

Leaping into Science Exploration: An Early Childhood EPK Science Curriculum

for the Greater Rochester Summer Learning
Association / summerLEAP Program

Developed by

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Summer LEAP Teachers,

We are delighted that GRSLA asked us to develop this play-based science program for EPK. Aimee has taught preschool at the Rochester Museum and Science Center (RMSC) for ten years, and I was involved in developing a preschool science curriculum in partnership with the UR back in the early 90's. We know that science is an extremely effective method for engaging young children in learning, but sadly few children have the opportunity to explore science. Thanks to GRSLA, your students will have many opportunities to investigate science topics this summer and we are eager to hear how your students respond and look forward to your feedback.

Three-year-old children are unique, and the program Aimee and I have developed is designed especially for them, honoring their need to direct their learning. Most of the activities will take place inside a sensory table and are meant to be available throughout the week during small group time. The EPK science experiences will involve "guided play" with 5 children and an adult playing together. The teacher's role will be facilitator, talking with the children, playing with them, asking questions and assessing what needs the children might have to enhance their experience. Because the activities are designed to be contained inside a sensory table, preparation each day will be minimal. The materials are open-ended so that children can decide how to use them. Teachers can make suggestions, but if play goes in another direction, teachers should be flexible and supportive.

We have tried to provide teachers with everything needed to be successful:

- easy to follow manual, with photographs of the sensory table contents
- information about guided play and the role of the teacher
- all required materials
- children's books related to the science topics
- suggestions for extended learning opportunities
- review of the Highscope COR Advantage Scoring Guide for Science

We wish you much success with this program and thank you for your dedication to the children in your care. We know your students will have a wonderful summer of play and discovery.

Sarah and Aimee

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Many thanks to **Luis A. Perez, LMSW** and **Gretchen Smith, LMSW** for their enthusiastic support for offering science to the EPK classrooms. Thanks also to **Tiffany Drum** for all her excellent suggestions and her help with purchasing materials and assembling classroom bins.

Topic- Introduction to Science & Insects

Books:

- What is a Scientist? by Barbara Lehn
- The Bug Book by Sue Fleiss
- My Five Senses by Alike

Sensory Table Set-up:

In the sensory table, place the collection of bugs, bug boxes, tweezers, magnifying glasses, shredded paper, sticks, gems and rocks. Don't overdo it.

Introduction:

Read aloud What is a Scientist? Explain to the class that they are going to be scientists this summer. Introduce the tools that they will use in their play with insects: tweezers, bug boxes, magnifying glasses. Tell the children that the rocks will scratch the magnifying glasses. Explain that some scientists study bugs. They are called entomologists. Remind children that rocks and sticks may not be used to hurt anyone.

Charting:

Create a Science Tools Chart using pictures provided. Start with the tools introduced with the Insect Unit: magnifying glass, tweezers, bug box. You will add to this chart through the summer as new tools are introduced, revisiting the chart at least once each week.

Guided Play Questions:

Ask what they notice about the bugs? Do they all have wings? Which is the biggest? Which is the smallest? Are any of the bugs the same as in the book? Which insects hide the best in the shredded paper? Why? Ask if they know what camouflage is? Talk about the five senses and which ones they are using.

Variation:

Remove the shredded paper and add the brown play dough. **Note:** *It is not advised to have both play dough and paper in the table together as they would be combined.* Ask the children how they could flatten the play-dough to look like the ground? What happens if you press a bug into the play dough? Ask them to press a bug into the play-dough and see if a friend can guess which insect it was?

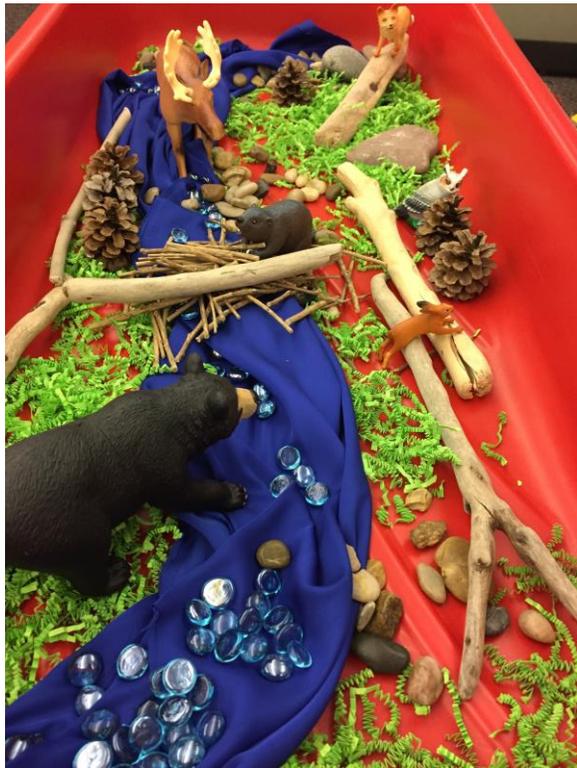
Extension:

Go outside with the bug boxes and tweezers and look for bugs. Place a plate of sugar water on the ground and over several days see if insects are attracted.

Topic- Animals

Materials:

- small wooden sticks (50 pieces)
- river rocks, polished
- glass gems in blue
- decorative shredded paper
- blue fabric (1 piece)
- hare
- jumbo forest animals
- brown play dough
- rocks, various sizes
- large sticks (fallen trees)
- pine cones (trees)
- cardboard tubes (caves)



Topic- Animals

Books:

- Baby Animals of the Woodland Forest by Carmen Bredeson
- Over in the Forest by Marianne Berkes

Sensory Table Set-up:

In the table, place the toy animals, shredded paper, sticks, variety of rocks, fabric, pine cones and cardboard tubes. Don't add everything. Leave room to play.

Introduction:

Read aloud Baby Animals of the Woodland Forest. Name the different animals mentioned in the book. Ask the children what they know about these animals. Next, introduce the toy animal set: moose, bear, fox, beaver, owl and hare. Talk to the children about where these animals live, what they eat, and how they are the same or different. Show and name the different materials that will be in the sensory table.

Charting:

Draw a picture of the different toy animals leaving space next to each one. Add information about the different animals based on what the children already know or what the group learns from other books and resources. Add to the chart through the week.

Guided Play Questions:

While the children are playing, ask questions about where a good place to sleep might be. Ask them if they can make a special sleeping place for the animals. Ask them if they think these animals like people or would run away from them. Ask what these animals do when it is winter? How do they stay warm?

Variation:

Remove the shredded paper, fabric, paper tubes and pine cones, and instead add the play-dough for use with just the animals, rocks and sticks. See what happens. Do the children make footprints in the play dough. Do they press the rocks and sticks into the play dough? If there is interest, you can talk about animal tracks and how each animal has a unique set of footprints.

Extension:

Read or sing Over in the Forest. Discuss if any of the animals in this book were also in the book about baby animals, or in the set of toy animals.

Topic- Air

Materials:

- balloon air pumps
- pompoms
- feathers
- zip lock bags
- variety of small classroom objects



Topic- Air

Books:

Air is All Around You by Dr. Franklyn Branley

Sensory Table Set-up:

Decide how you want to split the week between Air and Water. You could alternate days, or run Air activities on a tabletop and Water activities in the sensory table.

If you decide to do AIR in the table, place pompoms, feathers, variety of other objects, zip bags and balloon pumps in the table.

Introduction:

Read aloud Air is All Around You. Show the students two Zip Lock bags, one filled with pompoms and one filled with air. Ask the class if the bags are empty or full. If they say the one filled with air is empty, remove the pompoms from the other bag and show it to them flattened. This bag is empty. The bag with air is filled with something. What is it? It is air.

Charting:

Introduce the balloon pump. Add its picture to the Science Tool Chart.

Tell the class that they are going to see what they can move with air and make a list. After the children have done some experimenting, record what they report.

Guided Play Questions:

How can we use the balloon pump to fill the bag? What do we have to do to keep the air inside the bag? Can we move a rock with the pump? Why can't we? Which moves farther faster, the feather or the pompom?

Extension:

Go outside on a windy day. Look for indications that things are being moved by air.

Topic- Water

Materials:

- turkey basters
- sand and water mills (3)
- sturdy scoops (6)
- funnels (3)
- measuring cups & spoons
- graduated cylinders (set of 7)
- eyedroppers (6)
- water pump



Topic- Water

Books:

Water by Frank Asch

Sensory Table Set-up:

WATER: fill the table 1/3 with water. Add the pumps, turkey baster, sand and water mills, sturdy scoops, measuring cups and spoons, and graduated cylinders. If this is too much material for the size of your table, adjust. Each day could be different.

Introduction:

After reading aloud Water, turn the book to the double page illustration of the city scene. Ask the class how water is being used by the people in the illustrations. Explain that people, plants and animals need water to survive.

Charting:

Introduce the new tools: water pump, water mills, turkey baster, scoops, funnels, measuring cups and spoons, and graduated cylinders. Add these pictures to the Science Tools Chart. Review all the vocabulary words on the chart.

Guided Play Questions:

After much free play with the materials, begin asking questions. Did you notice when you squeezed the turkey baster with the tip under water that bubbles came out? What is inside those bubbles and why did they come out of the turkey baster? What makes the wheels turn on the water mill? Did you know that the wheel is a simple machine? We are going to learn more about simple machines this summer. Why is a funnel useful? What can you tell me about the graduated cylinders?

Extension:

Try some of these materials in the sand table and see how the children respond. Use the safety glasses for eye protection.

Topic- Color

Materials:

- food coloring
- spray bottles (6)
- super science test tubes
- primary jumbo eyedroppers
- safety glasses (6)
- graduated cylinders
- test tube tray
- bucket

* **provided by teacher:** 2L bottles or gallon jugs (3) & old towel for clean-up



Topic- Color

Books:

Mouse Paint by Ellen Stoll Walsh

Mix it Up! by Herve Tullet

Sensory Table Set-up:

Using three large containers of water and food coloring, teachers should prepare one each of blue, red, and yellow water. These large containers of colored water are for the teachers only and will be used to replenish the empty spray bottles. Do not put the large containers in the sensory table. Fill two spray bottles with each color so that you have 2 blue, 2 red, 2 yellow. Place these in the table along with 2 test tube stands, test tubes, and a bucket.

Introduction:

Read aloud Mix it Up! Explain to the class that they are going to mix colors in the sensory tables to see if they can make the same colors as shown in the book. Explain that they will wear safety glasses to protect their eyes. Remind them not to spray water at their friends. Invite children to squirt water into the test tubes combining 2 or 3 colors. Encourage students to hold the filled test tubes up to the light.

Charting:

Add safety glasses, spray bottles and test tubes to the Science Tools Chart. Review tool names. Create a color mixing chart using a mathematical equation format. Leave the answers blank for the children to determine through their own color mixing. Use markers to write the words in the corresponding colors. **Ex: blue + red=?, red+ yellow=?, yellow + blue=?**. After all the students have had fun mixing colors, complete the chart.

Guided Play Questions:

Ask them what color they made? Allow for imaginative play. Maybe they made a magic potion, or a medicine. Children will dump the mixed waters into the bucket and start again. Monitor the spray bottles and refill as needed. At the end of the color-mixing session, ask the children to look at the water in the bucket. What color do they see? Is it dark? Why?

Variation:

On day two, read aloud Mouse Paint. Add eyedroppers and graduated cylinders and see where the children take it. Add these tools to the Science Tools Chart. On day three, add the large test tube tray.

Extension:

Set up primary color mixing with paint or finger paint.

Topic- Simple Machines

Materials:

- tennis balls
- whiffle balls
- wooden balls
- ping pong balls
- gutters, 2 pieces
- hammering set
- tape measure for kids, 1
- safety glasses - set of 6

* **provided by teacher:** masking tape or duct tape to secure ramps



Topic- Simple Machines

Books:

Ramps and Wedges by Sian Smith

Levers by Sian Smith

Sensory Table Set-up:

Place the various balls and the gutters in the sensory table. Provide a flat alternative surface for the hammering set. Allow the children to set up the ramps the way they want. They may need materials such as tape, or the back of a chair to support the end of the ramps.

Introduction:

Read aloud Ramps and Wedges by Sian Smith. Tell the class that they will be exploring simple machines and that people use simple machines to make work easier. Introduce the gutter pieces and the balls. Have the students predict what will happen to a ball placed inside a gutter that is level. Then ask them what will happen if the gutter is tilted. Demonstrate the two scenarios. Show the hammering set. Explain that the golf tee is a wedge. Explain that everyone will get a turn using the hammer and the ramps.

Charting:

Create a Simple Machines chart using the images found in the appendix. Review the names of the simple machines as you progress through the week.

Guided Play Questions:

Did you notice whether one ball rolled faster than another? What did you do to make the balls roll faster?

Variation:

Read aloud Levers by Sian Smith. Review the Simple Machines Chart.

Extension:

Look for simple machines in the classroom. Can you find a wheel, a wedge, a ramp, a pulley or lever? Take the ramps outside on the grass. Use the measuring tape to measure how far the balls rolled on the grass.

Topic- Space

Materials:

- play space set
- planet blocks
- gravel 10 lbs.
- rocks
- aluminum foil



Topic- Space

Books:

- Sunlight by Erin Edison
- I Want to be an Astronaut by Byron Barton
- Hello World! Solar System by Jill McDonald

Sensory Table Set-up:

Line a sensory table with aluminum foil to make it look more like a spaceship. Pour the gravel into the table, add the rocks of various sizes, the planet blocks, and the space play sets.

Introduction:

Read aloud I Want to Be an Astronaut by Byron Barton. Tell the class that they will be playing pretend in the sensory table with astronauts and space vehicles.

Charting:

Ask the class what they already know about space. Chart the responses. As you read other books during the week, return to the questions and ask the children if there is any new information that can be added to their chart.

Guided Play Questions:

How does the gravel feel? Do you think plants could grow in rocks like this? Why do the astronauts have to wear spacesuits? Do you know what a planet is? Which block shows Earth, our home? What do you know about the sun? Which of these toys shows a vehicle that flew in space? Which toy is a rocket?

Variation:

Provide children with pieces of aluminum foil and let them crunch it up into small balls or wrap rocks with it. Add these items to the table.

Extension:

Go outside and look for the moon in the afternoon sky. Look for the sun.

Appendix:

Science Tools



Water Pump



Tape Measure



Water Wheel



Graduated Cylinders



Magnifying Glass



Scoop



Safety Glasses



Turkey Baster



Air Pump



Hammer and Nail



Measuring Cups



Tweezers



Bug Catcher



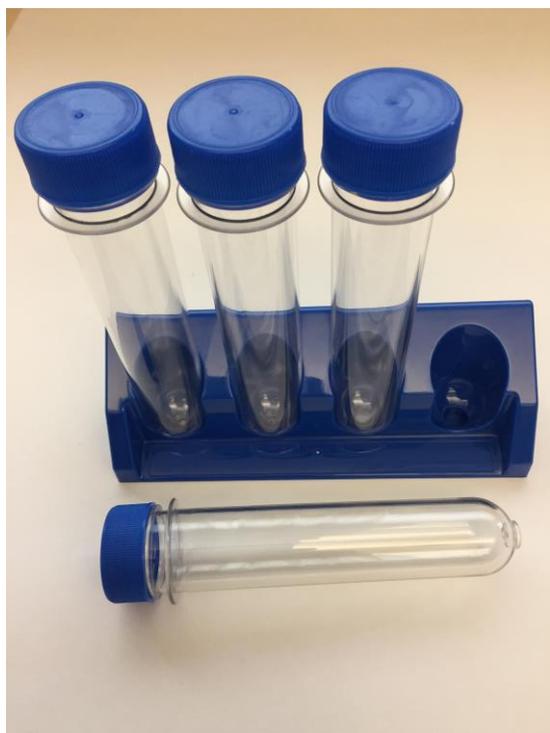
Funnels



Spray Bottle



Water Wheel

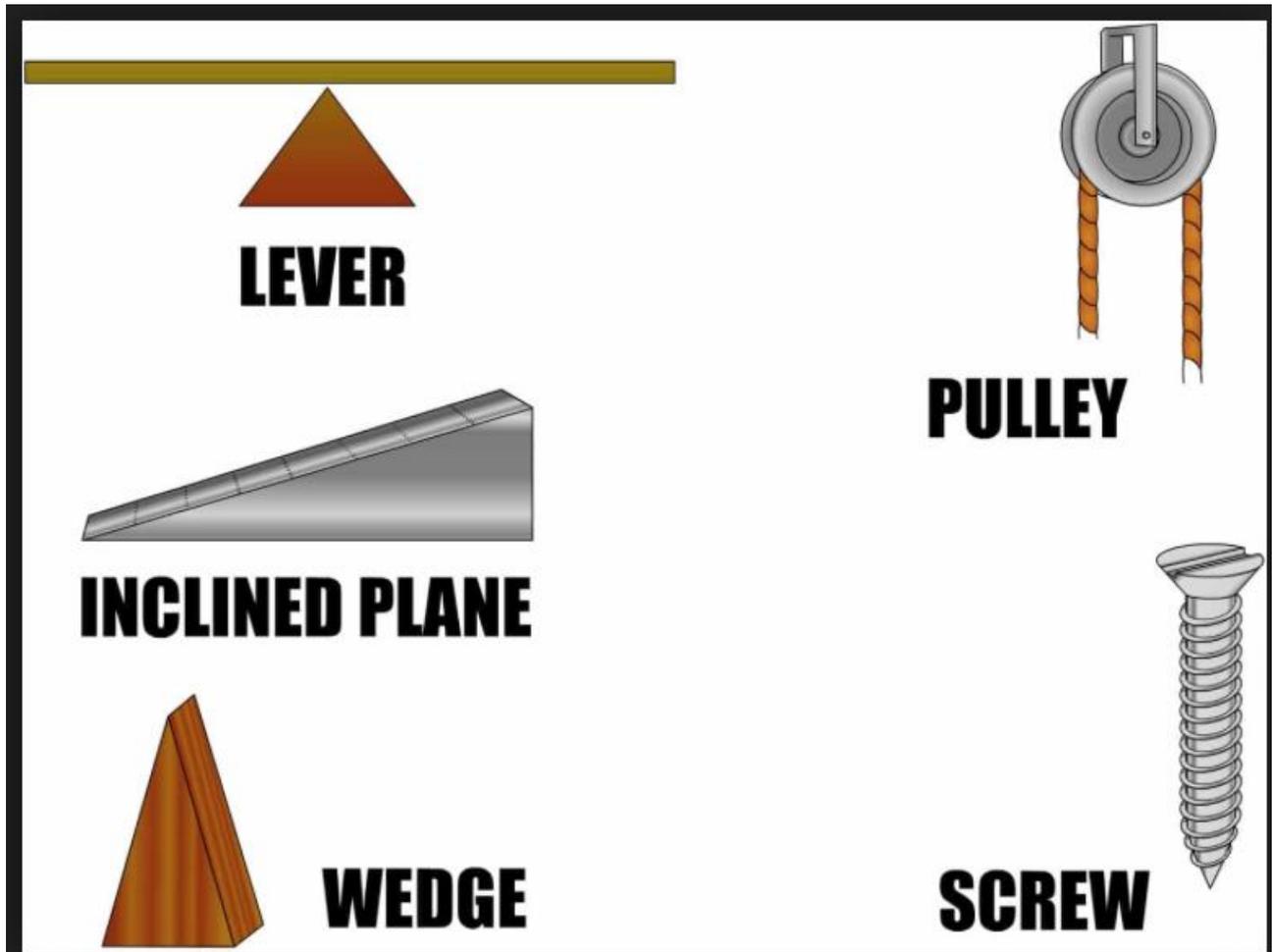


Test Tubes



Eyedroppers

Simple Machines Illustration



Supplement Resources:

Topic: Introduction to Science & Insects

- PBS Learning Media Videos: Lets Be Scientists Everyday Learning
- PBS Learning Media Videos: What is an insect? Everyday Learning, Bob the Builder/Life Cycle of a Butterfly, Cricket Noises/ Caillou
- ***RMSC Field Trip:*** Science and You Exhibit- 2nd floor

Books: I Love Bugs! by Emma Dodd,

Ten Little Caterpillars by Bill Martin Jr.

Explore My World Butterflies by Marfe Ferguson Delano

The Very Quiet Cricket or The Very Hungry Caterpillar by Eric Carle

Topic: Animals

- PBS Learning Media Video: A Tail Like This/ Backyard Wildlife
- **RMSC Field Trip:** Expedition Earth – Black Bear diorama & animal case, Beaver area

Books: Animal Tracks by Arthur Dorros
Raccoons by J. Angelique Johnson
Red Fox by J. Angelique Johnson

Topic: Water & Air

- PBS Learning Media Videos: 60 second science “Under Pressure”, “Putting Air To Work”, “Watching Water Move”, “What is Water?”
- **RMSC Field Trip:** Adventure Zone exhibit- Sail Boats, Weather Area, Sand & Water table

Topic: Color

- PBS Learning Media Videos: Primary Colors song- Sesame Street
- **RMSC Field Trip:** Illumination Exhibit, 2nd floor

Books: Little Blue and Little Yellow by Leo Lionni
Color Farm by Lois Ehlert

Topic: Simple Machines

- PBS Learning Media Videos: Lets Have Fun with Simple Machine
- **RMSC Field Trip:** Adventure Zone Exhibit (pulleys), ramp outside of museum, ramp up to water & sand table; Under Construction 3rd Floor- Crane and various construction components

Books: Roll, Slope and Slide; a book about ramps by Michael Dahl
Mama Zooms by Jane Cowen-Fletcher
Tool Book by Gail Gibbons
Tools by Ann Morris

Topic: Space

- PBS Learning Media Videos: Let's Look at the Moon-Everyday Learning
- ***RMSC Field Trip:*** Stained Glass Windows in the main entrance, Science on a Sphere- 2nd floor, Planetarium show: Animals in the Sky- 25 min.

Books: Roaring Rockets by Tony Mittan

Rockets and Space Ships by Karen Wallace

Papa Please Get the Moon for Me by Eric Carle

The Solar System by Melvin and Gilda Berger

Standards and Assessments:

A Framework for P-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas

National Research Council of the National Academies, 2012

“Currently, K-12 science education in the United States is not organized systematically across multiple years of school, emphasizes discrete facts with a focus on breadth over depth, and does not provide students with engaging opportunities to experience how science is actually done. The Framework is designed to directly address and overcome these weaknesses”.

Practices for P-12 Classrooms:

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information.

Highscope COR Advantage 1.5 Scoring Guide

BB Observing and classifying

Level 0 Child explores objects using different senses.

Level 1 Child uses a sound or hand sign to name an object.

Level 2 Child uses the same word to name more than one object.

Level 3 Child sorts or matches things and may identify things as being same or different.

Level 4 Child sorts things based on a characteristic & describes the reason.

Level 5 Child sorts based on two characteristics and gives the reason.

Level 6 Child intently or repeatedly observes something and describes his or her discoveries in detail.

Level 7 Child divides a category into sets, divides the sets into subsets, and describes the characteristics of each subset and how it relates to the original category and to the other subsets.

CC Experimenting, predicting, and drawing conclusions

Level 0 Child does a spontaneous action.

Level 1 Child performs an action on an object

Level 2 Child uses trial or error to investigate a material itself and/or an idea.

Level 3 Child describes a change in an object or situation.

Level 4 Child makes a verbal prediction at random.

Level 5 Child gives a reason for the result of his or her experiment.

Level 6 Child applies a conclusion he or she made from a previous experience to a new situation.

Level 7 Child poses a question and systematically tests out possible answers.

DD Natural and physical world

Level 0 Child responds to a sensory experience in the natural world.

Level 1 Child picks up, examines, or uses a natural object or material.

Level 2 Child names an object or event in the natural and physical world.

Level 3 Child initiates or talks about performing an action helpful to plants or animals.

Level 4 Child talks about where different types of wildlife live or are found (habitats).

Level 5 Child identifies a change in a material or the environment and a possible cause.

Level 6 Child explains how or why people's behavior can be harmful to the environment and offers an idea to help.

Level 7 Child identifies and describes a cycle or system.

EE Tools and technology

Level 0 Child responds to (mouths, reaches for, turns towards, touches) an object.

Level 1 Child explores a tool in his or her play.

Level 2 Child explores technology devices.

Level 3 Child uses tools to support his or her play.

Level 4 Child explains in a simple way how a tool works.

Level 5 Child explains in a simple way how to make a piece of technology work.

Level 6 Child explains how tools and technology assist in the tasks of daily living.

Level 7 Child uses technology to look up information he or she is interested in.