



EDUCATOR GUIDE

Dig UP! A Dinosaur Expedition

By STEMmersive



This guide is geared toward teachers of grades PK - 3

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About This Guide

Use this guide to help your students anticipate, investigate, and reflect upon your live performance experience. This guide is geared toward teachers of grades PK - 3.

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The great thing about the arts is that they can often evolve to meet their context. That means that many of the activities shared are flexible to a lot of different contexts depending on how you choose to frame them in your class. We know you all are experts on your classroom and students, so we invite you to use these lessons and activities as guideposts and adapt them to fit your classroom management style, range of student ability, and time constraints.

LEARNING CONNECTIONS

Science: Paleontology, dinosaurs, geology and prehistory

Theater: Puppetry, audience-in-role

21st Century Skills: Collaboration, problem-solving

LEARNING STANDARDS ICON KEY



Educators, we invite you to share with us what you did in your classroom around this guide or the production. You can email eschildkret@portlandovations.org or reach us via [Facebook](#) or [Instagram](#).

We want to hear and see what great learning is happening in your classrooms.

What To Expect

The Performance

- The entire experience is 50 minutes long and is divided into two parts.
- In the first part, various activity stations will be set up to prepare you for a simulated scientific journey. You can move between the activity stations to read a book, dig up fossils, and more.
- The second part is the performance, which takes place inside an inflatable planetarium dome. You will be seated on the floor, but chairs are also available upon request.
- Two performers in role as a geologist and paleontologist will lead you on your simulated scientific journey.
- The performance will happen all around you. Performers will play characters, use puppets, and images will be projected on the sides and top of the dome.
- You can leave the dome at any time during the performance, but for safety reasons, once you leave you cannot return.

The Sound

- The performers' voices will be amplified with microphones.
- The performance includes sound effects to make the experience feel more real.
- There will be original songs as part of the performance (and you can sing along!)

The Lights

- Images and videos will be projected on the walls and ceiling of the dome while the performance is happening.
- Lighting will be bright at times and dim at times.

Resources

- Plan your visit to Riverton Community Center: portlandovations.org/about/accessibility-riverton-community-center/
- Learn more about accessibility at Portland Oventions: portlandovations.org/about/accessibility/



EXPERIMENT

Make Your Own Crystals

Introduce gemstones and their formation process with this experiment. Making crystals yourself is a good way to learn firsthand how crystals grow. .

Materials:

A large pot
A heat source that can bring water to a boil
Water
Sugar (lots)
String
Washers or weights

Procedure:

1. Fill a large pot with water and stir in as much sugar as you can. When you see it settling on the bottom and no more dissolves, you've reached the saturation point. The water has absorbed all the sugar it can. This condition is called super-saturation.
2. Bring the pot to boil. At boiling, the saturation level changes. The solution is no longer super-saturated. You can now add considerably more sugar. So, add more sugar until you again reach a super-saturation level.
3. Remove the pot from the heat source. As the water cools to room temperature, the amount of sugar it can hold in suspension will return to the previous level. The excess sugar must come out of the solution. As it does, it will crystallize.
4. Hang a string in the sugar solution for the crystals to grow on. (Put a weight at the bottom of the string to keep it straight). Although the process itself isn't fast enough to observe unaided, you will see changes in the crystals every few minutes.
5. By the time the solution reaches room temperature, sugar crystals will cover the string. The water will again be super-saturated.

Reflection:

- What did we do in this experiment?
- What happened when we added heat to the sugar water? What happened when we added string and took the water off the heat?
- What can we tell about crystals in nature from making our own?



EXPLORE

EXPLORE: Gemstones and Mineral Crystallization

In the experiment above, you used a few simple ingredients—sugar, water, and heat—to create crystals. This process for making crystals in a pot with sugar water actually has a lot in common with the way minerals crystallize in nature. Minerals are earth's building blocks. They are solid, inorganic structures (inorganic means they don't come from living things). Minerals have a specific chemical recipe and have a crystal structure (which means their atoms are arranged in a neat, repeating structure). Minerals are not the same thing as rocks! Minerals are like simple ingredients - they can exist on their own or combine to form more complex structures. Gemstones like diamonds are minerals. Rocks are usually a mixture of more than one mineral. In order for minerals to crystallize and form gemstones, there are five requirements:

Ingredients: like the sugar you used in your experiment, in order for minerals like gemstones to form, you need chemicals to create their basic structure.

Temperature: Heating and cooling chemicals causes minerals to form, just like heating and cooling the sugar solution caused crystals to form in the experiment. Different minerals need different temperatures to form crystals.

Pressure: Along with temperature, pressure is a critical requirement for minerals to crystallize. Some minerals need lots and lots of pressure, as well as the right combination of heating and cooling, in order to form. For example, Diamonds need 725,000 PSI (Pound-force per square inch) to form. That's the equivalent of 86 elephants all balancing on each other's back on a single dime.

Time: Minerals can take millions or billions of years to crystallize under the right conditions in the right space inside the earth.

Space: Minerals need room to grow - just like the sugar needed a big pot for the string to be suspended in. In order for a mineral to crystallize inside the earth, it needs a space, or cavity, big enough for it to grow.



Crystallized mineral



Rock

If the right ingredients are exposed to the right temperature and pressure over time in a space under the earth big enough, they can create minerals, including the beautiful gemstones humans like to admire and wear.

EXPERIMENT

Make Fossil Impressions

Create your own impressions of “fossils” using pasta shapes and play dough or modeling clay. This fun art activity also provides a hands-on example of what fossils are. Use this experiment at the beginning of a lesson to gauge students’ prior knowledge of dinosaurs and fossils, or at the end of a lesson to assess what they learned.



Materials:

Modeling clay (like model magic) or play dough
Various pasta shapes
Blank paper

Procedure:

1. Begin by creating your dinosaur. On blank paper, arrange pasta shapes to create the shape of a dinosaur (do not glue it down). As you create your dinosaur consider its features- is it a meat-eater or a plant eater? What does its body shape tell you about where and how it lived?
2. Once you’re satisfied with your dinosaur, take a ball of clay or playdough and press it flat on a surface. Make sure your clay/playdough is big enough to fit your entire dinosaur.
3. Create your fossil by pressing the pasta shapes one by one into the clay/playdough to form the shape of your dinosaur. Press them firmly, then remove them to see the impression they leave behind.
4. If you’re using modeling clay, allow your impressions to dry into hard rock.

Reflection:

- What did we do in this activity?
- How did you use the pasta shapes to create a dinosaur? What did you think about as you designed your dinosaur?
- What was it like creating an impression of your dinosaur?
- What do you think these impressions have to do with real fossils?

EXPLORE

Dinosaurs and Fossils

Dinosaurs roamed the earth more than 150 million years ago. The word dinosaur means “terrible lizard” in Greek – Dinosaurs were large, lizard-like reptiles. The last dinosaurs became extinct, or died out, about 65.5 million years ago. We know dinosaurs existed because we have evidence—fossils. Just like the impressions you made in your experiment, fossils are remains or impressions of a plant or animal that have been preserved in rock. By studying these fossils, scientists know that dinosaurs were the ancient cousins of today’s crocodiles, snakes, and lizards. Scientists also believe that today’s birds descended from dinosaurs. Fossils of dinosaurs were first discovered in the early 1800s.

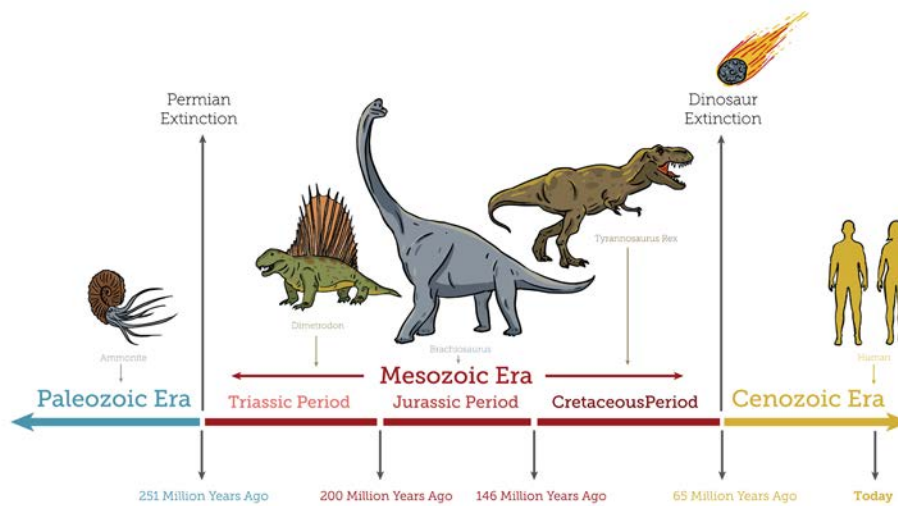
Maine’s state fossil is *Pertica Quadrifaria*, a plant that lived nearly 400 million years ago. Its remains were found in 1968 in Baxter State Park. Scientists believe it was the largest land plant of its time, and was among the first to evolve something like leaves. Why is Maine’s state fossil a plant and not an animal? Because there are no dinosaur fossils or giant mammal fossils found in Maine. In fact, there are no fossils found in Maine dating from 360 million years ago to 1 million years ago. This is because almost all the fossils from this period were destroyed by the glaciers that covered Maine 2.5 million years ago. Since dinosaurs went extinct by 65.5 million years ago, well before glaciers covered the area that is now our state, there are no dinosaur fossils in Maine.



Pertica Quadrifaria
Image from Maine Geological Survey

When and Where Dinosaurs Lived:

Dinosaurs lived a really long time ago. It was so long ago that it has to be measured in geologic time. Geologic time divides Earth's history into periods that are millions of years long. Dinosaurs were common during the Triassic, Jurassic, and Cretaceous geologic time periods. Those time periods lasted from 252 to 66 million years ago. Not all species, or types, of dinosaur lived at the same time. They also did not all become extinct at the same time. They died out gradually.



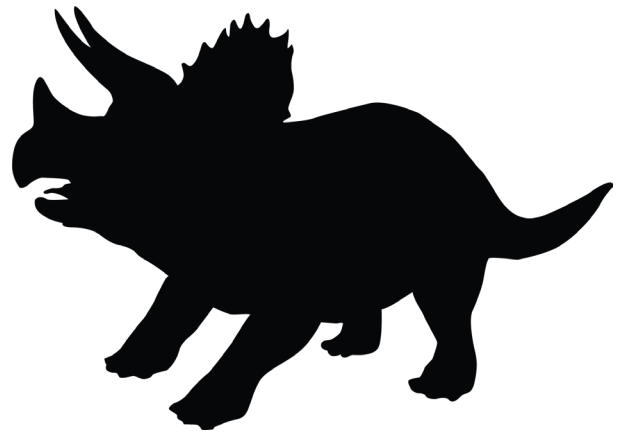
Dinosaurs lived throughout the world, and their fossils have been found on every continent. They lived in all different kinds of environments as well, ranging from tropical forests to dry, sandy deserts.



Types of Dinosaurs:

Dinosaurs were different sizes. Some dinosaurs were smaller than a chicken. Others weighed as much as 100 tons—more than 10 times as much as the largest elephants. Scientists have divided dinosaurs into two large groups. The groups are based on the way a dinosaur’s hip bones were shaped. One group is the Ornithischia, or bird-hipped dinosaurs. Members of this group are called ornithischians. The other is the Saurischia, or lizard-hipped dinosaurs. Members of this group are called saurischians.

The **ornithischians** had hips shaped like the hips of today’s birds. Despite this similarity, however, today’s birds are not related to the ornithischians. The ornithischians were plant eaters. They walked on either two or four thick, sturdy legs. Ornithischians generally had flat teeth to grind tough plants. They also had an extra bone at the tip of the lower jaw. This bone joined the two halves of the lower jaw together. It also helped to form a horny beak that made it easier for the dinosaurs to bite plants. Many of the ornithischian dinosaurs had special features. Some, such as Triceratops, had horns like a modern rhinoceros. Euoplocephalus had a huge club at the end of its tail. Stegosaurus had large, triangular bony plates sticking out of its back.



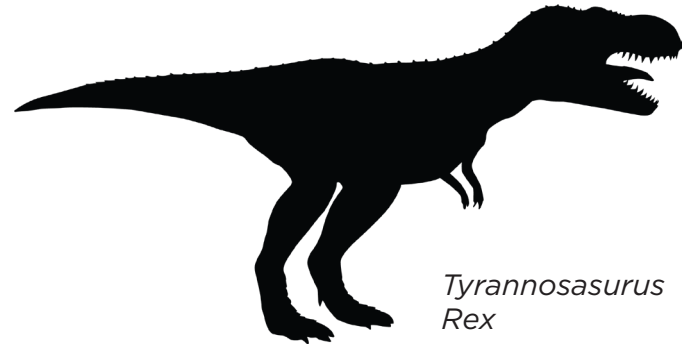
Triceratops

The **saurischians** had hips that look like the hips of today’s reptiles. But they also had some features in common with today’s birds. In fact, scientists believe that the saurischians are more closely related to birds than to some other dinosaurs. Archaeopteryx was a saurischian. The saurischians are divided into the meat-eating theropods and the plant-eating sauropods.

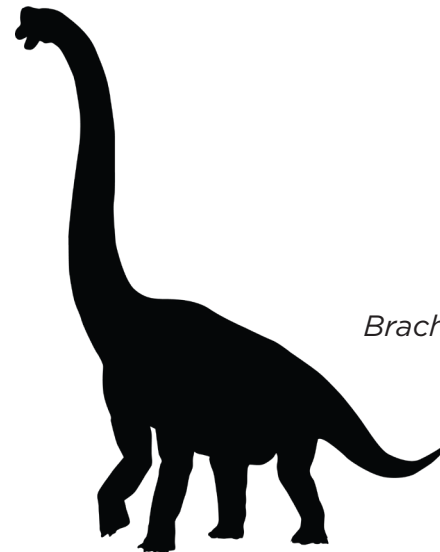


Archaeopteryx

Theropods include all the meat-eating dinosaurs. Among them is the fierce Tyrannosaurus rex, which weighed as much as eight tons. Giganotosaurus and Spinosaurus were even larger. Theropods walked on their two back legs. Most of them were built to hunt. They used their short front arms to catch and tear prey. Their fingers and toes had long, sharp claws. They had powerful jaws and sharp teeth for tearing flesh. Theropods normally hunted alone. They caught and ate smaller, plant-eating dinosaurs. Sometimes they hunted in groups and attacked larger dinosaurs. Sauropods were not only the largest of all dinosaurs. They were also the largest land animals that ever lived. **Sauropods** were plant eaters that walked on four legs. Brachiosaurus, Diplodocus, and Apatosaurus are examples of sauropods. Sauropods had a very small head and brain when compared to their huge body. But they had a long neck, which let them reach leaves on even the tallest trees. They had thick, strong legs, like those of an elephant. Many sauropods probably could stand up on their back legs to reach even higher into the trees. They used their long, muscular tail to balance themselves when standing. Some sauropods also might have used the tail as a whiplike weapon.



*Tyrannosaurus
Rex*



Brachiosaurus

Extinction:

The last dinosaurs died out about 65.5 million years ago (the cretaceous period). Scientists still do not agree about why this happened. Some scientists believe dinosaurs died out because the temperature on Earth got too hot or too cold for them. Other scientists believe the cretaceous extinction happened because a huge asteroid collided with the earth. The collision could have produced dust that blocked the Sun's heat and light for months or even years. Plants would have stopped growing, and plant-eating dinosaurs would have died from lack of food. So would have the meat eaters that hunted them.

Some animals lived through the time when the dinosaurs disappeared. The ancestors of today's frogs, turtles, lizards, and snakes found a way to survive. Birds also survived. Scientists do not know why some animals lived but dinosaurs did not.

EXPLORE FURTHER: Dinosaur Activities

Book List

Check out these titles collected by the team at STEMmersive to further your learning about dinosaurs, fossils, and paleontology.

Stalactite & Stalagmite: A Big Tale from a Little Cave
by Drew Beckmeyer

Dig, Dig Dinosaur
by Anjali Goswami and Maggie Li

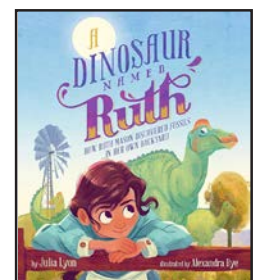
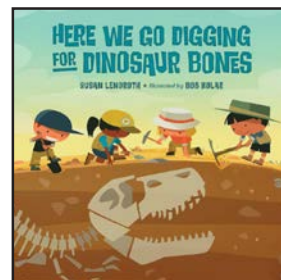
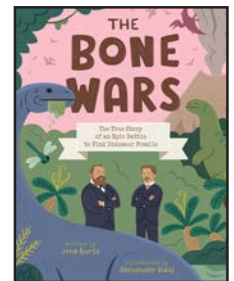
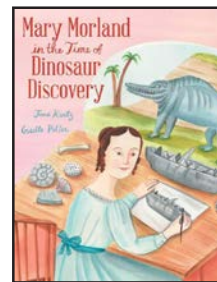
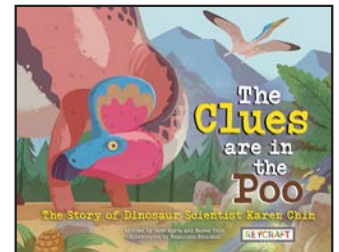
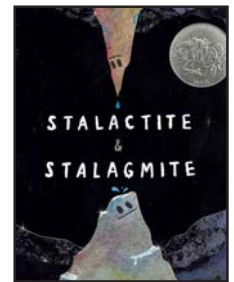
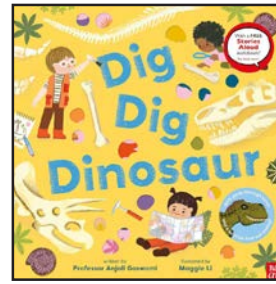
The Clues are in the Poo: The Story of Dinosaur Scientist Karen Chin
by Jane Kurtz and Karen Chin

Mary Morland in the Time of Dinosaur Discovery
by Jane Kurtz

The Bone Wars
by Jane Kurtz

Here We Go Digging for Dinosaur Bones
by Susan Lendroth and Bob Kolar

A Dinosaur Named Ruth: How Ruth Mason Discovered Fossils in her Own Backyard
by Julia Lyon and Alexandra Bye



ACTIVITY: Dinosaur Footprints

How big were dinosaurs? This simple activity helps students visualize exactly how large Stegosaurus was.

Materials:

A blank piece of paper (8.5 x 11)
Coloring supplies
A Measuring tape
Masking tape
Open floor space.

Procedure:

1. Begin by creating your dinosaur footprint. Draw the outline of a Stegosaurus footprint on a blank piece of paper. Use the entire blank space on the paper to create your footprint - Stegosaurus's feet were about 11 inches long, the length of a regular piece of paper. You'll need at least 2 footprints for this activity.
2. Lay one of your footprints on the ground and tape it down so it doesn't move.
3. Measure 6 inches from the first footprint. Lay your second footprint on the ground and tape it down. Stegosaurus had a stride of about 6 inches.
4. Admire your dinosaur footprints! Try walking in Stegosaurus's footsteps.

Reflection:

- What was it like trying to walk like a Stegosaurus?
- How big do you think Stegosaurus would be to have a stride this long?
- What do you think the earth was like when creatures like Stegosaurus lived?



ACTIVITY: Dinosaur Rubbing

One of the steps for preserving fossils is to take a rubbing of the fossil where it's buried. This helps preserve the shape of the fossil. Try this yourself with some simple materials - you can use this activity on its own or add it to the fossil impressions experiment above. Take a rubbing of your impression before you remove the "skeleton."



Materials:

Plastic dinosaurs or pasta shapes
Playdough or clay
Blank Paper
Crayon

Procedure:

1. Begin by creating your fossil. Take either a plastic dinosaur or a dinosaur skeleton created from pasta shapes (just like in the fossil impressions activity).
2. Lay a blank piece of paper over the fossil. Using a crayon, lightly color over the fossil on the blank piece of paper. Use gentle, sweeping motions to take your rubbing.
3. Observe the rubbing. Use crayons to emphasize the parts of the page where the skeleton was so you can best see your fossil.

Reflection:

- What did we do in this activity?
- What was it like taking a rubbing of your fossil? Why do you think scientists do this when they discover fossils?
- When else might it be useful to take a rubbing? Where else could we use this strategy?

ACTIVITY: Dinosaur Museum

Modify the popular game, Statues, to create your own dinosaur museum. This activity is a great brain break, but you can also use simple cues to add an element of science.

Materials:

Space to move

Procedure:

1. Choose a space in the room where you can move your body safely and freely.
2. Select someone to be the “curator.” The curator will be “it.” Ask the curator to close their eyes while the dinosaurs take their places.
3. Everyone except the curator, use your body to create a dinosaur statue, and freeze.
4. Curator: open your eyes and observe your dinosaurs. Are they all where you expect? Do any of them need dusting?
5. Dinosaurs: your goal is to move as much as possible without getting caught by the curator! As soon as the curator turns their back, shift to a different dinosaur position.
6. Curator: Your goal is to catch the statues moving! Check your exhibit carefully.
7. When the curator sees movement, the dinosaur is out until the next round. The last dinosaur standing becomes the next curator.
8. As you play, consider creating specific dinosaurs. Curators, instruct dinosaurs to create only theropods, sauropods, or ornithischians. Dinosaurs, how specific can you get with your body in creating your frozen dinosaur?

Reflection:

- What did we do in this activity?
- What skills did you use as a dinosaur? What skills did you use as a curator?
- Where else do we need to use these skills in our learning?



Resources

Learn more about STEMmersive:

www.stemmersive.com/

Dig into National Geographic Kids' Dinosaur Collection:

kids.nationalgeographic.com/animals/prehistoric

Take a National Geographic Kids quiz to see how much you know about rocks and minerals:

kids.nationalgeographic.com/games/quizzes/article/quiz-whiz-rocks-minerals

Explore more activities and lesson plans about dinosaurs:

amnh.org/learn-teach/curriculum-collections/dinosaurs-activities-and-lesson-plans

Read about Portland High School's Fossil Exhibit:

pressherald.com/2025/03/24/fossil-collection-of-portland-high-alum-has-new-digs-at-school/



ABOUT PORTLAND OVATIONS

Portland Oventions, founded in 1931, produces dynamic performing arts events including classical music, jazz, opera, dance, theater, and Broadway. We believe that cultural enrichment should be high quality and accessible to all. Oventions collaborates with other nonprofit organizations, education systems, and the business sector to promote lifelong learning while celebrating the power and virtuosity of the performing arts. We bring the exhilaration of the performing arts into our communities with free events as part of Oventions Offstage, connecting artists and audiences. Join us at unexpected “art happenings,” classroom workshops, masterclasses, community discussions, and pre-performance lectures to explore together the relevance and connection of the performing arts to our lives.

Land Acknowledgment

Portland Oventions’ programs are presented on Wabanaki land, home of the Maliseet, Mi’kmaq, Passamaquoddy, Abenaki and Penobscot Nations, their elders past and present, and future generations.

We encourage you to learn more and take action in support of Maine’s Indigenous communities through the following organizations

[Abbe Museum](#)

Maine’s premier museum dedicated to indigenous history and culture. Their mission is to inspire new learning about the Wabanaki Nations with every visit.

[Maine-Wabanaki Reach](#)

A Native-led non-profit that supports the self-determination of Wabanaki people through education, truth-telling, restorative justice, and restorative practices in Wabanaki and Maine communities.

Created and written by Dr. Liz Schildkret

Designed by Katie Day

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We want to know what *you* thought about the performance. You can write your answers below or draw a picture on the back of this page. Thank you!

PERFORMANCE: *Dig Up! A Dinosaur Expedition*

SCHOOL NAME: _____ TEACHER NAME: _____ GRADE: _____

YOUR NAME: _____ May we use your name when we share your comments?
Yes__ No__

What did you like about *Dig Up! A Dinosaur Expedition*? Why did you like that part?

What was something that you learned during the performance?

What would you like to tell other kids about *Dig Up*?

What types of performance would you like Portland Ovation to offer in the future? (Feel free to share what type of art you are interested in (theater, dance, music), what cultures you might like to see, what topics the art might connect with, or specific artists.)

We want to know what *you* thought about the performance.

Draw a picture of a part of *Dig Up! A Dinosaur Expedition* that you liked. Thank you!



YOUR NAME: _____ SCHOOL: _____ TEACHER: _____ GRADE: _____

Please scan and email to offstage@portlandovations.org or mail to Portland Oventions 120 Exchange St Portland, ME 04101

Please take a few moments to fill out this survey after you attend the performance. You can also fill it out [online here](#). Your response provides valuable insight on the impact, accessibility, and relevancy of the School-Time Performance Series and will allow us to improve and strengthen the program

PERFORMANCE: *Dig Up! A Dinosaur Expedition*

TEACHER NAME: _____ GRADE(S) OF STUDENTS: _____

SCHOOL NAME: _____ CITY/TOWN: _____

EMAIL ADDRESS: _____

1. From your perspective as a teacher, how would you rate *Dig Up! A Dinosaur Expedition*?
 Excellent Very Good Good Fair Poor

3. What made this a valuable experience for your students? (If it wasn't, what can we do better?)

4. What was your primary reason for choosing to bring your students to *Dig Up! A Dinosaur Expedition*

- I wanted my students to experience the performing arts.
- The performance topic fit with my curriculum goals.
- The date and time of the performance fit our schedule.
- The ticket price is affordable.
- Other (please specify):

5. How did this live performance connect to or enhance your curriculum?

6. Did you use the Educators Guide provided by Portland Oventions before or after attending the performance? Yes No

7. Why or why not?

.....

MAIL RESPONSES TO: Portland Oventions 120 Exchange Street Portland, ME 04101
EMAIL SCANNED RESPONSES TO: offstage@portlandovations.org

8. What improvements could we make to the Educators Guide to serve you and your classroom better?

9. How would you rate the following components of attending the School-Time Performance?

	Excellent	Very Good	Good	Fair	Poor
Reserving & paying for tickets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communication about the day of the performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Arrival at the venue	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Departure from the venue	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. What types of performances would you like to bring your students to in the future? (Feel free to share art forms, topics/themes, specific artists, etc.)?

11. A number of generous individuals and organizations make it possible for Portland Oventions to offer these School-Time Performance tickets at extremely discounted rates. Is there anything you'd like them to know in terms of your experiences or its impact on your students?