



K-2: Connections *The Nature of Networks*

Curriculum Connections

Physical Sciences Concepts

- Observe and describe the position, direction, and motion of objects, such as on top of, next to, over, under, slide, and roll.

Scientific Connections and Applications

- Become aware of and describe the importance of science and scientists in their world.

Scientific Thinking

- Begin to ask questions and construct explanations based on observations of objects and events.

Scientific Tools and Technologies

- Use technology and tools such as magnifiers, thermometers, balances, and computers.

Scientific Communication

- Acquire information from observation, experimentation, print and non-print sources.

** Based on the New York State Elementary Science Core Curriculum and the New York City New Standards™*

National Standards

Content Standard A: Science as Inquiry

- Understanding about scientific inquiry

Content Standard C: Life Science

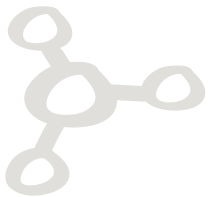
- The characteristics of organisms
- Organisms and environments

Content Standard E: Science and Technology

- Understanding about science and technology
- Abilities to distinguish between natural objects and objects made by humans

K-2 Exhibits List

Float
Network Finger Maze
Overhead
Spider Webs
Global Observer
Internet Arm Wrestling
Power Grid Network
Music Composition Table
Near
Zooming Maps
Ant Colony
Shell Display
Braided Streams
Flocking Behavior
Pachinko Routers
Train Tracks
Network Building





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Guide Theme

The theme of these guides are based on popular crime and detective show investigations on TV; a mystery unfolds, questions are asked, evidence is gathered, conclusions are drawn. This process is similar to what scientists go through with the inquiry method. For more details see About the Guides.

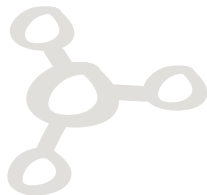


Begin the Investigation At School

A mystery unfolds, questions are asked...

There are several ways you can introduce the topic and start the investigation. Here are some ideas that will help students start thinking about the topic and generate questions:

- Create a mystery about arm-wrestling an opponent in Alaska, Pennsylvania or Iowa without leaving New York. (Mystery solved at Internet Arm Wrestling exhibit)
- Create a mystery about how the New York Fire Department got “x-ray” vision to see where all the roads, sewers and electricity are located. (Mystery solved at Zooming Maps exhibit)
- Create a mystery about an organized, working colony that is made up of ants!!
- Demonstrate one of the Laboratory Activities with no explanation-let the questions begin
- Do one of the Laboratory Activities and facilitate a probing discussion



Prepare for Investigation at the New York Hall of Science

Once students have generated questions around the topic tell them they are going to continue the investigation at the New York Hall of Science.

At this point you may want to begin one of the Continuum Activities. These activities have the following features:

- Vary in length and depth
- Provide continuity and purpose for the visit
- Provide a way of assessing student understanding



Orientation and Planning: If you do nothing else, do this!

Here are five reasons to conduct student orientation and planning before going on a field trip:

1. Students focus on exploring and investigation versus the novelty of the location
2. Students don't have to worry about logistics like restrooms, schedule, eating etc.
3. Students who understand the plan and purpose of the visit are more likely to stay focused
4. Students who have clear goals for their visit are less likely to race from one exhibit to another with little understanding
5. Students who get involved in the planning of the visit, take ownership and are less likely to misbehave

Read more about the Orientation and Planning Process





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Investigation at the New York Hall of Science

Evidence is gathered...

Okay. The class has arrived at the next phase of the investigation. The students have questions and seek answers. Everyone knows what exhibits they should visit and why. Everyone knows the schedule for the day. Students have materials to record findings or work on a Continuum Activity if required.

If all of the above is true, congratulations on a successful Orientation and Planning.

If you are curious about what teachers can do on site, we've put together a little piece called Teacher Role.

Finish the Investigation Back at School

Conclusions are drawn...

There are several ways you can complete the investigation. Some require less time than others. Here are some ideas:

- Student or group oral or written reports on investigation questions and answers
- Student or group illustrations of visit with answers to questions or mystery
- Do one of the Laboratory Activities
- Complete the Continuum Activity

Continuum Activities

Continuum Activities are designed to carry through the entire investigation. Some activities require less time than others.

Investigation Map

Description: Detectives will often map out related events, evidence and suspects during an investigation. This helps them get an overall picture. Students can map out their investigations with a concept map. The concept map will help you assess what students learn.

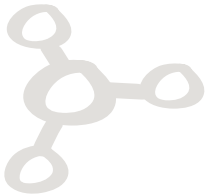
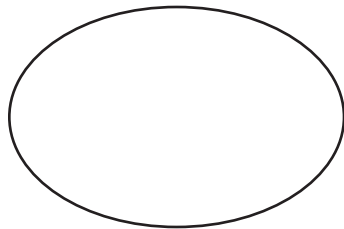
Time: (3)15-30 min. Sessions

Materials Needed:

- Blank paper
- Pencils, crayons

Procedure:

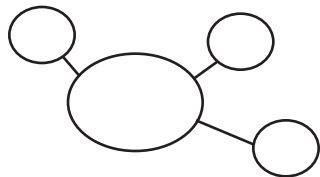
1. Begin with a center circle and write in the name of the main topic. (Students who do not write can have an adult assist or draw a representation of the main topic)





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2. As students generate questions about the topic, they can add offshoot circles. They can also add circles for facts they know about prior to the visit to the New York Hall of Science.



3. When students return from their investigation at the New York Hall of Science they add additional circles of information. Their final map should reflect everything they know about the topic. Teachers can easily assess what is learned based on how the map develops.

Investigation Journals

Description: Investigation journals provide a way for students to record their questions and findings throughout the investigation.

Time: (3) 15-30 min. Sessions

Materials Needed:

- Blank or lined paper
- Pencils or crayons
- On-Site Investigation Handout (print out from this web site and make copies)
- Zip-lock bags (for on-site handout only)
- Soft yarn or thick soft string (for on-site handout only)

Procedure:

1. Ask students if they have ever seen a detective take notes when trying to solve a mystery. Tell students that as “science detectives” they too will make a record of the mystery.
2. Have students begin their journal or report with questions that are generated when they Start the Investigation at School.
3. Students who do not have writing skills can make a large question mark and draw representations of their questions. If an experiment or demonstration is done, non-writing students can sketch what they observe.
4. Older students with writing skills can list their own and other students questions in their journal.
5. We strongly advise students not bring journals to the New York Hall of Science where they can get lost. We have provided

an On-Site Investigation Handout that can be copied if students want to record observations or make sketches.

6. When students return from their investigation at the New York Hall of Science have them write answers to questions or draw what they observed.

Become an Explainer

Description: Student science detectives investigate one exhibit with the goal of being able to explain it when they return to the classroom. Students can choose a variety of methods to explain and make presentations.

Time: (1) 15 min. Session (right before going on Field Trip)
(2) 45 min. Sessions (for in-class presentations)



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Materials Needed:

- Interesting object (used for student observation) (optional suggestions)
- Variety of craft materials (string, paints, glue, tape, colored paper, scissors, etc)
- Variety of clean, household recyclables (meat trays, cardboard tubes, aluminum foil, plastic wrap)
- Any other odds and ends students can construct with
- Poster board or paper
- Markers, crayons



Procedure:

First Session

1. Tell students as “science detectives” they will be investigating exhibits at the New York Hall of Science and will choose one exhibit to explain to the class when they return. (students can work in groups or individually)
2. Help students prepare for careful observation of exhibits by showing them an interesting object. (make sure all students can see object)
3. Now ask students to verbally describe what they see. Encourage details.
4. After students have described the object in great detail, tell them they will need to use these same observation skills

when they are investigating their chosen exhibit.

5. Go to the New York Hall of Science. (encourage observation and verbal descriptions)

Second Session

1. Upon return to class from the trip, tell students they will spend time preparing to explain one of the exhibits they saw.
2. Here are some suggestions for student presentations:
 - Verbal explanation (with or without picture)
 - Group or individual poster showing how an exhibit worked
 - Group or individual model using materials to represent exhibit (materials can be used to substitute and represent real materials from exhibit— ex. Clear plastic wrap simulates glass, cardboard tube becomes a rocket etc.)

Third Session (optional)

Use this time for students to make their class presentations if they made posters, drawings or models.

Laboratory Activities

Laboratory Activities are designed for the classroom and generally require simple materials. These activities can be done before or after a visit to the New York Hall of Science. To help students use higher-level thinking and generate questions, facilitate discussion with these types of questions:

- What do you notice here?
- Tell me about this.
- What do you see?





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- Why do you suppose this happens?
- What can you conclude from the evidence?



Blindfolded Maze

Description:

Students learn the importance of giving clear directions by helping blindfolded classmates work through a simple maze.

Time: (1) 30 minute session

Materials Needed:

- (3) Large sheets of paper
- Thick marker
- Student Blindfold

Preparation:

- Draw three simple mazes on the large sheets of paper with a thick marker.
- Hang the mazes at student height.

Procedure:

1. Gather students around so they can see the first maze.
2. Ask students if they can see the path to get through it?
3. Choose a student to come up and draw the path through the maze.
4. Now refer to the second maze.
5. Ask students if they can see the path to get through it?
6. Tell students that this time there is going to be a twist in doing the maze.
7. Choose a student to come up and draw the path through the maze, only this time blindfold the student.
8. Ask the class how they can help the blind folded student get through the maze? (give directions)
9. Facilitate the class giving directions to the blind folded student. (one student gives directions at a time, let them make mistakes in giving directions)
10. When the second maze is completed, have a short discussion about what happened. Here are some questions you can work with:
 - What words were most helpful in giving directions? (up, down, left, and right)
 - What happens when directions are not clear?
 - Do you think we can improve giving directions if we try again?
11. Refer to the third maze and blindfold another student.
12. Have the class give directions for completing the third maze. (comment on the improved quality of giving directions)

Extension:





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Make copies of simple mazes for student pairs. Give each student pair a blindfold and have them work through the mazes by giving directions to each other. Take turns.



Ant Colony Pictures

Description:

This language arts and art activity gives students a hands-on experience with ant colonies.

Time:(1) 30-45 minute session

Materials Needed:

One or all of the following books:

- Ant Cities (Lets Read and Find Out Books) by Arthur Dorros
 - Inside an Ant Colony (Rookie Read-About Science) by Allan Fowler
 - Thinking About Ants by Barbara Brenner
- (per student)
- heavy brown construction paper
 - markers or crayons
 - bottle of glue
 - sand
 - raisins
 - newspaper (to collect unglued sand)

Procedure:

1. Start by reading aloud from one of the ant books listed.
2. Tell students they are going to make their own picture of an ant colony.
3. Distribute materials.
4. Instruct students to draw with glue to make an ant hill showing intricate tunnels.
5. Instruct students to sprinkle the sand over the glue, and shake off the extra onto a newspaper.
6. Instruct students to use three raisins to make each ant, and glue them in the tunnels or on the mound.
7. Have students draw antennae and legs.
8. When students have completed their ant colony pictures you can have students write a story about their ant colony or share verbally.

Telephones and The Internet

Description:

Students compare phone and internet communications in this hands-on activity. Students create and use paper cup telephones and a computer “web” made with colored yarn.

Time: (1) 1 hour session

Materials Needed:

- Balls of yarn, different colors
- String



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- Large paper cups
- Deck of cards

Procedure:

1. Divide the class into two groups.
2. Distribute cups and string to one group and colored yarn to the other group.
3. Tell students that the group with cups and string are the Phone Group and will make the phones. The group with the colored yarn is the Web Group and they will make a web.
4. Instruct the Web Group to make a web in the classroom by tying different colored yarn to chairs.
5. Instruct the Phone Group to make phones by punching a small hole in the bottom of the cups, threading the string through and tying a knot at the end.
6. When both groups have completed their tasks bring the class back together.
7. Have the Phone Group come to the front of the classroom with their phones and give each student a playing card.
8. Instruct the Phone Group to use their phones to tell the student on the other end of the line what playing card they have.
9. When the Phone Group has sent their messages, ask the Web Group if they know who has which playing card. (It should have been difficult to hear these private phone conversations.)
10. Explain to the class that messages sent on the phone are between two people and are usually private.
11. Now have the Web Group go to the web they made.
12. Have students in the Web Group stand at various points where the web is tied down.
13. Give each student in the Web Group a playing card.
14. Instruct the Web Group to identify someone they are connected to and tell them what playing card they have. (This should happen all at once and be very noisy)
15. Stop the Web Group and ask the Phone Group if they know who has which playing card. (there should be several that are known)
16. Explain to the class that the web is like the internet which lets people on computers all around the world talk to each other.
17. Finally, lead a short discussion to summarize the activity. You can use the following questions:
 - What did you notice about the noise level with the Web Group? (very noisy)
 - What did you notice about the noise level with the Phone Group? (less noisy)
 - Which form of communication was more private? (phones)

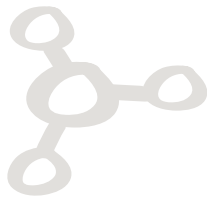
Nerve Network

Description:

Students become the nerves that transmit messages to and from the brain. Linked together with yarn or string, the students use the five senses to send messages through the web.

Time: (1) 30 minute session

Materials Needed:



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- Large space
- ball of yarn or string
- objects that can be experienced with the 5 different senses (smell, sight, touch, hearing, taste)
- Brain hat (teacher created hat for student)

Preparation:

- Make a brain hat that would fit a student. You can draw a picture of a brain on the hat or use the word “brain”. Be creative.

Procedure:

1. Take students outdoors or to a large room.
2. Have students take a ball of yarn or string and pass it around until they are all linked together.
3. Designate one student in the web to be “the brain” and have them put on the Brain Hat.
4. Tell the other students they are nerves.
5. Tell students the brain is responsible for sending a message and the nerves are responsible for passing the message along.
6. Tell students the brain is going to send a message to someone they are linked to and that the nerve has to send the same message to another nerve they are connected to. The message keeps getting sent until every linked nerve has been used.
7. Use the sensory objects you have and instruct the brain to send the following messages:
I smell _____
I am touching _____
8. Now let another student be the brain and send these messages:
I hear _____
I see _____
9. Change the brain student again and give the student something tasty and send this message:
I taste _____
10. Do a few more rounds with objects you have.
11. Summarize the session:
 - What were the five senses the brain sent messages about? (smell, touch, hearing, sight, taste)
 - The brain and nerves worked together to send messages. In our bodies the same thing happens. What are some of the things your brain tells you?

Book List

Books you can use throughout the investigation are:

The Spider's Web

Cole, Joanna. *The Magic School Bus Spins A Web: A Book About Spiders*, Scholastic, 1997.

Craig, Janet. *Amazing World of Spiders*, Troll Associates, 1990.

Robinson, Fay. *Mighty Spiders*, Scholastic, 1996.

Ant Colonies

Berman, Ruth. *Ants*. Lerner Publication Group, 1996.