explain the photographic principles of this phenomena, informing your visitors that the speed of the film in their cameras may influence their results.

(You may supplement this activity by allowing your visitors the opportunity to experiment with this method in the activity "Moving pictures" described later in this chapter.)
TYPE THREE ACTIVITIES

The primary purpose of this quadrant includes firsthand investigation and activities for visitors to try out in a "real world" situation the information they have acquired.

Color complements

Objective: to have visitors experiment with filter lenses, adjusting the light and the resulting color or tonal balance of photographs.

Ask your visitors to observe the different colored playing cards that you have put on display at an observation table. Have them select cards which illustrate colors of the spectrum photographers use when choosing filters to put over camera lenses. These colors include: red; orange; yellow; green-yellow; green; blue; purple-blue; purple; and red-purple.

Instruct each visitor to match one color of card with its complementary color, then carry their two-card match to a seat in an area where you will soon address the entire group. Provide your visitors with one example of a match so that they understand how the activity proceeds. For instance, tell visitors that the match of a red card is with its complement, a blue-green card.

After your visitors have carried their matches to the seated area, discuss with them the significance of the complementary scheme when taking photographs, and especially when using filter lenses to influence color or tonal balance of photographs. Color complement matches include:
--red = blue-green
--orange = blue
--yellow = purple-blue
--green-yellow = purple
--green = red-purple

Mention to visitors that, generally, a filter will reflect its own color (depicting objects of that color lighter than normal in the final print or transparency) and will absorb its complementary color (making it darker than normal in the result).

Thus, a red filter will pass red and absorb darker blue and green tones. Using a photograph as an example, show them how a photographer can use a red filter to capture darker tones of green light reflected in leaves, making them significantly darker than the flowers in the picture.

(Hang a color spectrum wheel poster next to the observation table(s).)

Suggest to your visitors that they use the spectrum wheel as a reference to choose matches for the colored cards that are on display.

(You may supplement this activity by allowing your visitors the opportunity to participate in the activity "Shades of colors" listed in this chapter.)

For more information:

Close-up
**Objective:** to have visitors experiment with methods of close-up photography in order to produce new photography perspectives.

Allow your visitors the opportunity to photograph objects on their own, suggesting that they concentrate on subjects for close-up shooting. Briefly, discuss with your visitors the infinite variety of subjects they may consider photographing, such as:
--flowers; leaves; insects; bark; rocks.

In addition, suggest to your visitors routes and trails at your center that offer opportunities for photographing objects at close range.

**For more information:**

Field trip photos
**Objective:** to have visitors effectively photograph animals and birds.

Because a principal problem in photographing living subjects at close range is that they frequently move quickly out of focusing range, arrange for your visitors to have more stationary wildlife to photograph.

Parks, arboretums, zoos, atriums, game farms and other public facilities offer a diversity of wildlife for your visitors to photograph at close range. Remember that in some cases you may have to receive permission from a facility in order to photograph its subjects.

Catch and click
**Objective:** to allow visitors the opportunity to photograph insects and butterflies at close range after they attract or catch them.

Provide your visitors various instruments with which they may catch or attract insects and butterflies. Using these devices, your visitors will be able to shoot photographs of these subjects at close range. One instrument you may provide visitors is a butterfly net. Cotton nets tend to be softer and less damaging to butterflies than synthetic fiber nets. Advise your visitors to use great care when removing the butterflies from the nets, as butterflies' wings are fragile and easily damaged.

Visitors may also collect insects in a small bottle or tube fitted with a rubber bung through which two tubes are inserted (see drawing). Small insects can be collected using this device, called a pooper. Demonstrate to your visitors how to suck on the mouth piece of the pooper so that air is drawn in through the inlet tube
carrying an insect with it. The gauze filter affixed over the opposite end of the mouthpiece tube prevents the captured insect from being sucked into a person's mouth.

A third device that is designed to attract butterflies to close range of your visitors' cameras is a home-made butterfly drinking stand (see drawing). This apparatus is simply a solution of sugar water put into small test tubes supported on a circular platform. A blue ring around the mouth of each test tube will help butterflies to locate the sugar solution.

For more information:

Moon illusions
Objective: to have visitors understand that the moon's size near the horizon is the same when it is higher in the sky.

If your program takes place at night, you may involve your visitors in an experiment to decide if the apparent large size of the moon near the horizon is real or illusory. Suggest to your visitors one method that they may wish to use with their cameras to determine whether a difference exists between the size of the moon they see near the horizon versus its position higher in the sky.

Invite them to step outside to photograph the moon within an hour of its rising on the eastern horizon. Then have them photograph the moon again either one to two hours later when it is seen higher in the sky or at another meeting of your program. Make sure to tell them to make both shots of the moon on the same negative. When your visitors return for the next meeting of your nature photography program, see if the diameter of the moon's discs varies.

(No size difference exists; people, however, often believe the moon is smaller when seen higher in the sky because they are conditioned to understand that objects get smaller as they move away from their eyes. In addition, people believe the moon is larger at the horizon because they perceive the moon to be in three-dimensional relation to other objects, such as houses and trees. Seen higher in the sky, however, people believe the moon is smaller because they perceive it to be a flat, two-dimensional object.)

For more information:

Moving pictures
Objective: to have visitors test their ability to photograph scenes that provide an illusion of movement on film.
Allow your visitors the opportunity to experiment with the method you explained in the activity "From ordinary to original" in style two quadrant of this chapter.

Suggest that they photograph simple objects which should be as bright as possible in front of a dark as possible a background. Suitable objects include:
--light-colored ducks swimming slowly in water.
--insects crawling on leaves or in the grass.
--lighter colored frogs against pond vegetation.

Caution your visitors that they get the best results when the set their shutter speed to provide a generous exposure of light (e.g. setting of 1/125th second or slower) and do not pan too slowly.

**Shutter bug**

**Objective:** to have visitors demonstrate an understanding of how aperture opening sizes affect the quality of photographs.

Using a slide projector and screen, show your visitors slides of various sizes of round, white circles. These diameter sizes, ranging from the largest (i.e. the f/1 setting) to the smallest white circle (i.e. the f/16 setting), may be made from clear blank slides. Simply use a black magic marker to block out all but the central circular portion of the slide.

The aperture opening inside the black area of the white circle your visitors see may range from the size of a pinhole (f/16 setting) to the size of the entire lens (f/1 setting). When flashing the various aperture opening slides on the screen, ask your visitors to match the opening sizes with an f/stop number. Place a large card which lists the f/stop number range found on most cameras on a wall near your screen. Visitors may use this f/stop range list as a reference when attempting to match the various sizes of white circles with an f/stop number.

Give your visitors the answers to the first one or two white diameter sizes you flash on the screen, if this will help them understand how to determine the f/stop readings of the circular images you project on the screen.

**For more information:**

**TYPE FOUR ACTIVITIES**

The activities in this quadrant encourage visitors to self discover "new connections" that integrate their experiences with new applications related to the interpretive concepts. Visitors are encouraged to teach others what they know or to create new ways of expressing or applying what they have learned.
Photograms

Objective: to have visitors create designs on photographic paper.

Provide your visitors with various natural objects or suggest that they use the ones they collect near your center. Tell your visitors to place their objects on the surface of the photographic paper you have provided them. Mention that they can greatly influence their designs by placing either opaque or transparent objects on the photographic paper. They may also change their images by moving the distance of the objects from a light source (e.g. sunshine or electric light) or altering the orientation of the objects.

They produce a final design on the photographic paper when they lay objects on the paper and expose them to a light source to form outlines of the objects on their paper.

For more information:

Trick photography

Objective: to have visitors create special effects in their photographs.

Describe to your visitors various ways in which they may produce special effects and various compositions in their photographs. For example, you may suggest that they depict multiple images of a reflected subject. To achieve this effect, demonstrate to your visitors how the distance between the camera and mirror must be kept comparatively short and that between the mirror and the object comparatively long. Focus the camera lens on the combined total distance from the camera to the mirror to the object. In addition, set the lens aperture to a large opening.

You may also suggest that your visitors use glass panes, water puddles or glossy, reflective foil when composing trick photographs. Most important, allow your visitors ample time to create their own methods to make trick photographs.

Another method for creating trick photographs is to have your visitors combine objects to make comic photographs. Some examples include:
--preserved bird parts transferred to other species, such as when hawk wings are affixed with paper clips to another mounted bird, such as a northern cardinal or American robin;
--a mounted owl placed on a person's shoulder;
--deer antler affixed to other mammals.

For more information:

Photo storytelling

Objective: to have visitors express their understanding of the slides each has made during your
program by narrating and presenting to the entire group slides which illustrate a story or theme.

If your nature photography program meets for more than one session, ask your visitors to organize and present to the group six to ten of the slides each has made during your program. Suggest that they select some of their slides to create a show that has a theme or story. Ask them to prepare a narration to correspond to their slides.

Some examples of themes your visitors may develop include:
1) Natural history information about specific objects in nature.
2) Various colors of objects in the outdoors.
3) Various textures of objects in the outdoors.
4) Various views of water, such as in rivers, in puddles or as dew and fog.
5) Feelings and moods portrayed through photographs.
6) The combination of natural scenes with human-made objects on the land (e.g. fence rows, cabins, etc.)

Paint chip photos
Objective: to have visitors identify the various colors which they can produce using filter lenses.

Provide small groups of visitors with various colors of paint; two people work well together for this activity. Have them photograph these with no filter, then with various filter colors. Ask them to compare the original color paint chip to its color when viewed through a filter.

Explain how they may make a game out of this experiment: one visitor places one color filter on a camera and gives the camera to his/her partner. The person with the camera then looks at one paint chip through the lens of the camera and must decide the real color of the paint chip. Conversely, a visitor may identify the color of a chip and ask the observer to say what color filter is on the camera.

Tell your visitors that they should close their eyes or look away from the chips and filters before guessing the colors of filters and paint chips. (You may be able to get free paint chips from hardware and paint stores.)

For more information:

Photo trades
Objective: to have visitors add different slides to their personal slide collections.

During the publicity for your nature photography program or at the first meeting of a program that meets more than one time, ask your visitors to bring slides with them when they come to your center. Make sure that you have told your visitors to write their names on each slide they bring. Then have them spread their
slides on observation tables and light tables. Visitors may then trade slides with one another.

Shades of colors

Objective: to have visitors create unordinary images of colors in the scenes of their photographs by changing the colors of filter lenses on their cameras.

Allow your visitors the opportunity to create their own photographs using different colored filter lenses. For instance, your visitors may create unordinary images of a typical sunset by placing a colored filter lens on their cameras.

Mention to your visitors that, generally, a filter will reflect its own color (i.e. depicting objects of that color lighter than normal in the final print or transparency) and will absorb its complementary color (making it darker than normal in the result). Thus, if your visitors place a green filter on their cameras while photographing a sunset, the filter will pass green and absorb the darker red tones.

For more information:
APPENDIX—Summaries of Survey Results

"BIRDS"

25 Nature Centers Offer "Birds" Programs

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2 hr. mode 2 hr. mode

*equals a half-day program

**equals a full-day program

***equals the total hours an ongoing program met over a series of weeks
**WILDFLOWERS**

22 Nature Centers Offer "Wildflowers" Programs

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*1.5 hr. mode*     *3 hr. mode*

*equals a half-day program*

**equals the total hours an ongoing program met over a series of weeks*
"PHENOLOGY/SEASONAL PROGRAMS"

15 Nature Centers Offer "Phenology/Seasonal Programs"

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* 15 hr. mode
** 8 hr. mode

* equals a half-day program
** equals a full-day program
*** equals the total hours an ongoing program met over a series of weeks
**** equals the total hours of a workshop that met once a week for seven consecutive months
13 Nature Centers Offer “Nature Crafts”

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2 hr. mode 4, 6, 15, 20 hr. mode

*equals a half-day program
**equals a full-day program
***equals the total hours an ongoing program met over a series of weeks
12 Nature Centers Offer "Nature Photography"

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*2, 3, 6 hr. mode

*equals a half-day program
**equals a full-day program
***equals the total hours an ongoing program met over a series of weeks