Collections:

A STEM-Focused Curriculum

Implementation Guide

Developed by Kori Bardige and Melissa Russell

This curriculum was developed for The Hundred Acre School at Heritage Museums & Gardens Inc. located in Sandwich, Massachusetts. Heritage Museums & Gardens received a Preschool Innovative STEM Curriculum Grant from the Massachusetts Department of Early Education and Care (EEC). The goal of the grant was to develop innovative preschool Science, Technology, Engineering, and Mathematics curricula to be used by early education programs for preschool-aged children. EEC recognizes that quality programs include: project based learning, hands-on experimentation, and providing experiences that support natural inquiry. These concepts are central in the Collections Curriculum. While this curriculum has been developed for use at The Hundred Acre School, the hope is that the concepts are easily replicable by other programs. The authors are available for consultation.

About the Authors

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Overview of the Collections Curriculum

Vision

The Collections Curriculum encourages children to be curious, to wonder, think, play, question, and connect with the world around them, so they will become innovators able to make great contributions to society.

About the Curriculum

This curriculum is designed for preschoolers, specifically 4-5 year olds. It covers all domains of development, but focuses teaching and learning activities through a STEM lens. The learning environment (indoors and out) had been carefully designed to promote STEM explorations and support and enhance the curriculum.

The curriculum is divided into Investigations for in-depth study of each topic. Following an emergent curriculum philosophy, the Investigations serve as a guide for teachers as they capitalize on children's and families' interests in each topic and design lessons based on children's inquiry questions. Each Investigation follows the same format and has been selected to cover all objectives outlined by the Massachusetts Preschool Learning Experiences developed by the Massachusetts Department of Early Education and Care.

This curriculum suggests beginning with investigating STEM tools to introduce children to the Scientific Method. The goal is to encourage children and families to explore inquiry learning and how to use tools to test their theories. The tools introduced in this initial Investigation will then become part of the instruments used for other Investigations. Using the Scientific Method becomes a way for children to organize their ideas, develop and test hypotheses, and build upon their knowledge. Children will have opportunities to complete 'lab reports' to help them describe their experiments and capture their hypotheses, experiments, and results.

Each Investigation begins with a provocation, designed to get children and families talking and asking questions about STEM concepts related to the specific Investigation. As children's questions emerge, teachers will design activities to help children test their hypotheses and further their learning. Investigations will culminate in the creation of an Exhibition where children can share what they have learned with others.

During the interim between Investigations, teachers should take time for reflection by bringing back some of the favorite materials or activities from the investigation and putting out provocations related to potential future investigations. This will give teachers and children an opportunity to prepare for the next investigation and determine what areas of interest they would like to study. This reflection time will likely take place between a few days to a week; but should last no more than 2 weeks. It should also be used as an opportunity for teachers to review children's assessment data, determine children's progress, and identify individual and group standard areas to focus on for the next Investigation.

Teachers should plan to cover all domains of development in their daily or weekly lesson plans and assessments. However, to encourage teachers to concentrate their focus on concepts specifically related to the Investigation topic, each Investigation highlights a few particular objectives from the Massachusetts Preschool Learning Experiences, (including the updates to the Science, Technology and Engineering, English Language Arts, and Mathematics Standards). The objectives are repeated in multiple Investigations so that teachers will have opportunities to revisit these standards several times throughout the year. One way for teachers to select a new Investigation is to consider which objectives they still want to focus on, where children have mastered skills and where they may need additional practice.

Connecting with Families

Families are an integral part of any early childhood program, and throughout the Investigations there are intentional opportunities for families to be involved by sharing their knowledge, favorite books, or experiments. As families enter The Hundred Acre School they will see provocations set up for them to explore with their children. This is one of many opportunities to capture the wonder of STEM learning and promote curiosity in both children and adults. Families are also encouraged to share children's questions, or help children with take-home activities such as the estimation jar.

Families are great sources of knowledge and are assets for furthering Investigations! Some ways families may get involved by coming in as guest presenters, bringing resources, volunteering in the classroom or preparing materials at home, sharing suggestions for experiments, and encouraging children to extend classroom learning by trying activities at home.

Families may be encouraged to add contributions to their children's portfolios, including children's questions, interests, and curiosities. Teachers could use these observations and insights as they complete children's assessments and engage in lesson planning.

Families could also have opportunities to capture children's questions and curiosities in "I Wonder . . ." Journals. Teachers could use this information to help children form and test hypotheses and to plan learning opportunities to extend children's ideas and enhance their understanding. "I Wonder" Journals could be kept online, through email exchanges, blogs, or in notebooks, depending on family preferences. Teachers could also use "I Wonder . . ." Journals as places to share children's questions and discoveries with families.

STEM Vocabulary and Engaging Questions

As teachers design lesson plans, provide direct instruction, engage in play, explore environments, talk with families, and create documentation, they should be deliberate in asking questions that prompt STEM explorations and use STEM terminology. Terms may include: observe, examine, investigate, probe, imagine, wonder, describe, identify, compare, count, extend, ask questions, hypothesize, experiment, speculate, predict, make deductions, and make inferences.

In talking with children about their discoveries, teachers should think about the adjectives they use and how to help children be specific about describing their experiences. They should use sensory words like bumpy, smooth, rough, slimy, slippery, hot, cold, freezing, loud, quiet, harsh, spicy, sweet, floral, etc. Attribute words describing size, rate, color, speed, shape, etc. can also encourage children to make comparisons. Comparison words such as, larger, smaller, greater, fewer, higher, lower, or equal to prompt children's mathematical thinking.

> "Children, even at a very young age, formulate theories and ideas for just about everything, and these ideas play a role in the learning experience. Through the use of appropriate questions at the right time, teachers can elicit these ideas and facilitate the learning process in a meaningful way. Questions that assist teachers with gaining information about children's concepts and ideas and at the same time promote the formation of children's understanding are productive questions (Jos, 1985).
>
> Productive questions promote science as a way of doing and encourage activity while constructing knowledge. The answers generated by productive questions are derived from first-hand experiences involving practical actions with materials. In addition, productive questions encourage an awareness of the possibility of more than one correct answer to the question. Children answer on their own developmental levels and the teacher views achievement as what is learned through the process of arriving at the answer. All children have success answering productive questions." – quoted from: http://www.maisk-6scienceinquiry.org/questions.htm
>
> Harry, V. *Productive Questions*, Mediterranean Association of International Schools, MAIS K-6 Science Inquiry, Investigation, and Design Technology, 2003. Web July 9, 2014 http://www.maisk-6scienceinquiry.org/questions.htm.

Original citation from: Jos, E. (1985). The right question at the right time. In Wynne Harlan (Ed.), *Primary Science… Taking the Plunge.* Oxford: Heinemann.

Engaging Questions That Promote STEM Explorations

Quoted from:
www.bostonchildrensmuseum.org/sites/default/files/pdfs/rttt/stem/english/STEM.Teaching.Kit_for_Web.pdf

Attention-focusing questions:

These are questions of observation: "Have you seen . . ." and "Did you notice . . ." types of questions. Children frequently take care of these questions themselves when they say, "Look here!" The "what" questions closely follow: "What is it?" "What does it do?" "What happens when . . ." "What do I see, feel, hear. . . ?" Simple observation questions are the route to the first simple answers, which will be followed by more complicated questions.

Measuring and counting questions:

Questions like "How many?" "How long?" and "How often?" are measuring and counting questions. Older children can check their answers themselves.

Comparison questions:

"Is it longer, stronger, heavier, more?" These are the comparison questions that come naturally after the measuring questions. Objects can differ in many respects, such as shape, color, size, texture, structure, and markings. Comparison questions can help young children begin to classify and assign attributes to things: "What is the same about the seeds? What is different about the seeds?"

Action questions:

These are the "what happens if" questions that can always be definitively answered. These involve a simple experiment, and then you have your answer. "What happens if you add more pennies to the tin foil boat? Will it sink? Will it float?" An exciting addition to solving "what happens if" questions is the challenge to predict the outcome. Initially children will guess, but with more experience, their ability to predict the actual outcome will be improved, and they will become increasingly able to tackle more complicated problem solving questions.

Problem-solving questions:

After practicing the above questions, children are ready for a new type of question: the more sophisticated "can you find a way to" question. This type of question sets up a real problem-solving situation to which children enthusiastically respond, provided it makes sense to them. For young children building with blocks, this question is appropriate after they have explored the materials for some time. "Can you find a way to stack the blocks as tall as you are?" "Can you find a way to stack them even taller?" These questions are appropriate when children's curiosity is going strong and their science understanding begins to make real progress.

Fredericks, B. & Kravette, J. (2014). *STEM Family Activities Workbook,* Boston Children's Museum, 2014. Retrieved from: www.bostonchildrensmuseum.org/sites/default/files/pdfs/rttt/stem/english/STEM.Teaching.Kit_for_Web.pdf (pg. 15-16).

Strategies for Creating a STEM-Focused Classroom Environment

The environment should be carefully crafted to serve as inspiration for children's explorations. Teachers should use their environment as inspiration for designing their own Investigations. Educators often describe the environment as being the "third teacher" and this should the case when using this curriculum as well. Because the Collections Curriculum is STEM focused, the authors thought it was important to retitle and reconstruct the preschool classroom to highlight STEM concepts. Rather than the typical preschool learning centers, each Investigation Station was developed to highlight tools children and teachers can utilize to further their study of a topic and test hypotheses.

Learning Center	Investigation Station
Circle/Morning Meeting	Hypothesis
Library	Research
Blocks	Engineering
Science	Ecology
Computers	Technology
Math	Mathematics
Puzzles/Manipulatives/Toys & Games	Dissection
Dramatic Play	Demonstration
Writing Center	Recording
Cozy Area	Reflection
Art	Arts Laboratory
Sensory Table (sand and water)	Chemistry
Gross Motor	Locomotion
Outdoors	Exploration

The environment should be able to serve multiple purposes and be flexible enough to be reorganized if additional space is needed for a specific Investigation. For example, if children need room for constructing a large ramp or giant bug sculpture, Investigation Stations could be combined or enlarged to accommodate children's play.

The environment should contain materials and resources children may want to use in their Investigations and these will be rotated as needed to continue to encourage children's explorations. A conscious effort should be made to incorporate natural materials and use materials found outdoors to prompt explorations as well as real props rather than toy replicas.

The environment is organized into Investigation Stations to prompt different types of STEM exploration. Materials should have specific locations and labels to be easily found; however, children will be encouraged to move freely about the environment and relocate materials as needed for purposes of investigations.

Concepts to be incorporated into the indoor and outdoor environments:

- High quality environments provide structure to build upon children's natural curiosity and inclination to wonder, ask questions, and explore
- Environments set up to promote and encourage inquiry and exploration with an emphasis on interrelated developmental domains
- Nature-inspired indoor and outdoor learning environments
- Use of reference materials such as iPads, books, maps, etc., to prompt questions and to research hypotheses
- Word walls, labels, and environmental print will be used to highlight key areas in Investigations and that are meaningful to children

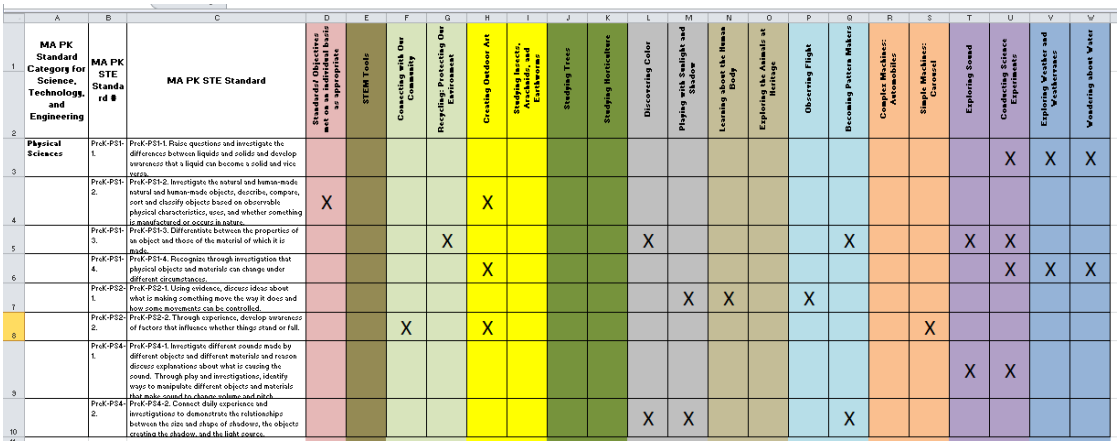
Aligning Massachusetts Guidelines for Preschool Learning Experiences with an Evidence-Based Assessment Tool

Utilizing a valid and reliable formative assessment tool is critical for all curricula. Before beginning this curriculum, programs **MUST** select and be trained in implementing a valid and reliable assessment tool and align the objectives of the assessment with the MA Preschool Learning Experiences.

The Hundred Acre School has selected the Teaching Strategies GOLD© Assessment tool for tracking children's progress, communicating with their families, and informing the planning and individualization of daily activities. This is one of the Massachusetts Department of Education, Early Education and Care (MA DOE/EEC) recommended assessment tools.

Incorporating the Massachusetts Guidelines for Preschool Learning Experiences

The Collections Curriculum authors have done a careful alignment of the Massachusetts Guidelines for Preschool Learning Experiences to the Investigation topics to make sure that standards are highlighted through several Investigations. Although teachers should work on every standard simultaneously, by highlighting particular standards in Investigations, hopefully this will help teachers to hone their focus and cover the standards in a bit more depth. A spreadsheet has been created aligning the MA DOE/EEC Standards for Preschool with the currently developed Investigations. The hope is that as teachers develop their own Investigations, they would extend this spreadsheet. The authors recommend that programs create their own alignment with their assessment tool, standards, and Investigations to make sure teachers are contentiously meeting all objectives.



MA PK Standard Category for Science, Technology, and Engineering	MA PK STE Standard #	MA PK STE Standard	Standard Objectives met on an individual basis as appropriate	STEM Tools	Connecting with Our Community	Recycling: Protecting Our Environment	Creating Outdoor Art	Studying Insects, Animals, and Environment	Studying Trees	Studying Horticulture	Discovering Color	Playing with Sunlight and Shadow	Learning about the Human Body	Exploring the Animals at Heritage	Observing Flight	Becoming Pattern Makers	Complex Machines: Automobiles	Simple Machines: Carousel	Exploring Sound	Conducting Science Experiments	Exploring Weather and Weatherman	Wondering about Water
Physical Sciences	PreK-PS1-1.	PreK-PS1-1. Raise questions and investigate the differences between liquids and solids and develop awareness that a liquid can become a solid and vice versa.																		X	X	X
	PreK-PS1-2.	PreK-PS1-2. Investigate the natural and human-made natural and human-made objects, describe, compare, sort and classify objects based on observable physical characteristics, uses, and whether something is manufactured or occurs in nature.	X				X															
	PreK-PS1-3.	PreK-PS1-3. Differentiate between the properties of an object and those of the material of which it is made.				X					X					X			X	X		
	PreK-PS1-4.	PreK-PS1-4. Recognize through investigation that physical objects and materials can change under different circumstances.					X													X	X	X
	PreK-PS2-1.	PreK-PS2-1. Using evidence, discuss ideas about what is making something move the way it does and how some movements can be controlled.										X	X		X							
	PreK-PS2-2.	PreK-PS2-2. Through experience, develop awareness of factors that influence whether things stand or fall.			X		X											X				
	PreK-PS4-1.	PreK-PS4-1. Investigate different sounds made by different objects and different materials and reason discuss explanations about what is causing the sound. Through play and investigations, identify ways to manipulate different objects and materials that make sound to change volume and pitch.																	X	X		
	PreK-PS4-2.	PreK-PS4-2. Connect daily experiences and investigations to demonstrate the relationships between the size and shape of shadows, the objects creating the shadow, and the light source.									X	X				X						

By carefully aligning the objectives and intentionally using them as a guide for developing lesson plans, providing instruction, and tracking progress, the teachers, administrators, and school stakeholders will be able to demonstrate children's progress and readiness for Kindergarten. They can also use this information for evaluating the school program, curriculum, and philosophy of using a STEM focus to increase children's knowledge and to support their development.

Daily Routines and Provocations Designed to Prompt Curiosity, Wonder, and Exploration

Suggested Schedule

(Daily schedules will vary depending on the needs of the children, families, and the teacher's lesson plans)

Time	Activity	Location	Purpose
8:30-9:15	Curiosity and Wonder	Playground or Arts Laboratory	Allow time for varied drop off times and rituals and for individual conversations
9:15-9:30	Snack	Classroom or Playground	Provide time for informal conversations
9:30-10:00	Greetings and Morning Meeting	Hypothesis Station	Begin investigations, orient to daily activities
10:00-11:00	Investigation Adventures	Playground/Outdoor Classroom, Nature Trail or Field Trip	Engage children in opportunities that support their experiments
11:00-12:00	Investigation Explorations	Indoors in classroom (may alternate with Adventures)	Engage children in opportunities that support their experiments
12:00-12:15	Think Time	Hypothesis Station	Talk with children about their experiment results
12:15-1:00	Lunch	As a group either inside or outside	Provide time for informal conversations and dismissal
1:00-2:00	Dream Time	Story and Rest	Opportunities for listening to a relaxing story, poetry, music, and rest
2:00-3:00	Curiosity and Wonder	Playground or classroom stations	Opportunities for children to continue morning activities and test additional hypotheses

The authors intentionally provided children with a 2 hour block of play time which can be a combination of indoor and outdoor learning opportunities. By giving children extended time for uninterrupted play, children have an opportunity to become invested in their explorations, conduct and complete their experiments and engage in socio-dramatic play.

Hypothesis Time

- Lab Reports
- Weather
- Songs/music and movement
- Classroom helpers
- Rules and schedule for the day
- Morning message
- Estimation jar
- Show and Share

Investigation Adventures

- Take a nature walk
- Work in school garden
- Check weather – investigate temperature, trees, rainfall, etc.
- Go on a field trip
- Spend time on the playground

Investigation Exploration

- Use stations to test and explore hypotheses questions
- Engage in free play and teacher-directed small group explorations
- Design experiments to further investigations

Think Time

- Revisit Lab Reports and talk about morning explorations
- Share information about what they have learned
- Prepare for transition to next activity

Dream Time

- Children listen to teachers read developmentally appropriate chapter books, poetry, tell stories
- Play quiet music such as classical, jazz, instrumental, or multicultural music
- Children may have access to drawing materials or storybooks if they don't sleep during rest time

Curiosity and Wonder

- Retest hypotheses
- Revisit classroom stations
- Continue explorations outside
- Record questions and consider future investigations

Strategies for Meeting STEM Massachusetts Preschool Curriculum and Learning Standards During Daily Activities

Science, Technology, and Engineering Standards	Suggestions of Daily Activities That Could Meet This Standard
Earth and Space Sciences	
PreK- ESS1 Demonstrate awareness that the moon can be seen in the daytime and at night, and of the different apparent shapes of the moon over a month.	Suggest families investigate the night sky; share resources to help families talk with children about universe in developmentally appropriate ways. Look for the moon during the daily weather check.
PreK - ESS1-2 - Observe and use evidence to describe that the sun is in different places in the sky during the day.	During morning weather check, investigate where the sun is. Later in the day point out sun's placement.
Earth's Systems	
Prek - ESS2-1. Raise questions and engage in discussions about how different types of local environments (including water) provide homes for different kinds of living things.	When outdoors, look for living things and discuss their habitats.
PreK - ESS2-2. Observe and classify non-living materials, natural and human made, in their local environment.	Place a variety of items in the **Dissection Station** for children to explore and classify. Children can also collect materials for art projects providing another opportunity for children to demonstrate their sorting ability.
PreK - ESS2-3. Explore and describe different places water is found in the local environment.	If your environment allows you to walk to or observe water, plan it into your lesson. Read books, watch video of other types of local bodies of water.
PreK - ESS2-4. Use simple instruments to collect and record data on elements of daily weather, including sun or clouds, wind, snow or rain, and higher or lower temperature.	During daily weather check, collect data from rain gauge and thermometer. Plot weather and temperature on graphs.
PreK - ESS2-5. Describe how local weather changes from day to day and over the season and recognize patterns in those changes.	Review weather check graphs and look for trends over time. Observe and discuss changes in your outdoor space.
PreK - ESS2 - 6. Understand the impact of weather on living things.	Talk about how weather impacts living things (garden, animals, children) during preparation for **Investigation Adventures**. Discuss why children need to wear coats in winter and why animals take shelter from the rain.
Earth and Human Activity	
PreK - ESS3 - 1. Engage in discussion and raise questions using examples about local resources (including soil and water) humans use to meet their needs.	Talk about how people use resources such as consuming food growing in garden, gathering water to drink from well, using earthworms to create soil for garden.
PreK - ESS3 - 2. Observe and discuss the impact of people's activities on the local environment.	Discuss how people need to care for environments, talk about why we recycle and what happens if we leave the water running for too long.

Life Science	
PreK-LS1-1. Compare, using descriptions and drawings, the external body parts of animals (including humans) and plants and explain functions of some of the observable body parts.	Explore pictures of life cycle in the **Ecology Station**. Practice moving like animals during transitions or in the **Locomotion Station**.
PreK-LS1-2. Recognize that all plants and animals grow and change over time.	Observe changes to plants and trees during daily weather check. Watch caterpillars change into butterflies and birds hatch.
PreK-LS1-3. Explain that most animals have five senses they use to gather information about the world around them.	Talk about how children can use their five senses during their experiments. Make comparisons to animals and read books about how animals use their senses to explore their environment.
PreK-LS1-4. Use their five senses in their exploration and play to gather information.	Put materials in the **Chemistry Station** for children to explore using their 5 senses. While on the playground, talk to children about using their five senses to explore.
PreK-LS2-1. Use evidence from animals and plants to define several characteristics of living things that distinguish them from non-living things.	While exploring during **Investigation Adventures**, talk to children about living things and what distinguishes them from non-living things (ex. living things need food and water).
PreK-LS2-2. Using evidence from the local environment explain how familiar plants and animals meet their needs where they live.	While exploring during **Investigation Adventures**, talk to children about how environment provides food, water, and shelter that plants and animals need.
Prek-LS2-3. Give examples from the local environment of how animals and plants are dependent on one another to meet their basic needs.	While exploring during **Investigation Adventures**, talk to children about how the environment provides food, water, and shelter and how plants and animals need each other (ex. animals eat plants, plants provide homes for animals).
PreK-LS3-1. Use observations to explain that young plants and animals are like but not exactly like their parents.	While growing plants or observing insects, talk about how they change over time (ex. caterpillars change to butterflies, plants grow from seeds).
PreK-LS3-2. Use observation to recognize differences and similarities among themselves and their friends.	While on the playground or **Locomotion Station** point out similarities and differences in how children are able to move. In individual conversations or as part of an Anti-Bias Curriculum/Social-Emotional Curriculum, discuss similarities and differences in skin, eye, and hair color and abilities. Use books to add depth to these discussions.
Physical Sciences	
PreK-PS1-1. Raise questions and investigate the differences between liquids and solids and develop awareness that a liquid can become a solid and vice versa.	During daily weather check, explore what happens to rain water (evaporates, gathers), ice (forms, melts), snow. Explore Oobleck, dissolve sugar/salt crystals, and make play dough and Jell-O in **Chemistry Station**.
PreK-PS1-2. Investigate the natural and human-made objects, describe, compare, sort and classify objects based on observable physical characteristics, uses, and whether something is manufactured or occurs in nature.	Invite children to gather a variety of natural (pinecones, sticks, bark, shells, stones, etc.) and human-made (paper clips, tin foil, plastic toys, Styrofoam, etc.) to sort and experiment with in sink and float activities or use in art projects.

PreK-PS1-3. Differentiate between the properties of an object and those of the material of which it is made.	Create classroom posters showcasing materials used in experiments grouped by categories, such as wooden or metal objects that float or sink.
PreK-PS1-4. Recognize through investigation that physical objects and materials can change under different circumstances.	Create a pizza box oven for children to experiment with melting chocolate, etc.; use the **Chemistry Station** to help children explore how objects and materials change through absorption, mixing, heating, cooling, condensation, dissolving, and precipitation.
PreK-PS2-1. Using evidence, discuss ideas about what is making something move the way it does and how some movements can be controlled.	Explore simple machines (pulleys, ramps, balance scales) in **Engineering Station** and on playground.
PreK-PS2-2. Through experience, develop awareness of factors that influence whether things stand or fall.	Build a variety of structures in **Engineering Station** from different materials; experiment with how to make things stand and fall.
PreK-PS4-1. Investigate different sounds made by different objects and different materials and discuss explanations about what is causing the sound. Through play and investigations, identify ways to manipulate different objects and materials that make sound to change volume and pitch.	Play real and homemade musical instruments. Talk about sounds and experiment with pitch and volume.
PreK-PS4-2. Connect daily experience and investigations to demonstrate the relationships between the size and shape of shadows, the objects creating the shadow, and the light source.	During weather check, explore light and shadow. In **Arts Laboratory,** experiment with using an overhead projector to create lights and shadows.
Engineering Concepts Described in STE Standards	
Asking Questions and Solving Problems/Designing Things	During morning meeting, demonstrate how to come up with hypotheses and help children talk about experiments they want to do.
Constructing Explanations/Theories and Evaluating Solutions	Talk about different ways to design experiments, make predictions, collect and interpret data, draw conclusions, and revise theories and explanations.
Planning and Carrying Out Investigations	Use lab reports to help children plan and execute hypotheses. Use provocations to prompt curiosity.
Make Meaning from Experience and Data	Collect data on estimation jar, explore ways to graph data in different ways to understand scientific results.
Engaging in Discussion/Argument from Evidence	During Think Time, help children process what they learned from their experiments and revise lab reports.
Obtain, Evaluate, and Talk About Information	Use the **Research Station** to help children explore ideas and concepts in greater depth.
Developing and Using Models	Use the **Engineering Station**, **Dissection Station**, and **Arts Laboratory** to help children create models of artifacts.
Mathematics Standards	
Counting and Cardinality	
MA.1. Listen to and say names of numbers in meaningful contexts.	Talk about numbers during estimation jar explorations, weather check, while passing out napkins or cups for snack.

MA.2. Recognize and name written numerals 0-10	Read numbers on temperature and rain gauge during weather check.
MA.3. Understand the relationship between numerals and quantities up to ten.	Compare materials in **Dissection Station** by sorting them and counting and graphing data.
MA.4. Count many kinds of concrete objects and actions up to ten, using one-to-one correspondence, and accurately count as many as seven things in a scattered configuration.	Count out materials for art projects or constructing block buildings, use estimation jar to help children make a guess and check by counting.
MA.5. Use comparative language such as *more/less than, equal to,* to compare and describe collections of objects.	Use balance scales; measure objects; compare volumes. Count body parts on insects and invertebrates, petals on flowers – comparing drawings and models with real objects; make own collections. Use meal times as opportunities to talk about "how much."
Operations and Algebraic Thinking	
MA.1. Use concrete objects to model real-world addition (putting together) and subtraction (taking away) problems up through five.	Use cooking opportunities to add up scoops of flour in a recipe. Use meal times to talk about adding and subtracting, "I have four crackers, how many will I have if I eat one?"
Measurement and Data	
MA.1. Recognize the attributes of length, area, weight, and capacity of everyday objects using appropriate vocabulary (e.g., *long, short, tall, heavy, light, big, small, wide, narrow*).	Use mathematics vocabulary with children and encourage them to be precise when measuring, weighing, experimenting with STEM tools, creating models, and describing results of investigations and experiments.
MA.2. Compare the attributes of length and weight for two objects including longer/shorter, same length; heavier/lighter, same weight, holds more/less, holds the same amount.	Provide opportunities for children to make comparisons during experiments. Invite children to work side by side and compare different results.
MA.3. Sort, categorize, and classify objects by more than one attribute.	Use the **Dissection Station** to help children explore ways to sort and classify objects. Make posters and Venn Diagrams that display their results.
MA.4. Recognize that certain objects are coins and that dollars and coins represent money.	Include play money in **Demonstration Station**. Ask children how much a doctor's visit costs or what they owe for the art supplies. Count out correct dollars and coins when "paying" for these services.
Geometry	
MA.1. Identify relative position of objects in space, and use appropriate language (e.g., *besides, inside, next to, close to, above, below, apar*t).	While in the **Locomotion Station** or on the playground, use position words and play games of 'follow the leader.'
MA.2. Identify various two-dimensional shapes using appropriate language.	Explore shapes in classroom and those found in nature. Help children use natural materials to make shapes and make shape patterns in the **Arts Laboratory** as part of artwork.
MA.3. Create and represent three-dimensional shapes (ball/sphere, square box/cube, tube/cylinder) using various manipulative materials, such as popsicle sticks, blocks, pipe cleaners, pattern blocks, and so on.	Talk about shapes of blocks while putting them away or using them to build. Encourage children to explore shapes in **Arts Laboratory**, **Dissection Station**, etc. where they are making comparisons between 2D and 3D shapes.

Implementing the Collections Curriculum Investigations

> Investigations are intended for teachers to add to, change, and improve over time; so that they can consider repeating it in future investigations or in future years. Investigations are meant to be shared between classrooms as well. Each Investigation, except for the first Investigation on STEM Tools, has a companion or complementary Investigation. The idea is that teachers would engage in joint planning and be able to alternate Investigations, providing opportunities to share materials, ideas, and children's questions. Some of the suggested activities in each companion Investigation deliberately overlap to offer teachers and children choices for explorations.

Each Investigation is formatted with the following sections:

Hypothesis Question – This is an overarching question that frames the Investigation and should help teachers to begin the initial process of selecting a particular Investigation.

Purpose – This describes the main ideas covered in the Investigation and why teachers may want to select it as a unit of study. This section adds suggestions for different ways to focus the Investigation and should prompt teachers' excitement and interest.

Objectives – This section contains MA Preschool Standards from the Massachusetts Guidelines for Preschool Learning Experiences with updates through January 2014. Although teachers are responsible for assessing children on all domains, the intent is to have them focus in on a few objectives at a time to make sure they are delving deeper into these areas. As teachers plan out Investigations throughout the year, they should select ones that cover each of the objectives multiple times a year to ensure children are developing skills in all domain areas. Depending on when teachers decide to complete the Investigation, some of the standards addressed may not be relevant, may be out of order, or not developmentally appropriate. For example, children need to be able to rote count before they can use 1:1 correspondence. When teachers recognize there is a discrepancy between the developmentally appropriate standard and the suggested objective, they should make the substitution for the objective that is a better fit. If skills have a developmental sequence, such as some mathematics, physical, and literacy skills, teachers **must** modify the objectives and assessment to meet student's individualized development and teach skills in order and in context. For skills that do not follow a developmental sequence, such as science or art, teachers should consider children's level of independence and scaffold activities to deepen their knowledge. **It is important for teachers to individualize and teach skills in context, sequential order, and use assessment to determine next steps. The standards suggested for each Investigation are intended to serve as a guide but should not eclipse the teaching that takes place as part of every day experiences.**

Reflective Questions – Throughout each Investigation there are reflective questions designed to help teachers think more deeply about a topic, be mindful of what children might be learning, and consider how they could adapt the lessons to more fully meet everyone's needs. Teachers are also asked to reflect at the end of each Investigation to consider where they may want to go next and how they will get there. Final reflection questions should also guide teachers in recalling what they did in previous years or in previous Investigations and how they may want to move forward. Reflecting on one's teaching and on children's learning is a key component of an intentional teaching. Making reflection a routine practice will help teachers continue to expand their own skills and individualize learning experiences for children.

Springboards – This section has suggestions for activities that may engage children's initial interest in the Investigation topic. The idea is to prompt children's curiosity and questions in the Investigation topic. As teachers have completed the Investigation, they may want to reflect on this section and add additional ideas based on children's interests.

Classroom Adaptations – This section provides suggestions for modifying the environment by adding props to the stations or reorganizing the environment to enhance children's explorations and play. Again, this is a key area for teachers to reflect on during the middle of the Investigation and when they record what worked well and additional ideas for future use and sharing.

Outdoor Explorations – Learning from and being outdoors is central to The Hundred Acre School's philosophy, and is an important area for teachers to consider. There are many options for bringing learning outside and encouraging children to explore the natural environment. Again, this is a key area for teachers to reflect on during the middle and end of the Investigation and record additional ideas for using in the future when replicating the Investigation the following year or when sharing with colleagues.

Juicy Words – This section has key vocabulary words that teachers may want to introduce when teaching lessons to help children add specific, technical, and STEM vocabulary to enhance their understanding of a topic. These words could be added to word walls and used as environmental print to prompt children's interest in writing and reading. Juicy words should vary depending on children's interests and the directions in which a class or group takes the Investigation.

Key Questions – This section provides a few examples to get teachers thinking about what they might want to ask children to prompt their interest or extend their explorations. These questions might also be helpful to share with families during provocations. Of course teachers will want to extend these questions based on children's interests and explorations. If teachers find there is a particular question or particular topic that prompts children's wondering they may want to add additional questions.

Notes Pages – This is an additional space for teachers to add their own notes and information they want to use during this Investigation or for recalling and reflecting for repeating this Investigation or sharing this with another teacher. This section should be moved wherever teachers find it most helpful and modified to best capture information teachers want to remember.

Provocations – These can be put out for families to explore with children during arrival and dismissal, to get children interested in the Investigation, and to prompt questions children may bring to the Hypothesis Station to generate their experiments. Provocations could be set up in Classroom Stations as well to prompt children's curiosity. These may be opportunities for families to explore activities at home together and share discoveries and questions in their "I Wonder . . ." Journals. Teachers might add provocations based on their observations of activities, materials, and strategies that pique children's interest and prompt questions that children are eager and able to pursue.

Classroom Stations – This section lists objectives based on the Massachusetts Guidelines for Preschool Learning Experiences that might be focused on in each of the classroom stations. It offers suggestions for materials that could inspire lesson plans/activities. It also offers suggestions in each Station to support teachers in assessing children's abilities on an ongoing basis. It should be used to scaffold children's learning opportunities, to develop activities, and should use data to drive instruction. Teachers should customize this section as they begin planning activities and have ideas of materials they want to add to Classroom Stations to enhance explorations. They may want to make a blank copy of this page and customize it based on lesson plans.

Key Information – This section contains a brief overview of background information that the teacher may want to use as a springboard for lesson planning or to prompt their own learning and desire to do further research. As teachers find additional information related to the Investigation topic, they may want to add it to this section.

Scaffolds – The scaffolds are different for each of the Investigations and share a strategy for helping children achieve skills by providing the steppingstones teachers might want to be aware of to help children master a specific skill. Although each scaffold loosely relates to the Investigation topic, the idea is to add strategies and knowledge to the

teacher's toolbox so that as they explore each Investigation topic they learn additional information they can add to their repertoire, which is useful as they work with individual students who may need some additional assistance.

Celebrating Diversity – The intent of this section is to help teachers support children as they develop self-awareness, confidence, empathy, and positive social identities. It is framed by Anti-Bias Education. It supports children in learning about the diversity of people, culture, languages, and abilities. It suggests ways to scaffold children's knowledge about their families and others around the world. This section has a connection to the Investigation, but also could be used with any individual child, small group, or large group as appropriate to address issues as they arise and as a proactive approach to encouraging children's development of anti-bias values.

Individualizing Learning – This section asks reflective questions designed to help teachers think about individual children and how they can meet their needs as part of each Investigation. Teachers should take this opportunity to review children's assessments, talk with families to gather information and spend time observing children to learn their skill levels, developmental strengths, and growing edges to be able to add specific activities to their lesson plans to meet each child's individual needs.

Lesson Planning – This section contains a brainstorming tool for teachers to try as they create their lesson plans. Each Investigation has a different tool or variant of a tool so that, over time, teachers can find what works best for them and utilize that tool for effective planning.

Home Extensions – This section provides ideas teachers may want to suggest to families to do at home. Families may be invited to add documentation to children's assessment portfolios, share information using "I Wonder" Journals and engage in informal conversations with teachers. The home extensions are ideas to help families further investigation studies at home and provide tools to engage families in each Investigation. Teachers may also want to share provocations and children's favorite activities for families to replicate at home.

Extension Ideas – This section helps teachers think about where they might like to move next based on children's interests. It provides links to other Investigations in the Collections Curriculum and offers guidelines for making choices that reflect children's current interests and questions. As teachers become familiar with current Investigations and write their new ones, they may wish to add to the extension ideas.

Exhibition Ideas – This section provides suggestions for sharing discoveries from each Investigation. The intent is to showcase children's learning and help children find ways to share their knowledge with others. Programs may want to approach local libraries or public locations near their program to see if they would provide display space for some of the exhibitions. **When sharing information publicly, teachers should be conscious of confidentiality.**

Reflection/Next Steps – This section helps teachers to reflect on the Investigation as a whole. Teachers are able to reflect on the strengths and challenges experienced during individual lessons, incorporating standards, assessing students and take time to reflect on themselves as teachers and learners.

Using STEM Tools for Investigations

Written by Kori Bardige

Using STEM Tools for Investigations

How can we use tools to explore our hypotheses?

MA Standards focused on during this Investigation

Science, Technology, and Engineering
STE-ESS2-4. Use instruments to record data.
ENG. Ask questions/solve problems, design things
ENG. Construct explanations/Theories and evaluate solutions.

Mathematics
MA-CC-1. listen to and say numbers in context.
MA-MD-1. Recognize attributes of length, area, weight, capacity and use attribute vocabulary.

Health Education
H-P-3. Discuss accommodations used by people (with disabilities).
H-P-5. Strengthen bilateral coordination.
H-P-9. Use pincer grasp.
H-P-10. Demonstrate grasp-release skills using tools and materials.
H-SE-16. Describe emotions.
H-SE-17. Solve or prevent problems (actions have consequences).

English Language Arts
ELA-RL.4. Ask and answer questions about unfamiliar words in a story.
ELA-RIT-4. Ask and answer questions about unfamiliar words in informational text.
ELA-RF-3c. Recognizes owns name and familiar signs/labels.
ELA-W-6. Use digital tools for communication.
ELA-SL-1. Participate in conversations during routines and play.
ELA-SL-3. Ask and answers questions to get help, information, or clarification.

History & Social Science
HSS-1. Identify order of daily routines.
HSS-8. Discuss classroom responsibilities.

Arts
ARTS-TA-15. Use dramatic play.

Purpose:
This unit begins the exploration of STEM tools and how to use them for investigative purposes. This investigation is a starting point for developing classroom routines, introducing children to the concept of the scientific method and how to design their own investigations; as well as how to select tools that will be most successful for answering their questions related to their hypotheses. STEM tools help us to learn and make it easier for us to explore our hypotheses.
Consider introducing STEM tools that help children:

- Analyze (such as graphs, spread sheets)
- Measure (rulers, scales, Unifix cubes)
- Enhance (microscopes, magnifying glasses, binoculars)
- Label (chart paper, word walls, online research, dictionary)
- Categorize (sorting trays)
- Discover (pulleys, ramps, magnets)
- Compare (Venn Diagrams, scales)
- Manipulate (tongs, eye droppers, scissors, levers)

The key is to help children learn to ask questions in such a way that they can use STEM tools to explore their questions and discover the answers.

Reflection Question
What key concepts or main ideas do you want children to know and be able to demonstrate once they have completed this Investigation of STEM Tools?

Springboards:
Put out materials that encourage children to ask questions and think about how to find out the answers.

Introduce a KWL chart where children can record what they know, what they want to know or what they think will happen in an experiment, and what they learned.

Watch children carefully as they use STEM tools: what are they doing with them, how are they using them to enhance their investigation, what tools might need further instruction?

Juicy Words

Hypothesis

Theory

Investigate

Measure

Weigh

Analyze

Sink/float

Explore

Temperature

Thermometer

Classroom Adaptations
Turn the **Demonstration Station** into a house corner; add cooking tools such as meat thermometers, temperature gauges, egg beaters, mixing bowls, measuring cups for children to explore.

Transform the **Chemistry Station** into a sink or float station. Help children to make hypotheses about what will stay on top of the water what will fall to the bottom.

Create buildings in the **Engineering Station** for children and encourage children to make comparisons of height and width, use rulers and non-standardized units of measurement. Make predictions about how many blocks it will take to build a tower as high as they are.

Key Questions

How could we figure out the answer to your question?

What could we do with this tool?

I wonder why that happened, what's your theory?

How does the tool make it easier/help you to complete your investigation?

What can you tell me about the tool you are using?

Outdoor Explorations:

Go on a nature walk – collect natural materials that can be analyzed, sorted, and categorized (as well as looked at under magnifying glasses)

Set up a weather station – find a place where children can explore temperature (in sun and shadow) on a daily basis, check on plants/trees and observe changes over time, and collect rainwater.

Choose a class tree – observe what happens to the tree over time by taking pictures with a camera or IPad, measure the circumference of the tree, take a closer look at the bark or leaves of the tree by using a magnifying glass or computerized microscope connected to a laptop or IPad.

Notes Page

Provocations

Float and Sink

Provide children with pieces of tin foil, ask them if it will sink or float. Challenge them to find ways to make the tinfoil sink. Add other items for children to make predictions with. Encourage children to guess which of the materials will sink and which will float and then test their hypotheses.

Making dough

Put out salt, flour, and water, invite children to follow the recipe and guess what they will make. Have them add a half cup of salt, two half cups of flour, and one half cup of water. Stir the dough together and see what they can create with it.

Using Thermometers

Provide color strip thermometers and actual thermometers for children to explore temperatures with. Give children containers of warm, cool, and ice water and ask them to guess what color or number the thermometer will show. Record their guesses and talk about the results.

Reflection Question

What are children's questions?

What are they interested in exploring further?

Ideas for Learning Opportunities in Classroom Stations

Hypothesis		Research		Engineering	
Objectives	Materials	Objectives	Materials	Objectives	Materials
✓Introduce the scientific method ✓Discuss strategies for explorations ✓Teach routines	Morning message Temperature chart Lab Reports Who came to school today? Rule chart	✓Use language to express thoughts ✓Expand vocabulary ✓Participate during read-alouds	Books about magnifying glasses, temperature/ weather, thinking like a scientist	✓Compare and measure ✓Use non-standard units of measurement ✓Introduce tools	Large and small blocks Measuring tape Unifix cubes Number lines Rulers
Assessment Are children able to explain and follow classroom rules?		**Assessment** Did children share at least one idea during read-alouds?		**Assessment** Can children describe a block structure using non-standard measures?	

Ecology		Technology		Mathematics	
✓Use magnifying glasses to explore materials ✓Sorts materials based on observation	Magnifying glasses Bug catchers Natural materials Sorting containers	✓Introduce iPad camera and internet search ✓Concepts of recording observations	iPads Flip Cam Clipboard/ Markers Computer/printer Computerized microscope	✓Practice with counting and measuring	Tongs Balance scales Rulers Measuring tape Numbers Counters Unifix cubes
Assessment Are children using magnifying glasses to explore their environment?		**Assessment** Are children able to use technology to further their investigations?		**Assessment** Can children count numbers one through ten?	

Dissection		Chemistry		Demonstration	
✓Develop finger dexterity (pincer grasp)	Tongs Eye droppers Puzzles Where's Waldo books	✓Make hypotheses and test theories ✓Explore sink and float ✓Measure volume	Water Small containers Materials that sink and float Tin foil	✓Engage in pretend play Explore using thermometers and other cooking tools	Thermometers Doctors kits Egg beaters Measuring cups Temperature dials
Assessment Can children use a pincer grasp?		**Assessment** Are children incorporating technical vocabulary words into play?		**Assessment** Can children take on a pretend play role?	

Reflection		Arts Laboratory		Locomotion Arena	
✓Talk about emotions and feelings ✓Talk about problem solving	Feelings chart/ check in board	✓Introduce scissors ✓Introduce tape/glue	Collage materials Variety of things for children to cut and glue Play dough and tools	✓Practice gross motor skills including balance and ball skills	Variety of music to inspire movement Balls and balance materials Beanbags
Assessment Can children identify their emotions? Can they problem-solve with others?		**Assessment** Are children exploring a variety of writing and drawing tools?		**Assessment** Are children able to throw and catch objects (balls, beanbags, etc.)	

Key Information

The scientific method may seem complex at first, but preschoolers are natural experimenters. The key is to help them find ways to talk about their experiments and introduce vocabulary such as *hypothesis, guess, predict, explore, experiment, discover, confirm, etc.*

Start by sharing an experiment with kids, something they are familiar with, such as sink and float.

Think and wonder out loud with children "I wonder what will happen if I drop this item in the water?"

Elicit children's ideas or guesses. "What do you think will happen?" (You might want to read a book about sink and float to help them make educated guesses).

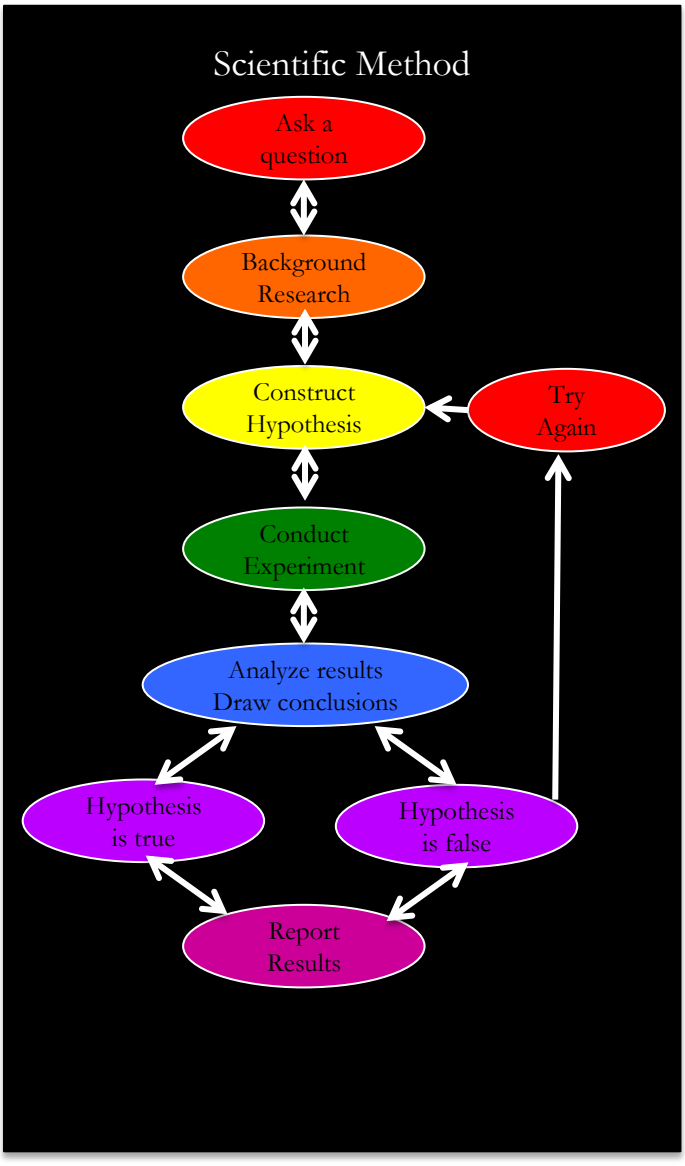
Agree on a guess to try (a hypothesis to test).

Give children opportunities to test their guess.

Was it correct? Did the item sink or float?

Invite children to talk about why and to try other items in their experiment.

Talk about and create a graph that shows the results of their experiments (these items sank, these items floated) .



Scaffolds

Measurement is a tricky concept for children. Start with helping children to make comparisons between larger and smaller sizes and discover contradictions. This tower is two of my hands tall but four of yours, how come?

Introduce the idea of guessing and testing to see if you were correct. "How long do you think your block road is? Is it three blocks long? Let's find out. Then count the blocks or use other blocks to compare size.

Children may have an easier time measuring length than height.

If children can count and follow 1:1 correspondence, then introduce using a tape measure to determine height. Help children to start at the bottom (fixed point) and measure up. If the measuring tape or rulers are confusing for children, continue using non-standard units of measurement.

Children may have an easier time experimenting with volume before height. Can these two different containers hold the same amount?

Celebrating Diversity

Invite children to explore equipment used by people who have disabilities.

Share how glasses can help people see, and provide children with opportunities to try different lenses and explore how looking through different concave and convex lenses change what they see.

Invite children to close their eyes and try walking using a cane to guide them. Talk about how you use other senses, and the cane is a tool that helps people identify where they are by locating boundaries in their environment. Invite children to try counting out steps to identify where they are in space.

Discuss how people who can't hear well use hearing aids. Give children microphones, headphones, and ear horns as well as musical instruments so they can explore how sound can be muffled or amplified.

Individualizing Learning

Reflection Question

What individual children do you want to hone in on during this investigation topic? What skills would you like to help them develop?

Reflection Question

What types of enrichment activities could you provide to help children who need additional practice to develop skills or for those who are more advanced than their classmates?

Lesson Planning Ideas

As you begin this Investigation, a KWHLN chart can to help you use a parallel process for planning daily activities and mapping out the unit plan**.** What do you know, wonder about, and want to learn through this investigation? What do you think children know, wonder about, and want to learn?

K What do you **K**now about this topic?	**W** What do you **W**ant to learn? What do you **W**onder about?	**H** **H**ow will you figure out the answers to your questions?	**L** What are you **L**earning through this Investigation?	**N** What are your **N**ext steps? How will you connect this Investigation to the next one?
What do your students **K**now about this topic?	What do you **W**ant your students to learn? **W**hat questions do they have? What are they **W**ondering about?	**H**ow will you help the students investigate STEM Tools and use the Scientific Method to figure answers to their questions?	What are your students **L**earning from this investigation?	Where do the students want to go **N**ext? What else are they interested in learning about?

Home Extensions

Encourage families to get children involved in exploring ideas by imagining and wondering with children. "What would happen if we could fly, where would we go?"

Share STEM tools families can use at home.

Provide families with cooking recipes where children can measure ingredients using measuring cups.

Reflections and Next Steps

What was most successful in this Investigation and Why?

What are the jumping off points? How will you lead into your next investigation?

Extension Ideas

If children have been interested in exploring measurement, consider moving to **Creating Outdoor Art** or **Playing with Sunlight and Shadows** where they can continue exploring size comparisons.

If children have been curious about nature explorations and using magnifying glasses to further their study consider moving to **Studying Horticulture** or **Studying Trees** where children can continue their investigations about nature.

If children have begun to ask questions about other types of tools, consider moving to **Simple Machines: Carousel** or **Complex Machines: Automobiles** where children explore how machines work by creating ramps and pulleys.

Exhibition Ideas

Create an exhibit of the materials children discovered in nature, take pictures of materials from the digital microscope and describe comparisons between the materials.

Put out magnifying glasses so others can look closely at the natural materials.

Incorporate children's questions into the display to get visitors talking. For example, "I wonder if all Rhododendron leaves have the same markings?"

Creating Lesson Plans

A lesson plan details the weekly and daily experiences within a classroom and provides a framework that shapes teacher's instruction. The Investigation unit should be used as a guide for informing daily activities and ensure that teachers are being intentional about the types of experiences they are creating within the classroom. Lesson plans should be revisited at the end of each day so teachers can reflect on what they covered, modified, or changed. Teachers should also consider what children learned, based on formative assessment and should make adjustments to their lesson plans for the next day accordingly. Lesson plans can and should serve as reflective documents for teachers as well as instructional plans.

We have created two different versions that support our vision for the curriculum. Teachers should select the one they feel is most helpful for them or should create their own based on the information provided in the curriculum.

Blank Lesson Plan Simple Format

Investigation: _____

Week : _____

Written by: _____

What is the goal(s) for this week's Investigation?
What specific topics do you plan to cover?

(check off content areas covered in this lesson plan)
Sci ___ **T**ech ___ **E**ng___ **M**ath ___ ELA ___ S/E ___ PE ___ Arts___ Hist/SS ___

What activities will you do to help children learn these concepts or skills?

What question(s) do you plan to ask children to further their explorations?

What did children learn as a result of completing the activities?

What did you learn?

What would you add to further children's explorations and knowledge of this Investigation topic next week?

What was most successful for you and the children this week?

Individualizations

(Information about specific students you want to focus on this week)

Materials Needed/

Weekly To Dos:

Blank Lesson Plan Detailed Format

Investigation: _____

Week : _____

Written by: _____

Monday Hypothesis Station		**Tuesday Hypothesis Station**		**Wednesday Hypothesis Station**	
Objective	Activity	Objective	Activity	Objective	Activity
Assessment		Assessment		Assessment	

Thursday Hypothesis Station		**Friday Hypothesis Station**		**Monday Investigation Adventure**	
Objective	Activity	Objective	Activity	Objective	Activity
Assessment		Assessment		Assessment	

Tuesday Investigation Adventure		**Wednesday Investigation Adventure**		**Thursday Investigation Adventure**	
Objective	Activity	Objective	Activity	Objective	Activity
Assessment		Assessment		Assessment	

Friday Investigation Adventure		**Arts Laboratory**		**Arts Laboratory**	
Objective	Activity	Objective	Activity	Objective	Activity
Assessment		Assessment		Assessment	

Ecology Station		**Technology Station**		**Engineering Station**	
Objective	Activity	Objective	Activity	Objective	Activity
Assessment		Assessment		Assessment	

Mathematics Station		**Chemistry Station**		**Dissection Station**	
Objective	Activity	Objective	Activity	Objective	Activity
Assessment		Assessment		Assessment	

Writing Station		**Demonstration Station**		**Research Station**	
Objective	Activity	Objective	Activity	Objective	Activity
Assessment		Assessment		Assessment	

Language & Literacy		**Locomotion Station**		**Social & Emotional Development**	
Objective	Activity	Objective	Activity	Objective	Activity
Assessment		Assessment		Assessment	

What did children learn as a result of completing the activities?

What did you learn?

What would you add to further children's explorations and knowledge of this Investigation topic next week?

What was most successful for you and the children this week?

The following are examples of other investigation topics that have been developed specifically for The Hundred Acre School based on its unique features (location, museums, and outdoor spaces). These topics are aligned with the Massachusetts Department of Education and Department of Early Education and Care standards and help teachers at the school create a comprehensive curriculum for the year-round program. Use the blank investigation template as a way to develop your own investigation on one of the following topics or on a topic of your choice.

Additional Investigations Topics

Creating Outdoor Art

Hypothesis question: How does Heritage's Big Bugs art installation inspire our own artwork? What other artists and illustrators might inspire our outdoor art?

Investigation purpose: In this unit children will explore different ways to create two and three dimensional art using natural and recycled materials. Children will have opportunities to play with size and scale as they create artwork that can be displayed outside. During this investigation, children will read about and study many different artists and media. Because Heritage Museums & Gardens will have a collection of Big Bugs (giant art sculptures of bugs), children will focus on studying Eric Carle's books about bugs; highlighting how one author/illustrator uses collage and paint to create the illustrations for his books. Children will also be exposed to other famous artists and introduced to their various techniques.

Studying Insects, Arachnids and Earthworms

Hypothesis question: How do insects, spiders, and earthworms help the environment?

Investigation purpose: This unit will focus on the similarities and differences between insects, arachnids, and earthworms. Children will learn about their body parts, habitats, life cycles, markings, and ways they help the environment. Children will spend time exploring the forest floor and finding insects, arachnids and earthworms in their natural habitat. Depending on interests, children may recreate these habitats in their school by planting a garden to attract butterflies, building an earthworm house, or creating giant spider webs.

Connecting with Our Community

Hypothesis question: What can our community teach us about STEM?

Investigation purpose: This unit focuses on exploring the local community, using maps and discussing occupations and transportation. Children will study community helpers through a STEM lens, such as learning how engineers work on bridges, horticulturists cultivate gardens, or veterinarians care for animals. Children will have opportunities to explore these occupations through pretend play, visits with professionals, and field trips to observe community members in action. This Investigation Unit also provides opportunities to explore social problem-solving techniques and why caring for one another is important. Educators may use this unit as an opportunity to introduce Second Step: Social-Emotional Skills for Early Learning©. Children will learn about civics and what it means to be a community as they study their own classroom, the Heritage Museums & Gardens, and Sandwich, MA. Children may also expand their studies to include other locations, learn about different climates and cultures around the world.

Recycling: Protecting Our Environment

Hypothesis question: Why is recycling important for protecting the Earth?

Investigation purpose: In this unit children will learn about the importance of recycling and protecting the planet. They will begin or further their study of earthworms by learning about composting. They will discover ways to reuse and repurpose materials. They will practice with sorting and classifying human-made materials and learn how items, such as paper, are made from natural materials. They will also explore their community and learn ways to help others care for their environment.

Complex Machines: Automobiles

Hypothesis question: How do the parts of an automobile work together to make it move?

Investigation purpose: This unit is about using complex machines. Complex machines are made of two or more simple machines that are integrated together. Some examples of complex machines include scissors, bicycles, and automobiles. The Automobile Collection at Heritage Museums & Gardens will provide a hands-on tool for this investigation as children explore the parts of an automobile, learn about assembly lines for building machines, discover how motors work, and explore the mechanics and physics involved in making automobiles move.

Simple Machines: Carousel

Hypothesis question: How do the parts of a carousel work together to make it move?

Investigation purpose: Simple machines are mechanical devices that require a single force to work (e.g., lift, pull, turn). They have few if any moving parts. There are seven types of simple machines including: levers, screws, wheels and axles, pulleys, wedges, inclined planes, and gears. In this unit children will explore the simple machines that are part of the carousel at the Heritage Museums & Gardens. In addition to exploring how simple machines work, children will also explore the carousel and discover how simple machines help the carousel balance, the types of materials that make up the carousel, and how carousels are part of amusement parks and fairs.

Studying Trees

Hypothesis question: Why are trees important?

Investigation purpose: This unit will focus on trees and exploring their parts, life cycle, and uses. Children will explore materials that come from trees such as sap, pine cones and acorns, benefits of trees, such as providing shade, oxygen, and homes for animals, and uses of trees, such as supplying wood and making paper. Children will also explore the similarities and differences between coniferous and deciduous trees.

Studying Horticulture

Hypothesis question: What makes plants similar and different?

Investigation purpose: This unit will focus on plants and gardening. Children will create their own garden at The Hundred Acre School and determine what they want to grow, how they will need to care for their plants, and learn about hybridization. Heritage Museums & Gardens has a large collection of hybridized rhododendrons that will be a main focus on this investigation. Children will also learn about gardening, farming, and how we gather, ship, and grow food around the world.

Exploring Weather and Weathervanes

Hypothesis question: How does the weather affect our daily activities?

Investigation purpose: This unit is about studying the weather and using specialized instruments (thermometer, barometer, rain gauge, weathervane, and hygrometer). Although 'weather check' is part of the daily routine, this unit extends children's knowledge of weather. Children will have opportunities to chart their observations and observe the seasons over time. Children will also explore weather in fictional and non-fictional stories about the different types of houses and weather around the world.

Wondering about Water

Hypothesis question: Why is water important?

Investigation purpose: Because children use water every day, this unit focuses on helping them learn more about water and its purposes. Children will explore the water cycle, look at maps of bodies of water, discuss the types of water, and how water changes from solid to liquid to vapor. Children will have opportunities to experiment with water pressure, water conservation, and properties of different types of water. They will also study the ecology of water and its importance for people, animals, and plants.

Conducting Science Experiments

Hypothesis question: How does the scientific method help me make and prove my discoveries?

Investigation purpose: This unit will focus on exploring chemistry concepts. Children will further their use of the scientific method by developing hypotheses and testing them through experiments. Children will explore how materials transform, such as liquids becoming solids or gas; and learn about chemical reactions and catalysts. Children will discover the "magic" of science as well as the explanations as to why the reactions occurred. Children will also learn about scientists and other STEM occupations.

Exploring Sound

Hypothesis question: How can I make different sounds?

Investigation purpose: This unit focuses on the sense of hearing and helping children explore different sounds. Children will explore sounds they hear in nature, human-made sounds and sounds they can create using their own bodies or voices. Children will have opportunities to create their own instruments and to explore musical concepts such as melody, pitch, rhythm, tempo, dynamics, and timbre. They will also play with words in sounds, exploring phonological awareness, onsets and rimes, alliteration, and poetry.

Playing with Sunlight and Shadows

Hypothesis question: How do we use light to create shadows?

Investigation purpose: In this unit children will explore light and shadows, discuss times of the day, and how to use sundials to tell time. Children will also play with two-dimensional (2D) and three-dimensional (3D) shapes and how shadows turn 3D objects into 2D reflections. They will explore ways to use shadow puppets to create theater productions. Children will also explore the role of the sun in the universe; as well as its influence on animals, plants and seasons.

Discovering Color

Hypothesis question: What creates the colors we see in our environment?

Investigation purpose: In this unit, children will have opportunities to explore the color spectrum through refracting light, colors found in nature, and by creating their own colors. Children will discover how to describe, sort, match, and mix colors to create new ones as they play with prisms and create rainbows, and explore the absence of color (black and white). This unit focuses on the role color plays in nature such as in camouflage and photosynthesis. Children can use natural colors to create their own dyes for artwork. Children will also explore the concept of 'eating a rainbow' and how fruits and vegetables of different colors provide nutrients for the body.

Observing Flight

Hypothesis question: What makes things fly?

Investigation purpose: In this unit, children explore things that fly including animals (birds and insects – especially butterflies and moths), materials found in nature (maple spinners) and human-made materials like kites, airplanes and helicopters. Children will explore aerodynamics and what makes things fly, how wind and gravity work. Children will explore migration and observe birds and butterflies in their natural habitat as well as learn about their body parts and make comparisons between living and human-made things.

Becoming Pattern Makers

Hypothesis question: What patterns can we discover and create in our environment?

Investigation purpose: In this unit, children will discover patterns in their environment and have opportunities to learn to create their own patterns. Children will use human-made and natural materials to explore patterns, shapes, and mathematical concepts. As children become good pattern makers they will develop number sense and be able use patterns to understand mathematical algorithms. They will discover ways to count by (multiplication), count time, count order, count objects, and count on (addition). They will learn about symmetry and balance and about the beauty of patterns found in nature.

Exploring the Animals at Heritage

Hypothesis question: How can we help and protect animals that live in our community?

Investigation purpose: This unit will focus on the different animals children may be able to see in their environment. At Heritage Museums & Gardens there are geese, snapping turtles, foxes, coyotes, wild turkeys, squirrels, chipmunks, and a variety of birds. Children will learn about these animals and their natural habitat as well as ways they can protect the animals. Children will explore animal tracks, animal homes, and animal diets including those of herbivores, carnivores, and omnivores.

Learning About the Human Body

Hypothesis question: How do our bodies work?

Investigation purpose: This unit is about helping children to learn about themselves and others, comparing similarities and differences, learning about body parts and body systems, and exploring their world using their five senses. Children will learn ways to stay healthy including nutrition, visiting doctors and dentists, and ways to stay safe. Children will look at their bodies as tools and machines and explore how they can move and create different actions.

Investigation:

Written by _____

MA Standards focused on during this Investigation

Science, Technology, and Engineering

Mathematics

Health Education

English Language Arts

History & Social Science

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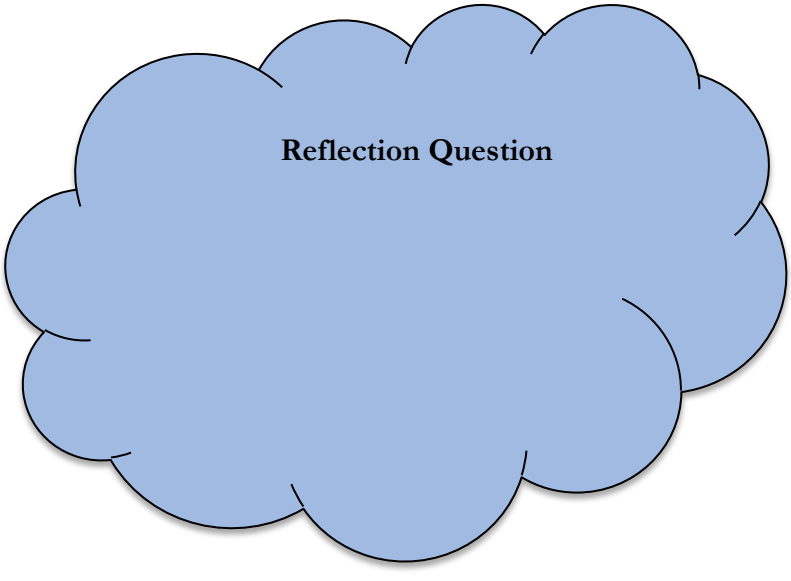
Arts

Title:

Hypothesis Question:

Purpose:



Springboards:

Juicy Words

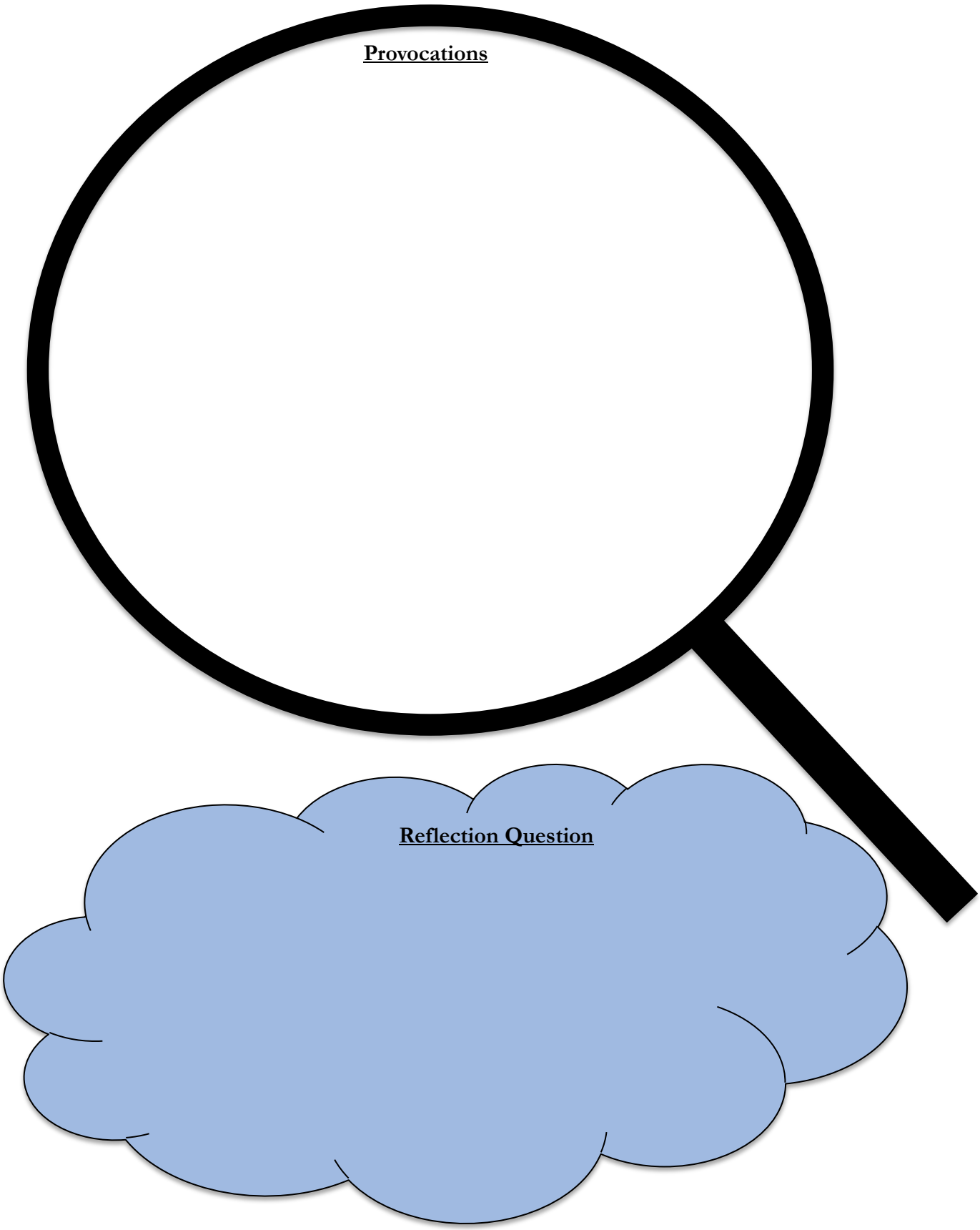
Classroom Adaptations

Key Questions

Outdoor Explorations:

Notes Page

Provocations



Reflection Question

Ideas for Learning Opportunities in Classroom Stations

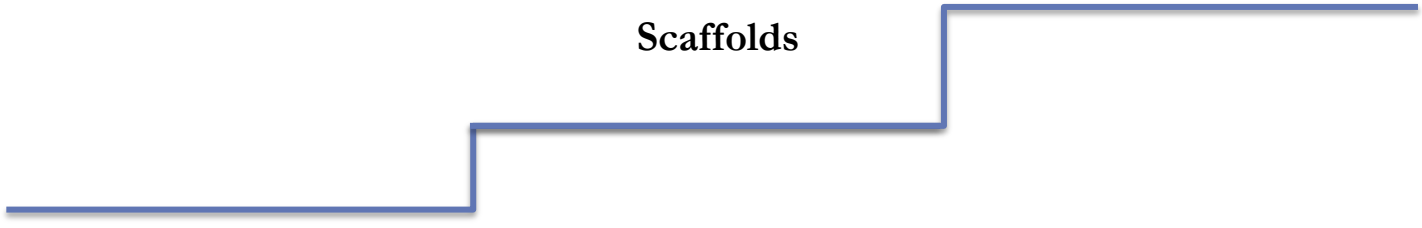
Hypothesis		Research		Engineering	
Objectives	Materials	Objectives	Materials	Objectives	Materials
Assessment		**Assessment**		**Assessment**	

Ecology		Technology		Mathematics	
Assessment		**Assessment**		**Assessment**	

Dissection		Chemistry		Demonstration	
Assessment		**Assessment**		**Assessment**	

Reflection		Arts Laboratory		Locomotion Arena	
Assessment		**Assessment**		**Assessment**	

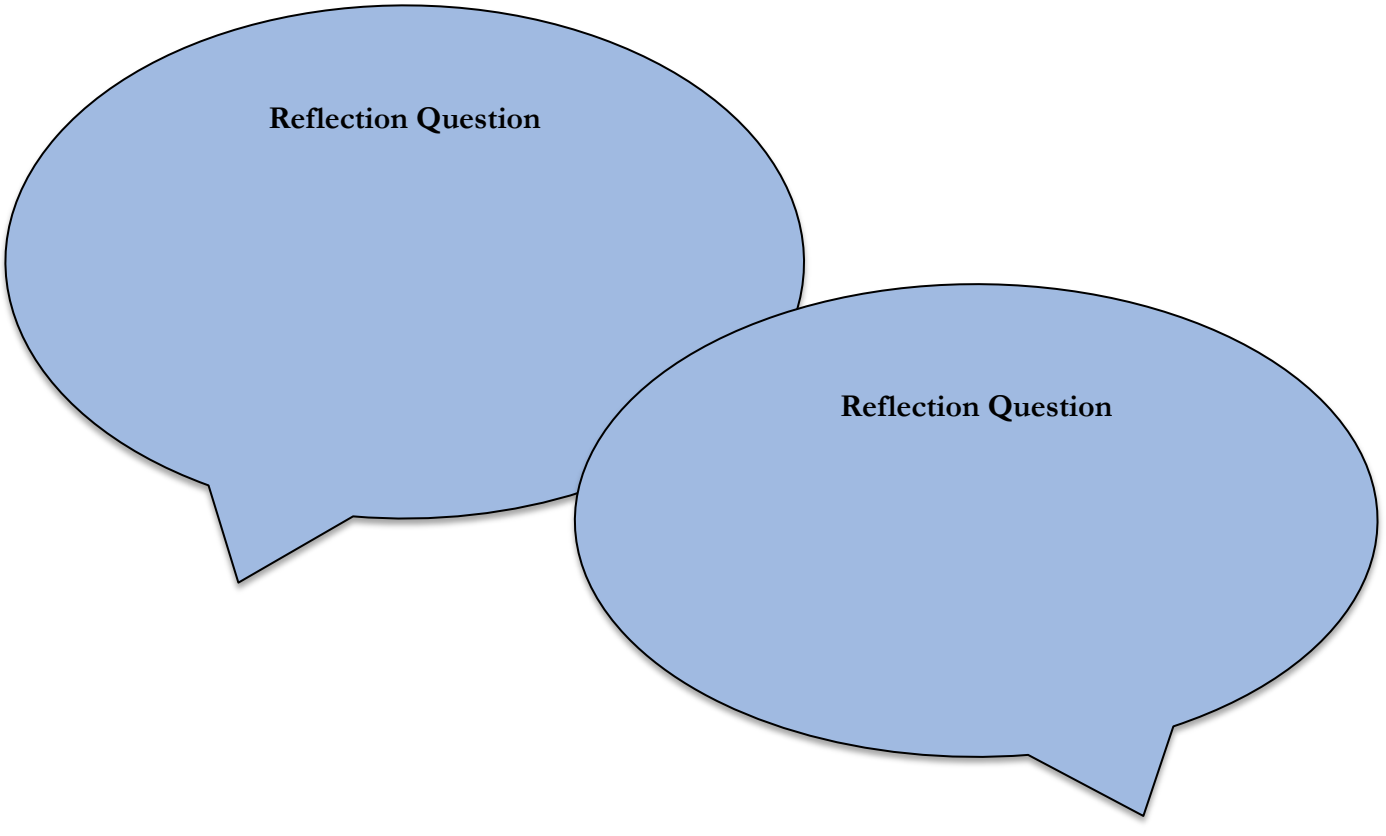
Key Information



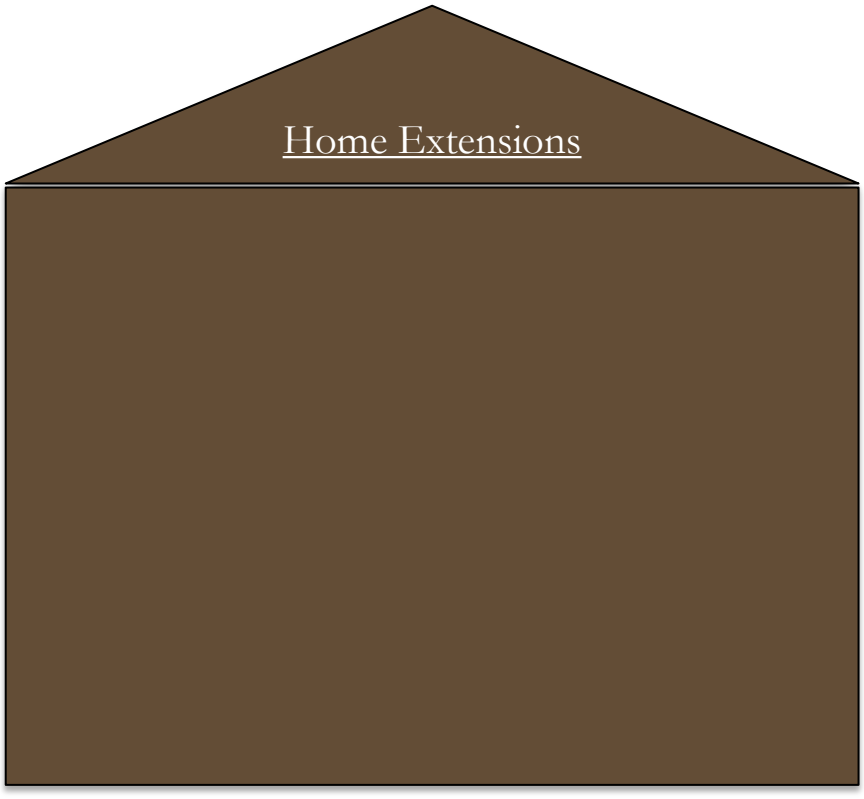
Scaffolds

Celebrating Diversity

Individualizing Learning



Lesson Planning Ideas



Extension Ideas

Exhibition Ideas

Reflections and Next Steps

What was most successful in this Investigation and Why?

What are the jumping off points? How will you lead into your next investigation?