Performance Descriptors and Classroom Assessments

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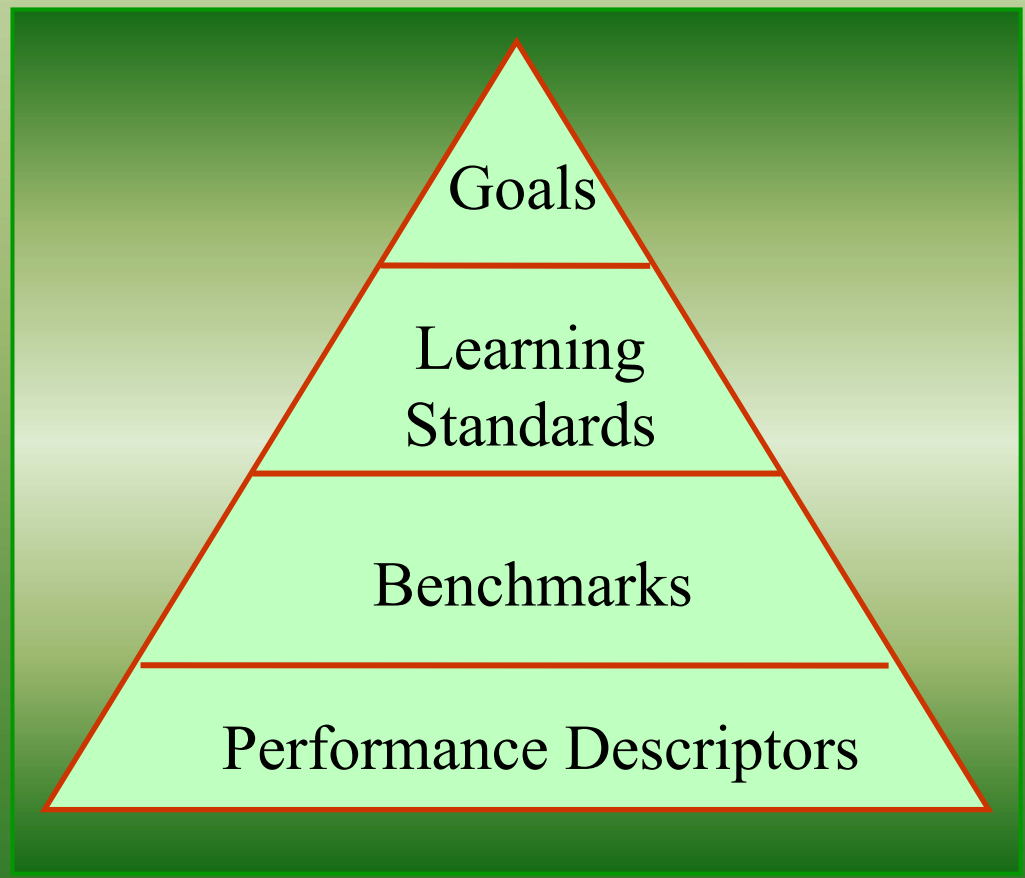
This presentation is designed to help groups of teachers use the Performance Descriptors and the Classroom Assessments. Before using this with groups of teachers review the presentation and print some of the items found on the website or CD to facilitate the group activities.

Topics In This Presentation

- Standards as Achievement Targets
- Performance Descriptors
- Classroom Assessments
- Activities for Staff Development
- Use www.isbe.net to find resources

Standards Are Achievement Targets



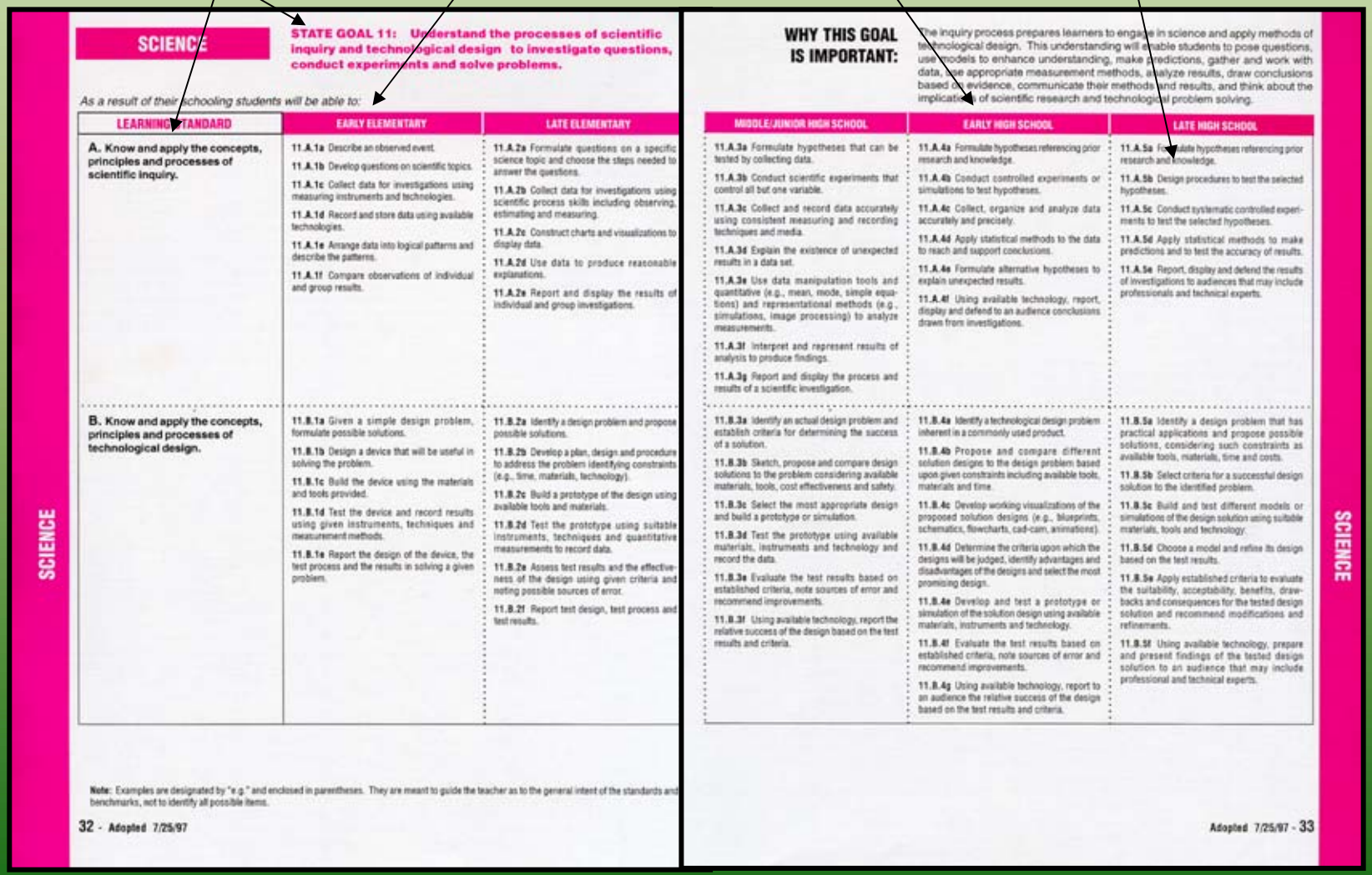
- **Goals** are the most general of the statements about learning. There are 30 state goals over seven learning areas. Science has three goals.
- **Learning Standards** are aligned under each goal area. They are the first breakdown and the initial target for learning. They will be repeated or reinforced in many lessons. Science has ten standards within its three goals.
- **Benchmarks** further describe learning at 5 levels:
  - Early Elementary
  - Late Elementary
  - Middle/Junior High
  - Early High School
  - Late High School

- **Performance Descriptors** are resources that help to make the standards and benchmarks more specific. They evolved from the State Goals and Standards with each layer adding more detail and specificity.

1. The primary purpose of the Performance Descriptors is to provide educators with clear descriptions of the performance expectations for the ILS stage by stage (grade by grade).
2. Performance Descriptors supplement the ILS. The descriptors are not required, nor are they an exhaustive listing of all expectations.
3. Performance Descriptors are classroom resources to help teachers plan their own curriculum.
4. The current Performance Descriptors are available on the ISBE web-site (www.isbe.net)

Illinois Learning Standards

Goal | Standards | Benchmark Levels | Benchmark Statements



SCIENCE

STATE GOAL 11: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.

As a result of their schooling students will be able to:

LEARNING STANDARD	EARLY ELEMENTARY	LATE ELEMENTARY
A. Know and apply the concepts, principles and processes of scientific inquiry.	**11.A.1a** Describe an observed event. **11.A.1b** Develop questions on scientific topics. **11.A.1c** Collect data for investigations using measuring instruments and technologies. **11.A.1d** Record and store data using available technologies. **11.A.1e** Arrange data into logical patterns and describe the patterns. **11.A.1f** Compare observations of individual and group results.	**11.A.2a** Formulate questions on a specific science topic and choose the steps needed to answer the questions. **11.A.2b** Collect data for investigations using scientific process skills including observing, estimating and measuring. **11.A.2c** Construct charts and visualizations to display data. **11.A.2d** Use data to produce reasonable explanations. **11.A.2e** Report and display the results of individual and group investigations.
B. Know and apply the concepts, principles and processes of technological design.	**11.B.1a** Given a simple design problem, formulate possible solutions. **11.B.1b** Design a device that will be useful in solving the problem. **11.B.1c** Build the device using the materials and tools provided. **11.B.1d** Test the device and record results using given instruments, techniques and measurement methods. **11.B.1e** Report the design of the device, the test process and the results in solving a given problem.	**11.B.2a** Identify a design problem and propose possible solutions. **11.B.2b** Develop a plan, design and procedure to address the problem identifying constraints (e.g., time, materials, technology). **11.B.2c** Build a prototype of the design using available tools and materials. **11.B.2d** Test the prototype using suitable instruments, techniques and quantitative measurements to record data. **11.B.2e** Assess test results and the effectiveness of the design using given criteria and noting possible sources of error. **11.B.2f** Report test design, test process and test results.

Note: Examples are designated by "e.g." and enclosed in parentheses. They are meant to guide the teacher as to the general intent of the standards and benchmarks, not to identify all possible items.

WHY THIS GOAL IS IMPORTANT:

The inquiry process prepares learners to engage in science and apply methods of technological design. This understanding will enable students to pose questions, use models to enhance understanding, make predictions, gather and work with data, use appropriate measurement methods, analyze results, draw conclusions based on evidence, communicate their methods and results, and think about the implications of scientific research and technological problem solving.

MIDDLE/JUNIOR HIGH SCHOOL	EARLY HIGH SCHOOL	LATE HIGH SCHOOL
11.A.3a Formulate hypotheses that can be tested by collecting data. **11.A.3b** Conduct scientific experiments that control all but one variable. **11.A.3c** Collect and record data accurately using consistent measuring and recording techniques and media. **11.A.3d** Explain the existence of unexpected results in a data set. **11.A.3e** Use data manipulation tools and quantitative (e.g., mean, mode, simple equations) and representational methods (e.g., simulations, image processing) to analyze measurements. **11.A.3f** Interpret and represent results of analysis to produce findings. **11.A.3g** Report and display the process and results of a scientific investigation.	**11.A.4a** Formulate hypotheses referencing prior research and knowledge. **11.A.4b** Conduct controlled experiments or simulations to test hypotheses. **11.A.4c** Collect, organize and analyze data accurately and precisely. **11.A.4d** Apply statistical methods to the data to reach and support conclusions. **11.A.4e** Formulate alternative hypotheses to explain unexpected results. **11.A.4f** Using available technology, report, display and defend to an audience conclusions drawn from investigations.	**11.A.5a** Formulate hypotheses referencing prior research and knowledge. **11.A.5b** Design procedures to test the selected hypotheses. **11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses. **11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results. **11.A.5e** Report, display and defend the results of investigations to audiences that may include professionals and technical experts.
11.B.3a Identify an actual design problem and establish criteria for determining the success of a solution. **11.B.3b** Sketch, propose and compare design solutions to the problem considering available materials, tools, cost effectiveness and safety. **11.B.3c** Select the most appropriate design and build a prototype or simulation. **11.B.3d** Test the prototype using available materials, instruments and technology and record the data. **11.B.3e** Evaluate the test results based on established criteria, note sources of error and recommend improvements. **11.B.3f** Using available technology, report the relative success of the design based on the test results and criteria.	**11.B.4a** Identify a technological design problem inherent in a commonly used product. **11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time. **11.B.4c** Develop working visualizations of the proposed solution designs (e.g., blueprints, schematics, flowcharts, cad-cam, animations). **11.B.4d** Determine the criteria upon which the designs will be judged, identify advantages and disadvantages of the designs and select the most promising design. **11.B.4e** Develop and test a prototype or simulation of the solution design using available materials, instruments and technology. **11.B.4f** Evaluate the test results based on established criteria, note sources of error and recommend improvements. **11.B.4g** Using available technology, report to an audience the relative success of the design based on the test results and criteria.	**11.B.5a** Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time and costs. **11.B.5b** Select criteria for a successful design solution to the identified problem. **11.B.5c** Build and test different models or simulations of the design solution using suitable materials, tools and technology. **11.B.5d** Choose a model and refine its design based on the test results. **11.B.5e** Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements. **11.B.5f** Using available technology, prepare and present findings of the tested design solution to an audience that may include professional and technical experts.

SCIENCE

Performance Descriptors for Illinois Learning Standards

Early Elementary Grades 1-3			Late Elementary Grades 4 - 5	
Stage A	Stage B	Stage C	Stage D	Stage E
Grades 1-2	Grades 1-2-3	Grades 2-3-4	Grades 3-4-5	Grades 4-5-6

Middle/Junior High School Grades 6 - 8			Early High School Grades 9-10	Late High School Grades 11-12
Stage F	Stage G	Stage H	Stage I	Stage J
Grades 5-6-7	Grades 6-7-8	Grades 7-8-9	Grades 8-9-10	Grades 10-11-12

Performance Descriptors

- **The design of the Performance Descriptors** is to show increased performance incrementally through 10 stages of educational development.
- This means the content, skills and reasoning get more in depth as the continuum is followed through stage J.
- This does not mean that the students in 1st grade or 2nd grade don't reason- rather they reason like 1st or 2nd graders.
- There are 10 stages for each standard.
- The stages can correspond to grade levels. Stage A is for 1st grade, Stage J is for the late high school level.
- However, a range of grades could be part of each stage, because students in your class are not all at the same place at the same time.

<u>Example</u>

- If a 2nd grade teacher working on curriculum wanted to know where to begin, the suggestion is to start with stage B but also to look back at Stage A and ahead to Stage C.
- Schools also have different curricula and may have items from one stage at a different grade level from another school.

Specificity of Science Statements

Let's take an example of the hierarchy from Goal to Performance Descriptors for Stage H, which could be the 8th grade level.

At the level of the GOALS…students should

- ***Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.*** *(Goal 11)*
- ***Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.*** *(Goal 12)*
- ***Understand the relationships among science, technology and society in historical and contemporary contexts.*** *(Goal 13)*

Basically, we want students to apply the processes of science to understand the concepts of science with real-world connections.

Specificity of Science Statements

THE STANDARDS are Continuing at Stage H, let's look at three specific standards to review together:

- *From 11A: to know and apply the concepts, principles, and processes of scientific inquiry*
- *From 12B: to know an apply the concepts that describe how living things interact with each other and with their environment*
- *From 13B: to know and apply the concepts that describe the interaction between science, technology and society*

Basically, we want students to apply the processes of scientific inquiry to understand the concepts of the environmental sciences with real-world connections within and between science, technology and society.

Finer Specificity of Science Statements

- **BENCHMARKS** help to define the standard further.
- **DESCRIPTORS** are very specific and help to clarify the standard at each of the ten stages. Notice the grain size of the statement. These statements are more at the level for teaching and assessing in the classroom. Several of these statements could be put together in the same unit of study and even combined with descriptors from other Science Standards or those from a different learning area.

Finer Specificity from the Descriptors

- From 11 A at stage H:
  - *Formulate an issue-specific hypothesis…*
  - *Design scientific issue investigation which addresses proposed hypothesis…*
  - *Conduct issue investigation…*
  - *Interpret and represent analysis of results…*
  - *Report, display and defend the process and findings of issue investigation….*

  This provides the scientific process….

Add concepts and connections … from the descriptors

- From 12 B at stage H:
  - *Apply scientific inquiries to…*
    - *Explore the implications of change and stability in ecosystems or*
    - *Examine species' demise or success within ecosystems or*
    - *Study biogeography or*
    - *Analyze Illinois-specific ecosystems and biomes*
- From 13 B at stage H:
    - *to explore the interaction of resource acquisition, technological development and ecosystem impact or*

Performance Standards

Performance Standards
include all of the following:

- Performance Descriptor
- Assessment Task
- Performance Levels (based on a Rubric) with Student Work Samples

The performance descriptors and assessment tasks were written by teachers. Teachers field tested each assessment and scored the student work samples.

Classroom Assessments

Each assessment is organized in the following manner:

Performance Standard

Procedures for Instruction, Assessment, and Evaluation

Time Frame

Resources

To be added: Exemplars at Meets and Exceeds levels

See Teacher's Guide to Classroom Assessments on CD or www.isbe.net for more information

RUBRIC: Continuum of Evidence

From Present/Correct to Absent/Incorrect

Evidence is Present and Correct

Exceeds All or almost all evidence is present and correct	Little evidence is absent or incorrect
Meets Most evidence is present and correct	Some evidence is absent or incorrect
Approaches Some evidence is present and correct	Most evidence is absent or incorrect
Begins Little evidence is present and correct	All or almost all evidence is absent or incorrect

Evidence is Absent or Incorrect

SCIENCE RUBRIC

Exceeds - must receive no more than one 3 and the rest 4s in the other areas of the rubric.
Meets - may receive no more than one 2 and a combination of 3s and 4s in the other areas of the rubric.
Approaches - may receive no more than one 1 and a combination of 2s, 3s, or 4s, in the other areas of the rubric.
Begins - must receive at least a 1 all 3 areas of the rubric.

	KNOWLEDGE Knows and understands scientific terms, facts, concepts, principles, theories and methods	**APPLICATION** Applies scientific knowledge, skills and methods to manipulate, analyze, synthesize, create and evaluate	**COMMUNICATION** Communicates scientific knowledge and applications through writing, speech, and visual displays
4	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are complete and correct.	• Applications are thorough, appropriate, and accurate.	• Written, oral and/or visual communication is well-organized and effective.
3	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are mostly complete and correct.	• Applications are mostly thorough, appropriate, and accurate.	• Most of the written, oral and/or visual communication is well-organized and effective.
2	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are somewhat complete and correct.	• Applications are somewhat, appropriate, and accurate.	• Some of the written, oral and/or visual communication is organized and effective.
1	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are minimally present or correct	• Applications are minimally appropriate and accurate.	• Little of the written, oral and/or visual communication is organized and effective.
0	• All descriptions of scientific terms, facts, concepts, principles, theories and methods are missing and/or incorrect.	• All applications are missing and/or incorrect.	• All of the written, oral or visual communication is missing and/or lacks organization.
Score			

Science RUBRIC on www.isbe.net

Group Activity One

In your group:

- Choose one of the following four examples given in this power point (Stage D – Beaks to Survive, Stage E – Frozen Stiff, Stage H – Illinois Habitat Happening, Stage I – Population Dynamics);
- Read the task;
- Review the science rubric and identify the knowledge, reasoning, and communication to be used in this task.
- Look at the evaluation procedure (last step) in the assessment;
- Discuss how the example (or others) can be tested in the classroom, evaluated by the teacher and compared among colleagues.

Beaks to Survive

Performance Standard 12B/11A.D

Students will apply the processes of scientific inquiry to examine relationships among organisms in their environment accordingly:

- *Knowledge*: Identify and describe the physical features that help animals (birds) adapt to and/or survive in their environments.
- *Application*: Model the features (beaks) of animals (birds) that help them adapt and/or affect their chances for survival.
- *Communication*: Explain how physical features help them adapt to and/or survive in their environments.

Beaks to Survive

Procedures

1. ***In order to know and apply concepts that describe how living things interact with each other and with their environment (12B) and the processes, concepts and principles of scientific inquiry (11A),*** students should experience sufficient learning opportunities to develop the following:
    - Formulate inquiry questions associated with the comparative body structures and functions as related to the adaptive possibilities in differing environments.
    - Propose and conduct inquiry investigation which finds answers to posed hypotheses/questions with limited variables.
    - Research resources for comparative photographs, environmental factors, food resources, etc. (data) for analysis to resolve proposed hypothesis statements.
    - Communicate the findings associated with adaptations related to the environment and structures and/or functions.
    - Generate further questions for future investigations.

Note to teacher: This activity relates to knowledge associated with the standard 12 B, while addressing the performance descriptors for stage D within standard 11A. This classroom suggestion is shortened from its original source at Science NetLinks: http://www.sciencenetlinks.com/lessons.cfm?BenchmarkID=5&DocID=81

It was collaboratively created using materials and resources from The Oakland Zoo, SeaWorld, eNature.com, Peterson Online, the National Aquarium in Baltimore, the Missouri Department of Conservation, A Children's Guide to Birdwatching, and Wild About Birds websites. Permission is granted for educational purposes. The direct hyperlinked resources and activities provide extraordinary examples and strategies for classroom use. An interesting, optional extension will incorporate the processes of technological design (11B) in an assessment activity, using the Build a Bird activity from the National Aquarium in Baltimore.

Beaks to Survive

Procedures continued

2 Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.

3 Begin contextual inquiry investigation for Patterns of Adaptations in Animals with questions such as: What do birds beaks do? How? What are the similarities between all beaks? What kinds of distinctions are there between different birds and their beaks? How does the food source relate to the beak's structure, etc.? Guide students toward answering their questions and stating their understanding using appropriate scientific vocabulary terms and resources. Introduce the investigation's premise of studying beaks of birds to study environmental adaptation variations. Using the process suggested at Science NetLinks for the Bird Beaks activity, students will compare pictures of varieties of birds to the kinds of foods that they eat in their natural habitats. They will use a variety of tools, mimicking beak types, such as "spoons, chopsticks, tweezers" to retrieve a variety of foods for birds, such as "glass marbles, pennies, toothpicks" in timed, competitive attempts, graphing their results. Following the discussion of their results, students should respond to the following suggested questions:

- Which beak collected the most of which food item?
- What do you think would happen to your bird if only one food item was available?
- Which of the beak types feed most successfully on which food item?
- Was one beak type successful with ore than one food item?
- Did your earlier observations about beak types help you to understand how birds feed side by side but utilize different food items?

Beaks to Survive

Procedures continued

4 Encourage students to generate further questions which could follow from this initial investigation. Science NetLinks suggests ideas such as predicting habitats where one beak type is best suited for the foods found there, finding other beak types and correlations to types of "tools", considering if certain beak types are more successful in multiple kinds of environments.

5 Evaluate each student's work using the Science Rubric as follows and add the scores to determine the performance level:

- *Knowledge*: The identification and descriptions of the birds' physical features and their food source types were complete and correct,
- *Application*: The information on the charts was complete and well-organized.
- *Communication*: The explanations were complete and accurate. Questions for future studies were pertinent and applicable.

Beaks to Survive

Examples of Student Work

- Meets
- Exceeds

Time Requirements

- Two to three 25 to 30 minutes sessions, depending on Internet access to resources and choices of options

Resources

- Internet access for students in small groups
- Beak practice materials: spoons, chopsticks, tweezers, marbles, pennies, tooth picks, etc.
- Clock/stopwatch
- Science Rubric

Frozen Stiff

Performance Standard 12B/11A.E

Students will apply the process of scientific inquiry to categorize organisms by their energy relationships in their environments accordingly:

- *Knowledge*: Identify and describe the adaptations of predators and prey in ecosystems.
- *Application*: Correlate the factors for success for predators and prey in their habitats.
- *Communication*: Generalize the interrelationships of adaptations of predators and prey with their habitats.

Frozen Stiff

Procedures

1. ***In order to know and apply concepts that describe how living things interact with each other and with their environment (12B) and the concepts, principles and processes of scientific inquiry (11A),*** students should experience sufficient learning opportunities to develop the following:
    - Construct a scientific inquiry hypothesis from research of different ecosystem inhabitants with a focus on predator-prey adaptations and relationships in ecosystems.
    - Collect information about habitat conditions, relationships and adaptations of animals that live there.
    - Role-play the processes involved in finding shelter, food and safety in the "Quick Frozen Critters" game.
    - Analyze ratios of responses according to various factors.
    - Make inferences about the successes of predators and prey and limiting wildlife populations.

    Note to teacher: This activity relates to knowledge associated with standard 12B, while addressing the performance descriptors for stage E within standard 11A. This activity was produced originally through Project WILD and shared with ISBE in collaboration with the Illinois Department of Natural Resources. More information about this resource is available from Randi Wiseman (rwiseman@dnrmail,.state.il.us) through the Office of Land Management and Education, 1 Natural Resource Way, Springfield, IL 62702; phone: 217-524-4126 and the web site: http://dnr.state.il.us/lands/education/classrm/wild/intro.htm

Frozen Stiff

Procedures continued

2 Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.

3 Provide background information and directions to enact the Quick Frozen Critters simulation. Students will be divided into predators and prey; they will alternate roles. Following the simulation, provide time for students to interpret their results in small groups and eventually for individual reflections. Discuss the ways they escaped capture when they were prey—which ways were easiest? Most effective? What means did they use as predators to capture prey? Which were the best? What did the predators do in response to a prey animal that "froze"? In what ways are adaptations important to both predator and prey? How do predator/prey relationships serve as natural limiting factors affecting wildlife?

4 Assign one or more of the following assessment choices:

- Choose a predator and its prey. Describe the adaptations of both in their habitats. What are their limiting factors?
- Draw an imaginary animal that can escape: A quick flying predator: A stalking predator: A pouncing predator. Explain its adaptations.
- Write about a predator that can capture: A well-camouflaged specie: A species with excellent eyesight, a species that has body armor or quills. Explain its adaptations.
- Create an instruction manual for predators or prey. Use actual animal adaptations.

5 Evaluate each student's work using the Science Rubric as follows and add the scores to determine the performance level:

- *Knowledge*: The identification and descriptions of the relationships that exist among predators and prey were complete and correct.
- *Application*: The explanations for responses and adaptations were complete and accurate.
- *Communication*: The reflections were well-detailed and accurately explained the predator/prey relationship.

Frozen Stiff

Examples of Student Work

- Meets
- Exceeds

Time Requirements

- 20 minutes for overview and explanation of role-playing scenarios; 1 class period for 'freeze-tag' adaptation; 1 class period for discussion and reflections; additional time for creating final reports; 1 class period for presentations

Resources

- Food tokens (3 per student); vests or labeling devices for predators; 4 boundary markers for corners of 'habitat', 4-5 hula hoops for 'safe shelters'
- Data tables; timers (5-7 minute maximum periods)
- Science Rubric

Frozen Stiff

BACKGROUND INFORMATION

- Predator: an animal that kills and eats other animals for food.
- Prey: an animal that is killed and eaten by other animals for food.
- Limiting factors: Factors (e.g., disease, climate, pollution, accidents, shortages of food) that affect an animal when they exceed the limits of tolerance of that animal (predators are limiting factors for prey; prey are limiting factors for predators.)
- Animals display a variety of behaviors in predator/prey relationships. These are adaptations to survive.
- Some prey behaviors are signaling to others, flight, posturing in a fighting position, scrambling for cover and even "freezing" on the spot to escape detection or capture by predators. The kind of behavior exhibited partly depends on how close the predator is when detected by the prey. Each animal has a threshold for threat levels. If a predator is far enough away for the prey to feel some safety, the prey may signal to others that a predator is near. If the predator come loser, the prey may try to run away. If the predator is too close to make running away feasible, the prey may attempt to scurry to a hiding place. If the predator is so close that none of these alternatives is available, the prey may freeze in place. The closer the predator comes to the prey animal, the more likely it is that the prey will 'freeze' in place. This 'freezing' occurs as a kind of physiological shock in the animal. (Shelter or camouflage also may make them invisible to the predator when they freeze.)
- Too often people who come upon animals quickly and see them immobile infer that the animals are unafraid when, in reality, the animals are 'frozen' or as the adage goes, "frozen stiff".
- The main purpose of this activity is for students to recognize the importance of adaptations to both predators and prey and to gain insight into limiting factors affecting wildlife populations.

Frozen Stiff

PROCEDURE:

1. Select any of the following pairs of predators/prey: coyotes/cottontails; hawks, ground squirrels; cougar, deer; foxes, quail. Identify students as either "predators" or "prey" for a version of "freeze tag" with approximately one predator per every four to six prey.
2. Using available space (gymnasium or playing field), identify one end as the "food source"; and the other end as "shelter".
3. Place 4-5 circles (hula hoops, string circles, chalk on asphalt, etc.) on the open area between the "shelter" and the "food." These represent additional shelter or "cover" for the prey and can be distributed randomly.
4. Food tokens are placed in the "food source" zone on the ground. Allow three food tokens for each prey animal.
5. Clearly identify predators using safety vests or other means.
6. Use a whistle or signal to start each round. When a round begins, have the prey start from their "shelter." The task of the prey animals is to move from the permanent shelter to the food source, collecting one food token each trip and returning to the permanent shelter. To survive, prey must obtain three food tokens. Their travel is hazardous, however. If they spot a predator, they can use various appropriate prey behaviors, including warning other prey that a predator is near. Preys have two ways to prevent themselves from being caught by predators: They may "freeze" any time a predator is within five feet of them, or they may run for cover (with at least one foot within the hula hoops). Frozen prey may blink, but otherwise should be basically still without talking. Prey can have bandannas in their pockets which when removed by predator represents predation. Prey can also be assigned different modes of locomotion.
7. Predators start the activity anywhere in the open area between the ends of the field and thus are randomly distributed between the prey's food and permanent shelter. Predators attempt to capture prey to survive, tagging only moving (not "frozen") prey, by removal of bandanna. Predators must each capture two prey in order to survive. Captured preys are taken to the sidelines by the predator whom have captured them.
8. Establish ground rules for student behavior. Behave in ways that are not harmful to other students, even when simulating predator behavior.
9. Set a time limit of 5-7 minutes for each round. Remind prey that they can remain frozen as long as they like, but if they do not have enough food at the end of the activity, they will starve to death. In nature, an animal must balance the need to find food with the sometimes conflicting need for safety.
10. Play four rounds, allowing each student to be both prey and predator. Record the number of captures in each round. Have the students who are captured become predators, and have each predator that did not acquire enough food in a round become a prey animal in the succeeding round. This feature quickly develops the concept of dynamic balance as prey and predator populations fluctuate in response to each other.

Illinois Habitat Happening

Performance Standard 12B/11A/13B.H

Students will apply the processes of issue investigations as scientific inquiry to analyze Illinois-specific ecosystems and biomes and their local issues of resource acquisition/conservation/management and/or technological development, accordingly:

- *Knowledge*: Define the optimum and actual biome setting and conditions and change and stability factors within a local habitat.
- *Application*: Conduct an investigation of a local habitat/ecosystem which is facing an interaction impact dilemma.
- *Communication*: Report the findings of the issue investigation associated with the interactions within the local habitat from group work and individual reflections.

Illinois Habitat Happening

Procedures

1. ***In order to know and apply concepts that describe how living things interact with each other and with their environment (12B), and apply the concepts, principles and processes of scientific (issue) inquiry (11A), and the concepts that describe how living things interact with each other and their environment (13B),*** students should experience sufficient learning opportunities to develop the following:
    - Generate inquiry questions that addresses a local ecosystem or biome issue, associated with:
        - the interaction of resource acquisition, technological development and local ecosystem impact, and/or
        - natural resource conservation and management programs within a particular local ecosystem, and/or
        - the implications of change and stability in the local ecosystem or biome, and/or
        - specific species demise or success within this ecosystem or biome, and/or
        - the biogeography of Illinois with specific attention to its topographic features, population data, plant diversity and distribution, etc., and/or
        - scenarios of changes to the local ecosystem for near- and long-term future contingencies, etc.
    - Collect and research pertinent qualitative and quantitative data, research and expert resources that address the selected local issue, including:
        - seasonal/annual data of ecosystem factors, and/or
        - estimates of interaction cost factors, etc.

Illinois Habitat Happening

Procedures continued

- Select applicable conceptual, mathematical or physical models for utility.
- Design scientific issue investigation that addresses proposed inquiry questions.
- Propose applicable survey instruments to assess depth of informed opinions on issue.
- Select associated research, analysis and communication components for investigation.
- Use appropriate technologies for data collection and assimilation.
- Follow established formats for random sampling, if necessary.
- Follow all procedural and safety precautions and materials/equipment handling directions.
- Interpret and represent analysis of results.
- Evaluate data sets to explore explanations of unexpected responses and data concurrence.
- Evaluate survey validity and reliability.
- Analyze research and data for supporting or refuting the hypothesis of the inquiry investigation.
- Determine action response options to deal with issue in local context.
- Report, display and defend the process and findings of the investigation.
- Generate further questions or issues for additional consideration.
- Evaluate resolutions or responses for action for applicable correlations, consolidation or explanation.

Note to teacher: This activity relates to knowledge associated with standard 12B, while addressing the performance descriptors for stage H within standard 11A and 13B. Data for local ecosystems may be accessed from the county offices of the Association of Illinois Soil and Water Conservation Districts and the Illinois Department of Natural Resources, Illinois State Water, Geological and Natural History Surveys and county and municipal departments and agencies.

Illinois Habitat Happening

Procedures continued

2 Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.

3 Begin this investigation with foundational questions and information about ecosystems generally and Illinois' ecosystems specifically. Further specific details should follow relating to the local ecosystem, familiar to the students. Determine a local issue facing the citizens of the local ecosystem (such as subdivision development, groundwater contamination, local conservation policies, landfill closure, energy production, wildlife control, etc.) Devise group-work and individual assignments for the issue investigation including data gathering and analysis, model research and development, survey instrument creation, completion and analysis, and mechanism for reporting findings with student input. Present group or individual findings to classroom audience. Students should prepare journal entries for progress of investigation and foundations of ecosystem facts and applications. Individual submissions on the personal reflections as a citizen and future questions to consider should be collected.

4 Evaluate each student's work using the Science Rubric as follows and add the scores to determine the performance level:

- *Knowledge*: The correlation of the foundational facts and the ecosystem interaction dilemma was defined thoroughly and with sufficient detail.
- *Application*: The individual and group assignments for the issue investigation were well-constructed, well-organized, and met class-determined criteria for usefulness.
- *Communication*: The group presentation was thorough, well-focused, well-detailed, and included all the required elements; individual reflections as a citizen and future questions presented a well-focused understanding of the issue and its possible resolution.

Illinois Habitat Happening

Examples of Student Work

- Meets
- Exceeds

Time Requirements

- 2-3 days for foundational understandings for issue investigation; 2 days for development of survey instrument; 1-2 weeks for investigation and preparation for presentations; 2-4 days for class presentations and resolution considerations; 1 day for personal reflection as a citizen.

Resources

- Access to local resources (materials, experts, etc.) about local ecosystem issue
- Science Rubric

Population Dynamics

Performance Standard 12 B/11A/13B.I

Students will apply the processes of scientific inquiry to explain population model studies to determine limiting factors and mathematical patterns of population growth in real-world situations accordingly:

- *Knowledge*: Understand the basis of population models, databases and foundations.
- *Application*: Graphically represent and analyze Humboldt penguin population using age-gender population pyramids.
- *Communication*: Apply measures of change to make predictions about captive populations.

Population Dynamics

Procedures

1. ***In order to know and apply concepts that describe how living things interact with each other and with their environment (12B) and the concepts, principles and processes of scientific inquiry (11A) and the concepts that describe the interaction between science, technology and society (13B),*** students should experience sufficient learning opportunities to develop the following:

- Formulate hypothesis about Humboldt penguin population kept in zoos and aquariums in the United States and Canada.
- Reference Species Survival Plans from American Zoo and Aquarium Association (AZA) research materials.
- Identify roles and relationships of organisms (captive Humboldt penguins) in their community in terms of impact on populations and the ecosystem.
- Propose options for appropriate questions, procedural steps and necessary resources to research population models to determine limiting factors and mathematical patterns.
- Design investigation which addresses selected hypothesis.
- Determine variables and control groups.
- Use technologies to conduct investigation.
- Analyze how resource management and technologies accommodate population trends.
- Interpret and represent analysis of results to produce findings.
- Evaluate data sets and apply statistical methods.
- Present and defend process and findings.
- Generate further questions for consideration to assess global consequences or ecosystem modifications

Note to teacher: This activity relates to knowledge associated with standard 12B, while addressing the performance descriptions for stage I within standard 11A. It integrates information as suggested in standard 13 B. All materials referenced in this activity are available free from the website of Brookfield Zoo, Brookfield, IL:http://www.brookfieldzoo.org/0.asp?nSection=15&PageID=196&nLinkID=31 These materials are a part of the project: Connections: To Save a Species: Managing a Captive Population. Their production was supported by the Chicago Zoological Society and the Public Museum Operating Grants Program—Illinois Department of Natural Resources and the Illinois State Museum. (ISBN 0-913934-31-3) Brookfield Zoo has graciously provided permission for offering this activity for the Illinois Learning Standards Performance Descriptors Project.

Population Dynamics

Procedures continued

2 Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.

3 The web-based materials provided in 'To Save a Species: Managing a Captive Population' offer materials for understanding how zoos help endangered animals, investigating the current population and making predictions and planning for the future. For these purposes, the population investigation will be highlighted. Practice activities for managing large amounts of data and the introduction to the provided Humboldt Penguin database should be used. Students will formulate queries needed to isolate the number of penguins alive in a given year and extract the necessary information from the provided AZA database. Students will graphically represent the penguin population over time using age-gender population pyramids and analyze their finding using class comparisons.

4 Evaluate each student's work using the Science Rubric as follows and add the scores to determine the performance level:

- *Knowledge*: The identification of the ecosystem's abiotic and biotic factors and organism niches, habitats, and trophic levels found within ecosystems were complete and correct,
- *Application*: The analyses were thorough, well-detailed, and accurate, and
- *Communication*: The report was well-organized, well-detailed and complete.

Population Dynamics

Examples of Student Work

- Meets
- Exceeds

Time Requirements

- One class period to orient students to assessment
- About 5 hours of out-of-class time to research and prepare the report

Resources

- Download the middle/high school (grades 7-12) curriculum materials and software from the Brookfield Zoo Managing a Captive Population from: http://www.brookfieldzoo.org/0.asp?nSection=15&PageID=196&nLinkID=31
  By phone: Contact the Education Department at (708) 485-0263, ext. 367 for information about ordering a printed copy of the curricula materials, including a CD with both the Macintosh and Windows software or a CD with both the Macintosh and Windows software, as well as the curriculum materials in pdf format.
- Science Rubric

Should You Try This At Home?

Group Activity Two

- Organize a group of teachers who are teaching the same grade level or same content.
- Choose one of the assessments from the CD or web-site and review it carefully.
- All of teachers in the group should teach the lesson and give the same assessment.
- The teachers should bring their student work from the assessment to a meeting and practice scoring each other's work. Compare your scores to the scores of the other teachers in the group. See if you have the same score and similar reasons why the group came up with this score.
- Keep practicing until everyone can use the RUBRIC consistently and accurately.

Resources for Group Activity Two

- Science RUBRIC
- An appropriate assessment at the grade level.
- Sample student work with the assessment
- “Keys to Successful Use of Classroom Assessments”
- Resources are found on www.isbe.net
- Your own students’ work

If you have questions or ideas about the Classroom Assessments or Performance Descriptors please call:

- Illinois State Board of Education
- Curriculum and Instruction
- 217/557-7323