Integrating Technology into Elementary Science

Contents

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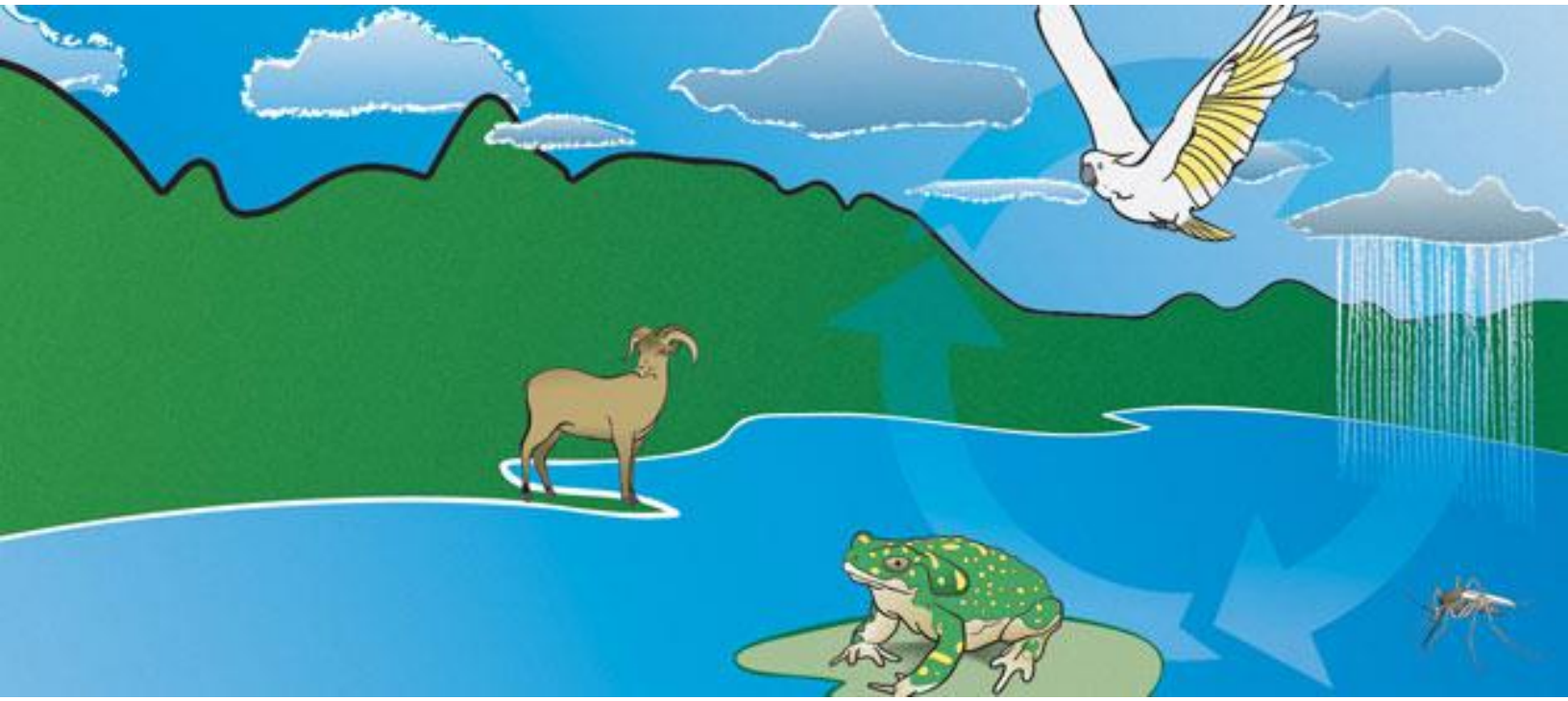
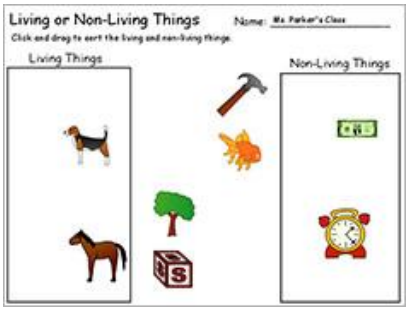
Engage Primary Students in Science

Meet science standards with targeted activities and open-ended projects



Creative work with technology tools, like Pixie and Wixie, can help you get primary students to embrace the inquiry process while developing essential skills for future science learning. Simple activities you do together can teach and assess student understanding of the five senses, animal classification, and life cycles, helping you address specific standards from kindergarten to second grade. You can further develop learners' observation, problem-solving, and critical thinking skills with student-created projects that incorporate painting, diagramming, writing, storytelling, narration, and more.



Assess for Understanding

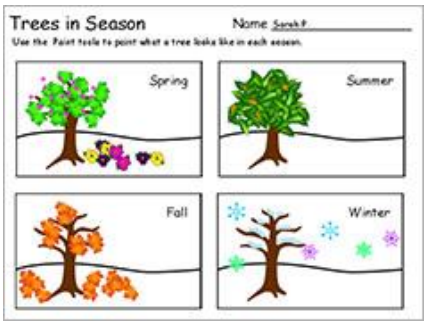
Building strong foundational knowledge about science is crucial. Sorting activities can help you assess student understanding on a topic. For example, after teaching students about the differences between living and nonliving things, have students classify objects to evaluate comprehension. If you have an interactive whiteboard, ask individual students drag a sticker to classify an item, prompt them to explain the decision, and then discuss with the rest of the class.

Take a more creative approach to evaluate comprehension by asking students to tell stories that show what they know about the topics they are learning. For example, after learning about the pond habitat, have students write and illustrate a one-page story that includes animals and plants found in ponds. Combine each student's page into a class book you can share in the school library and with parents at home.

Record Classroom Observations

One of the most important skills young students need to learn is scientific observation, the foundation of the scientific method and the reason students learn about the five senses so early. It is important for young scientists to learn that observing plants and animals

leads to questions (inquiry) and helps them draw conclusions. After learning about the seasons, have students write a five senses poem about one of the seasons or paint what a tree looks like during each season.



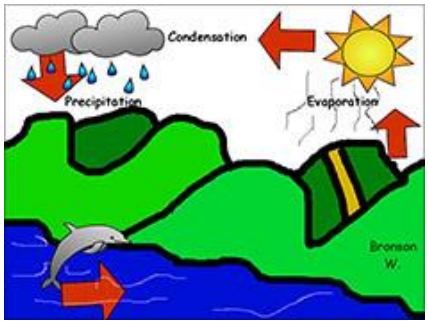
If you are studying weather, have students look outside to observe the weather each day. Have students describe the daily weather using pictures and weather vocabulary. Use a classroom computer or an interactive whiteboard to chart the weather for one week or even a month.

Comparing and Classifying

Students can apply their observation skills by comparing and classifying. Give students multiple objects and then ask them to use their five senses to identify how they are different and how they are alike and then sort them into groups. Then ask them to group them together and share the "rules" they used to sort. Identifying similarities and differences is one of the nine instructional strategies found to improve student achievement in Robert Marzano, Debra Pickering, and Jane Pollock's Classroom Instruction that Works.

Another fun way to have students write and create to identify similarities and differences is through the creation of an If...But Report. For example, students can compare different types of animals or weather by writing sentences that begin with "If I were" to describe the first object, followed by "But I would not" to describe the second topic.

Getting Started with Inquiry



If your students grow bean plants to learn about the life cycle of a plant and the requirements for plant growth, ask them to keep a science journal with text and pictures. After they record their observations, create a printed journal or online life cycle site. Consider having individual students capture their observations at a seed center in your classroom and combine their reflections to create a class journal.

As students write about their observations, work with them to ask questions about what is happening and what they think will happen next. This will help them begin to use observations as the basis for scientific inquiry. The scientific process isn't about finding the answer to someone else's questions, but learning to ask questions and develop ways they can experiment to find an answer. Start with a simple inquiry process that leads them to ask a question, make a guess (hypothesis), determine how they can test, and draw conclusions.

Put Students in the Driver's Seat

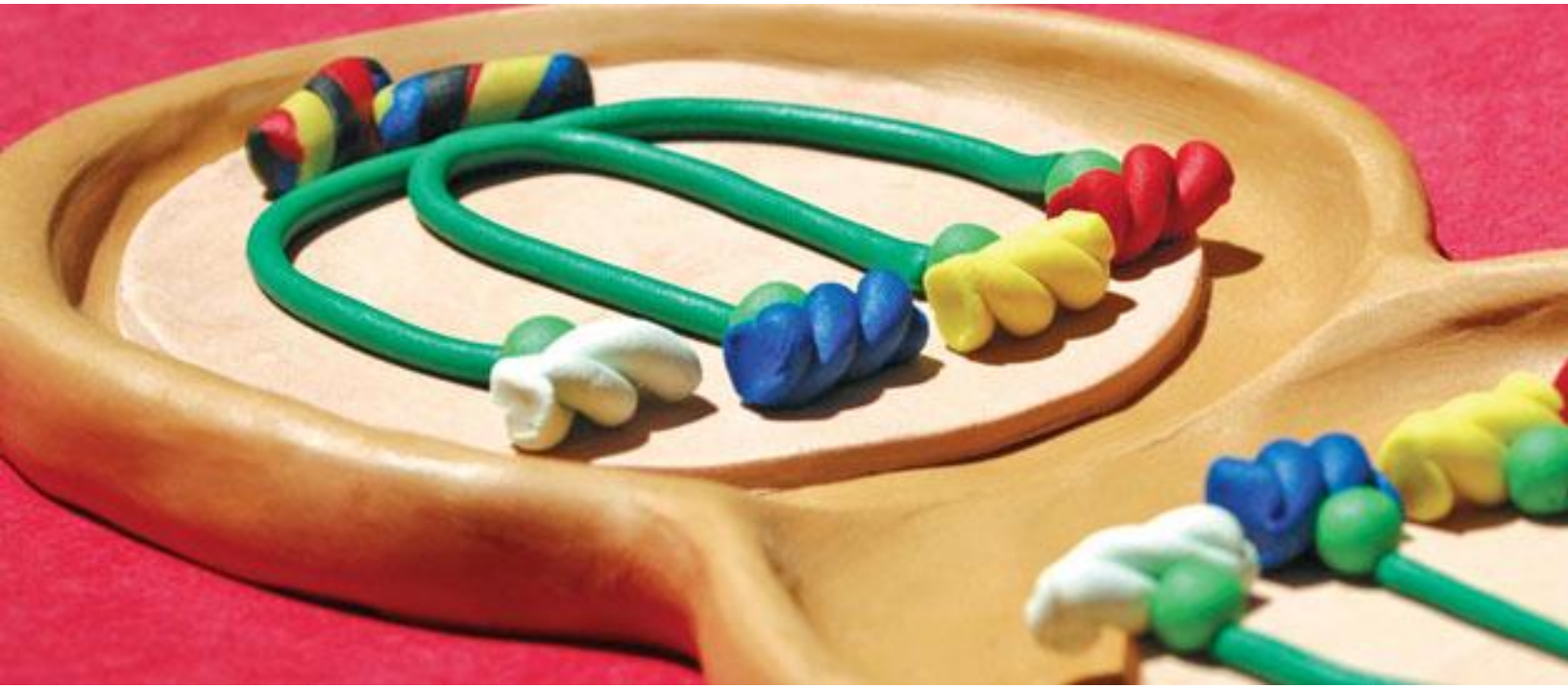
Constructing their own models and diagrams requires higher-order thinking skills and helps students organize information. This type of project work also helps you assess their comprehension. For example, after studying the water cycle, have students paint the cycle. The paintings make a great final assessment because the activity does not provide hints or clues. Students can't guess using content and terms you have provided and must have a thorough understanding of the water cycle to complete this activity.

Students love to be part of the action. Asking them to become an animal they are studying is motivating and a great way to help them practice scientific observation and writing in the first person. First, capture students' faces using a web cam. Next, provide a few photographs of animals they can use for reference as they draw accurate body parts around their faces to transform themselves into animals. Once the drawing is complete, have students write a story about their life as this animal, including details to demonstrate knowledge of the animals' features and habitats.

Painting images, diagramming cycles, and creating stories gives students agency in their learning and fosters the development of important knowledge and skills to support future science learning.

Support Science Learning with Clay Animation

Make science concepts tangible with this fun and creative activity.



Clay animation is a motivating process you can use to engage students as they explore and grapple with complex scientific topics. Science education is designed to provide students with the skills to become independent inquirers about the natural world. The National Academy of Science encourages teachers to use collaboration as a tool so that students participate in the sharing of data and development of group reports. They also suggest that students should be given opportunities to make presentations of their work and "engage with their classmates in explaining, clarifying, and justifying what they have learned." Clay animation is perfect for supporting this learning environment!

Make Science Processes Tangible

First of all, clay animation helps make many science processes and concepts tangible. In What Works in Classroom Instruction, Marzano explains that humans store knowledge in linguistic and visual form. For concepts that are hard to explain in writing, creating non-linguistic representations with clay animations can help students explore and remember information. Because science topics range from very small things like atomic particles to very large structures like the solar system, it is difficult to explore many concepts in a tangible way. Clay animation allows for hands-on manipulation and the creation of physical models, helping students analyze scientific structures and processes like cell division and plate tectonics.

Improve Thinking Skills

While students are motivated by creating their final animation products, it is the process of making clay animation, including writing, brainstorming, planning, sequencing, team work, and management, where the real learning takes place. As they plan their clay animation to demonstrate a science process, such as plant growth, students must use logical thinking skills to

sequence the steps. Critical thinking skills are required to analyze the process and determine what factors are necessary for each step in the process and movement from one step to the next. As students create the clay animation, they must evaluate the information and work together to determine the most effective way to demonstrate the concept or process they are animating.

Collaboration is a necessary component of successful classroom clay animation. Consider, for example a project on cell division. If each team attempts to animate the entire process of cell division, due to time constraints, the resulting animations might not include all of the essential information and details. On the other hand, if each team were to animate one phase in the process, the entire class could combine their animations into one presentation. The whole class will still need to look at the entire process to determine what colors and shapes to use. This ensures that models display cell structures like the nucleus and cell walls consistently throughout the animation. Each team would also have to work with the team before it and after it to ensure that no part of the cell division process was missed.

Students at Bauer Elementary in Hudsonville, Michigan create a clay animation as the culminating assessment of a unit on plant and animal life cycles .The students choose which life cycle they want to work on, and form groups to make clay animations to demonstrate their understanding. Teacher Julie Myrmel shares, "Not only do they delve deeper into the progression of the life cycles, they get to showcase their artistic side, learn how to compromise as a member of a group, and work on a project they really care about. The element of fun, and the strong sense of ownership of the project, brings out the best in them."

Watch video on YouTube

Engaging ALL Learners

Engaging the intelligences of all students in a classroom is part of what makes clay animation so motivating. Students have seen clay animations on television, and even though they are using animations to represent concepts in science, this makes the project more relevant to their lives. Creating an animation that will be viewed by other students in their class, students in other classes if they are shown at a school assembly, or students around the world if they are shared online, reinforces that the work our students are doing in the classroom is valuable and important.

> *"One of my favorite parts of working with these projects is that the kids who are often the leaders are the same ones that struggle with more traditional class work. So, instead of being the one who has to HAVE help, they are the experts the other kids go to, and they're the ones GIVING the help. The look on their faces as they're sought out as pros by their peers is priceless."*
>
> *Julie Myrmel*

Anne Truger, of Lake County, Illinois, works with students who have behavioral and learning issues. She can't reach her students without projects that are motivating. When using clay animation, she found that her students were "more engaged...than I had seen all year. Students gave up study halls, lunch, and even came in early to work on the projects!"

This visual approach to learning also supports the multiple intelligences students use to learn in the classroom. Clay animation provides an opportunity to reach the variety of learners in your class. The parts of a clay animation production help all learners strengthen the different intelligences as they complete their project. Making a clay character engages the bodily-kinesthetic intelligence; writing the story or script engages the linguistic intelligence. Working in a team engages the interpersonal intelligence. Creating an animated production engages the spatial intelligence, and organizing and sequencing the frames and tasks engages the logical-mathematical intelligence.

Assessing for Understanding

The process of creating a clay animation also provides multiple opportunities for assessing understanding.

With many traditional forms of assessment, students can recall enough rote information to guess a multiple choice question correctly or parrot back an exact definition without understanding what it means. Creating a clay animation provides many opportunities for you to assess for understanding. Lania Ho, of Barrington, Illinois, asked her students to create clay animations that demonstrated a real-life situation to explain physics concepts they were learning. When students used a martial arts fight to demonstrate Newton's Third Law of Motion – every action has an equal and opposite reaction - the questioning and planning during the process provided an opportunity to ask questions and identify misconceptions. In this instance, making sure that the students understood that while the action, one character hitting another, was obvious, the reaction was not the other character falling down.

Jean Trusedell, of Decatur, Indiana, used clay animation for a germ unit. Her students created animations that showed how viruses and bacteria attack our cells, how medicine might affect the germ and kill it, and how the cells could be protected. While building the animation, they had to discuss their ideas with their teammates as well as explain their ideas to her. "The greatest part of using clay animation is that the kids are always having to explain the process as they go, and I can constantly assess their progress. Asking them to visualize the cellular level is always difficult; the clay animation process helped make that possible," she shares.

Making the Investment Worthwhile

The process of clay animation involves a significant time investment. Although there are ways to simplify projects and the process, you would not want to use clay animation to teach every topic in your science curriculum. You can ensure that the time investment is worthwhile by choosing your topics carefully and structuring the process to meet your classroom needs. Using clay animation to explore a difficult topic helps provide multiple opportunities to catch misconceptions, while providing students many opportunities to analyze content. If student teams create animations on many different topics at the end of the unit, sharing the finished animations is a great way to revisit concepts at the end of a unit and review for an upcoming assessment.

Remember, the learning during a clay animation project occurs during the process. Sandra Smits, of Hudsonville, Michigan, explains, "When they were done with the project, they really had a strong understanding of the life cycle because they spent so much time planning it out and talking about the steps involved to make it all work." The visual format and popular medium appeal to students who might not otherwise engage in the content or be willing to struggle through difficult concepts. Clay animation projects require students to think, not simply recall facts and information. Jean Trusedell sums this up nicely: "Clay animation requires my students to delve deeper into their higher level thinking skills. Rather than learning that is rote, clay animation requires my students to synthesize the facts and turn that knowledge into a new understanding and THEN demonstrate their new understandings to others."

References

Marzano, R.J., Pickering, D.J. & Pollock, J.E. (2001). **Classroom Instruction that Works: Research-based Strategies for Increasing Student Achievement**.

National Committee on Science Education Standards and Assessment, National Research Council. (1995) **National Science Education Standards**.

Lesson Plans

The following lesson plans provide specific, detailed examples of the ways creative technology tools can be applied in the elementary science curriculum to engage students and improve content knowledge and retention.

Each lesson includes:

- the **task** students will perform,
- ideas to **engage** students in the content,
- a description of what students will **create** with a technology tool,
- ways to **share** student work beyond the classroom walls, and
- tips for **assessing** student work.

Soil - Diary of a Worm Comic

Using Diary of a Worm as inspiration, students will create a media campaign to educate others about the layers, components, and inhabitants of soil and explain why soil is beneficial.

Apps: Pixie® or Wixie®

Task

In a move to reduce landscaping budgets and keep their yards and businesses cleaner, many people are paving over areas of dirt around their homes and stores. Fortunately, you know that dirt is more than just dirt - it's soil, home to creatures and plants that are important to the Earth's health.

Create a campaign to stop the paving and preserve the soil. Design media products, including pamphlets, comics, and videos, to educate students, parents, teachers, administrators, and the community about the benefits of soil and alternative solutions to paving, such as greenways and gardens. Use your media products to share a media campaign to stop the paving!

Engage

There are many types of soil, each with its own unique characteristics and benefits for the ecosystem in which it is found. Bring different types of soil into your classroom as well as investigate different types of soil found around your school and community. Discuss the characteristics of each type of soil and document with pictures, descriptive words and research of uses, including the pros and cons of using specific soils for different purposes.

Students should be able to answer:

1. What is soil?
2. What are the layers of soil?

3. What plants and animals depend on soil?
4. How do we depend on those plants and animals?
5. What are the benefits of soil?

Read Doreen Cronin's **Diary of a Worm**. Ask students to explain the benefits of soil and what role a worm plays in the ecosystem. Discuss the practice of paving over "dirt" to save money.

1. What is the result of the paving over the dirt?
2. What alternatives used will make the "dirt" more valuable for everyone?

Discuss ways students could educate others about the benefits of soil, such as stories, brochures, public service announcements, or comics.

Create

Let students know they will be responsible for educating others about the benefits of soil. Form small teams of students and have them list the stories, facts, and ideas they think will be helpful in making a successful argument. Teams should review their notes, complete additional research, and develop a plan for the product they will create to educate others.

View a student sample project

Have teams share their proposals with the rest of the class. This allows all teams to benefit from all students' thorough research, powerful facts, and creative ideas. Ask each team to choose one or two core arguments and begin determine how their team might best make the case to support their position, developing products such as presentations, bumper stickers, posters, public service announcements, children's stories, brochures, or comics.

Students use Pixie or Wixie to develop their materials. Student work should be saved, exported, printed, and published so that it can be shared with others.

Share

Have students present their information to other students at school during an assembly or at a booth on the playground or in the cafeteria.

You might choose to share PSAs on your school web site or present them during morning announcements. You may also be to share the PSAs on your local access television station to help educate the community. Post student videos and web sites to your school web server or to a video sharing community for wider distribution. Brochures can be printed and distributed at local coffee shops and garden stores.

You can turn this project into a parent night or community event by hosting a "Don't Pave It!" trade show. Have teams make presentations and share their resources at booths and make-and-take events.

Assessment

You can begin to evaluate students' content knowledge during the initial investigations of soil and from discussions about **Diary of a Worm** and the paving problem. Ask questions about their research and arguments to evaluate comprehension and understanding. Engaging students in discussion about the information they have found will help you identify misconceptions and better assess understanding before project work begins.

The final presentations will help you evaluate how well students are able to apply knowledge to communicate an idea and craft written and visual arguments.

Resources

Cronin, Doreen. **Diary of a Worm**. ISBN: 043969745X

Rosinsky, Natalie. **Dirt: The Scoop on Soil**. ISBN: 1404803319

Dirt! The Movie

Fact Monster: Soil

Animal Riddles

Students will research an animal and create a riddle to showcase their knowledge and engage other students in the natural world.

Apps: Pixie® or Wixie®

Task

Kids love jokes and riddles! Your class will create a series of riddles that other students can use to learn about animals.

Engage

In this lesson, students will complete research about an animal and demonstrate their knowledge about the animal by creating riddles in Pixie or Wixie.

Introduce your students to animal riddles by reading ABC Animal Riddles (rhyming verse) by Susan Joyce or If Not for the Cat (haiku) by Jack Prelutsky. These books will engage your students in the process and demonstrate various ways that riddles can be written.

Discuss the riddles you have read with your students. You might ask:

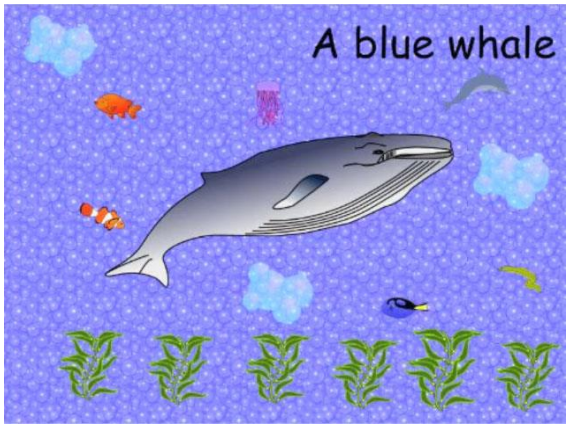
- What was your favorite riddle? Why?
- What clues helped you figure out the answer?
- What types of words did the author use?
- What makes a good riddle?

As a class, explore the steps at the Read, Write, Think website for Riddle Writing which includes great ideas for finding descriptive words, using a thesaurus, and writing in perspective.

Let your students know that they will be creating their own animal riddles. Each student will choose an animal and create two pages for the riddle.

Page 1 will be the riddle. For example:

I have beautiful black spots. I am a carnivore. I live on the savanna. I am the fastest land animal on the planet.



Watch video on Vimeo

Page 2 will be an illustration of the animal.

Brainstorm a list of different animals with the entire class. Depending on your current science focus, you may want to narrow your brainstorm to types of animals, such as mammals, or animals that live in a particular habitat like the desert.

Students should choose one animal from the list and write down what they already know about the animal using a cluster map or other graphic organizer.

In order to formulate the riddle, students will write clues based on the following questions:

- What does this animal look like?
- Where does it live?
- What does it eat?
- What makes it unique?

Give students time in the library or online to research the answers to these questions. Students should add their research notes to their existing cluster organizer.

Create

When their research is complete, students should write a draft of the riddle. The riddle should contain four sentences:

- Sentence 1: how the animal looks
- Sentence 2: what the animal eats
- Sentence 3: where the animal can be found
- Sentence 4: a unique fact or distinguishing characteristic

Use the Text tool to add the text of the riddle to page 1 and use the Options panel to adjust the size and font. Use the paint tools to illustrate the animal.

If they have time, students can record their voice reading the riddle on page 1 and add illustrations or images that support the words in the riddle.

Students can print their two-page project as a table tent or greeting card. You can also collect all students' files into one folder, combine them into one file in Pixie with each riddle followed by its illustrated answer, and export the project as HTML or a movie.

Share

Celebrate and present the student riddles! If students print table tents or greeting cards, have them place the printed projects on their desks and encourage students move around the room to read and guess at other students' riddles. If you choose to create a whole-class HTML file, project the exported riddles in front of the class and have each student read their riddle and facilitate class discussion and guesses. You might even want your class to share this with another class.

Assessment

In the beginning stages, the cluster map organizer can be used to assess each student's prior knowledge. You can continue to monitor progress as students complete and add their research notes and write their riddles. As students begin illustrating, prompt them with questions about their animals to encourage them to add more details and create more complete and specific illustrations.

Resources

Joyce, Susan. **ABC Animal Riddles**. ISBN: 0939217511

Yolen, Jane. **Least Things: Poems About Small Creatures.** ISBN: 1590780981

Prelutsky, Jack. **If Not for the Cat**. ISBN: 0060596775

Animal Planet

Fact Monster

Riddle Writing

Create a Creature

Students apply what they have learned about animal characteristics and adaptation to create a new creature and introduce it to the scientific community.

Apps: Pixie® or Wixie®

Task

Scientists are finding new species every year. While some of them live in remote environments, others have been found in large urban cities! While you can't travel to faraway lands in the hopes of finding a new species, you can use what you know about plant and animal adaptation to create a new species of your own!

Create an electronic book to introduce your species to the world, sharing its physical adaptations, daily habits (behavioral adaptations), predators, and prey.

Engage

There are lots of right ways to explore this topic. You might focus on a specific habitat and brainstorm animals and adaptations for that habitat. You might instead have students individually or collaboratively research a favorite animal and explore its habitat and adaptations. This "create a creature" project is a good culminating assessment of student understanding of animals, habitats, and adaptations and assumes they have already explored these topics.

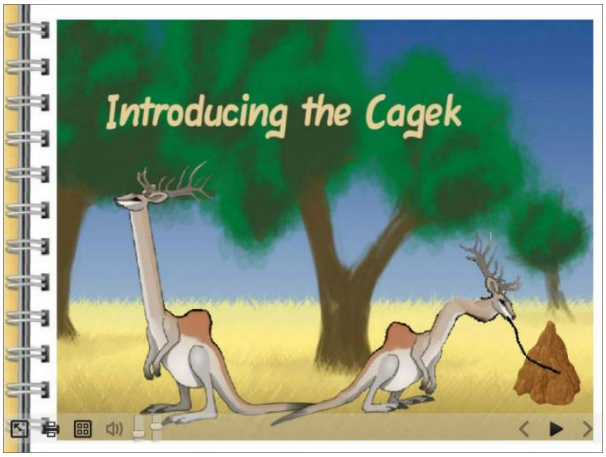
Begin project work by reading about one of the amazing creatures in Extreme Animals: The Toughest Creatures on Earth by Nicola Davies. This book is filled with remarkable information about many animals kids are familiar with. Share additional photos of the animal with your students from education-friendly sites like Pics4Learning. Penguins are a perennial favorite with elementary students and images, leveled literature, and information texts abound.

Ask your students to share what they know about other amazing creatures. Help lead students to the realization that a unique physical or behavioral adaptation is what makes the animal interesting. To get them talking, ask students to share:

- What the animal looks like.

- Where the animal lives in the wild.
- What makes it interesting.

Explain that new plants and animals are still being discovered by scientists and researchers. Share examples of some of newly-discovered species with your students. Live Science has a collection of some great examples for 2013; a search on the Web will turn up many others.



View a sample student project

Let students know that they will become animal explorers tasked with a mission to "find" a new species. They will use what they have learned about plant and animal characteristics and adaptations to create a new species and introduce it to the world by creating an electronic book.

Create

Depending on the culture and students in your classroom, students may work individually or in small groups. If you have highly independent learners, let them show off their individuality through personal work. If you have students who must collaborate to come up with ideas, small teams provide many more opportunities to discuss and process learning. Group work also provides additional opportunities for you to identify misconceptions and help the group to focus on key understandings.

If your students have a strong grasp of characteristics, adaptations, and habitats, have students or teams begin by describing the habitat in which their new animal will live. They should include information about weather, temperature, rainfall, plants, and other animals.

Next, have students think about where their animal will live in this habitat – on the ground, in the air, water, or tree tops, etc. Share graphic organizers like t-charts, 4-squares, clusters, and storyboards to help students organize their ideas.

Ask students to create a creature with adaptations that help it survive in this environment. Encourage them to look to other creatures in similar habitats to identify features and characteristics that would help this creature thrive in its habitat. If they are creative thinkers, they can simply start designing.

If your students are just beginning to understand the idea of adaptations, have them create a creature first by combining body parts from one or more categories of animal types, including birds, reptiles, amphibians, fish, insects, and invertebrates.

Tell your students they will be creating ePubs/iBooks to introduce their amazing creatures to the world.

Books should include the features of informational text, including images, labels, photos, captions, and headings. The information students provide should answer questions like:

- What are the physical features of this creature?
- Why are these features needed in this habitat?
- What does this creature eat?

What does this creature do during the day? Or is it nocturnal?

Does this creature have any natural predators?

If your students are ready, give them flexibility to choose the information they will include in their project. If you want to provide direction and structure to the project, you could ask students to create a project that includes pages for:

1. Title page with name of animal and scientist(s) who discovered it
2. Image of create in habitat
3. Description of habitat and images to support description
4. Description of creature's characteristics and image with labels

5. Description of creature's predators and prey (diet)
6. Story of how the creature was discovered (narrative writing)

Have students record their voices as they read the information on each page. (Note that audio for ePub may not work on all Android devices.)

Share

Have students present their creatures to the rest of the class or to a different team. To give the project an additional air of authenticity, bring in local experts to ask questions and evaluate student work. If you do not have a local zoo, veterinarians, park rangers, and even pet enthusiast parents may be willing to help.

Students can publish their books as ePub files and share them using a service like iTunes or Dropbox. Share the ePubs in the school library database, on computers in the library, or in a publically accessible network location where other students can access and download the publications.

If you don't have ready access to eReaders, you can export the finished work as PDF files for easy sharing. You can also print their work and share it in classroom and school media centers or post the digital files to your classroom web site.

Assessment

The final ePub and the work during the process will help you evaluate student understanding of animals, habitats, and adaptations.

As individual students or teams begin working on the descriptions of their habitats and animal features, monitor their progress and ask questions. You can also use graphic organizers as tangible check in points.

As students begin illustrating, prompt them with questions about their animals to encourage them to add more details and create accurate illustrations.

The resulting ePub or PDF can serve as an artifact for summative assessment of content and expository, or informative, writing. If their work includes a story detailing the discovery of the creature, you can also evaluate their narrative writing skills.

Be sure to evaluate oral presentations for content accuracy. Students' ability to answer questions from the audience will help you assess how well they have internalized the concepts of behavioral and physical adaptations.

Resources

Nicola Davies. **Extreme Animals: The Toughest Creatures on Earth**. ISBN: 0763641278

Pamela Hickman. **Animals in Motion: How Animals Swim, Jump, Slither and Glide**. ISBN: 1550745751

LiveScience: Newfound Species

National Park Service: Our Wild Neighbors

National Geographic: Creature Feature

Don't Let the Earth Down

Students will write persuasively on a conservation issue and create a public service announcement to promote their cause.

App: Frames™

Task

Earth needs your help! While pollution has decreased in many places, we are still releasing tons of toxins into the air and water every day. Access to clean drinking water is decreasing, and landfills are filling up quickly. One and one-half acres of rainforest are lost every second.

Balancing the demands of a growing population, a high standard of living, and a healthy environment is a delicate and difficult process. Using their incredible powers of persuasion, and the techniques of persuasive writing, have students craft a public service announcement that educates citizens on environmental issues. They should make their announcement powerful enough to persuade people to change their behavior to lessen a negative impact or increase a positive impact on the environment.

Engage

As a class, brainstorm a list of things worth conserving. You may want to focus on a threatened area, like the rainforest, or look for problems your students can solve in their own communities, like waste reduction or clean water.

Have individual students choose an issue that is important to them and formulate a thesis or debatable statement about the issue. Have them research information about the issue and then review and organize their materials. Since facts are a great way to support a compelling argument, students may want to organize their facts using a fact vs. opinion graphic organizer. Students also need to determine which research information supports their argument and which information contradicts it. Once they have identified arguments against their thesis, have them

develop counter arguments they can incorporate into their essays.

Students should now write a first draft of the essay, trying to get all their ideas down in logical order. When the first draft is finished, have them print and edit their work, making changes to improve the essay. This would be a great time to have students review one another's work.

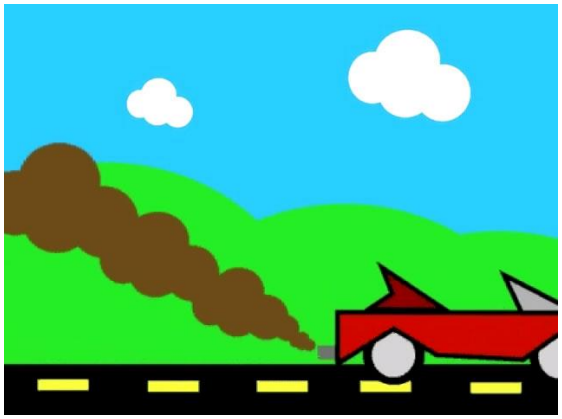
Share examples of public service announcements you find on television or online.

- Which ones do the students like? Why?
- Which ones make the most compelling arguments? Why?

Most public service announcements are between 10 and 60 seconds long. Ask students how much of their essay they can they read in ten seconds. How are they going to need to think differently to make their argument in a PSA? Work as a class to brainstorm nonverbal strategies for making a compelling PSA.

Create

Let students know they will be working on a team with other students exploring their issue to create a 30–second public service announcement. Group the students together and have them begin their work by reading their arguments to the rest of their team members.



Watch video on YouTube

Working as a team, ask students to identify the best arguments in each essay and brainstorm how they could share those ideas in a short PSA. Have them list the stories, facts, and ideas they think will be helpful in making an argument in their public service announcement.

Have each team complete a vision for their project to define their argument, identify their audience, refine their goal, and choose an idea to pursue. Each team should then refine their vision and begin developing a storyboard to serve as the map for the PSA design.

Teams should begin by gathering the media resources needed for their PSA. Teams may choose to work on each stage of the development process together or assign roles, such as researcher, editor, graphic artist, and director, to divide up the tasks. Have students use the tools in Frames to develop their PSA.

Share

Have teams share their PSAs with the class while talking about the collaborative process it took to create the PSA. You might choose to share the PSAs on your school web site, or present them during morning announcements. You may also be to share the PSAs with your local access television station to help educate the community.

Assessment

The fact vs. opinion organizer, vision, and storyboard will give insight to the direction teams are heading with their project. Assessing these items and observing the collaborative process before students begin working in Frames may help ensure the successful completion of the PSA. You may want to have students keep a project journal or write daily reflections, as it will be impossible to hear every student's comments during the process. The final PSA will help you assess their understanding of the issue as well as their ability to persuade viewers using multimedia.

Resources

Chiras, Daniel D., John P. Reganold, and Oliver S. Owen. **Natural Resource Conservation: Management for a Sustainable Future** ISBN: 0130333980

Botkin, Daniel B. and Edward A. Keller. **Environmental Science: Earth as a Living Planet** ISBN: 0471389145

Daily, Gretchen C. **Nature's Services: Societal Dependence on Natural Ecosystems.** ISBN: 1559634766

Magical Metamorphosis: Butterfly Life Cycle Stories

Students explore the life cycle of a butterfly as they write and illustrate stories that show the stages of a butterfly's metamorphosis.

Apps: Pixie®, Wixie®

Task

Most young children are familiar with butterflies and caterpillars and love to listen to stories about them, whether they are printed and found in the library or listened to online or using an iPad or tablet.

As budding scientists and authors, tell the students in your class that they are going to write and illustrate their own butterfly stories to teach younger students about the life cycle of a butterfly and get them excited about reading.

Engage

Ask students to indicate if they have all seen a butterfly and prompt them to describe what that butterfly looked like. Most will describe a butterfly in its adult stage.

Ask students if they have ever seen a caterpillar. Is that a butterfly? What about a chrysalis? Ask them to share what they think based on prior knowledge. While they may KNOW that a caterpillar will eventually turn into a butterfly, you may also want to challenge them to share how they could prove this information through scientific observation or experimentation.

Read a story that includes the various stages of a butterfly's life cycle, such as the perennial favorite, The Very Hungry Caterpillar by Eric Carle. After reading, work as a class to identify the four stages of butterfly's life cycle - eggs, caterpillar/larva, chrysalis/pupa, and adult.

As a group, brainstorm other ways a caterpillar might feel, such as sad, happy, scared, angry, jealous, or brave. You might want to use an idea cluster or

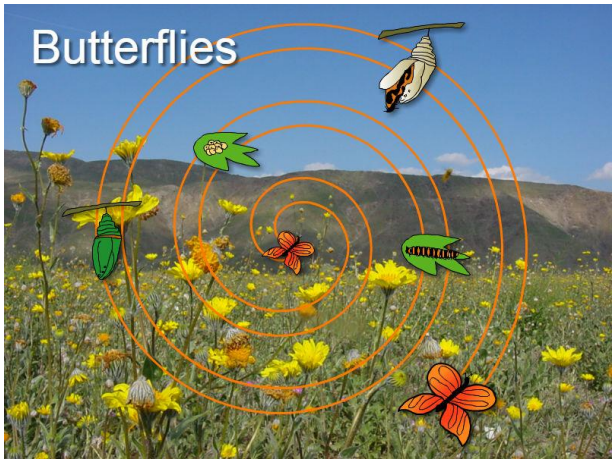
character traits organizer. Might a butterfly's or caterpillar's feelings change at different stages of their life cycle?

If you want to evaluate student understanding before they begin writing, have them complete a butterfly life cycle organizer.

Create

Tell your young scientists and authors that they are going to write and illustrate their own butterfly life cycle stories! Go back and reread the list of feelings the class thought a butterfly or caterpillar could have. Have students choose one feeling to describe the main character in their story.

Share a character/setting/events organizer with each student. Have them write the feeling in the top of the character box. Students can then brainstorm ideas for setting and events. Remind students that events in their story need to make sense with the changes (events) in the butterfly's life cycle.



Give the students a blank 4-stage cycle diagram to organizer their writing. Students can refer to the cycle diagram you created as a class or on their own to make sure they write about the stages correctly.

As students think about what might happen in their story, have them write words and simple ideas next to the boxes on the cycle diagram to describe what happens to their character during each stage of metamorphosis.

Let students know that their book will need to have at least one page for each stage in the life cycle. Have students develop a first draft of their story.

Ask students to read their rough draft three times and answer the following questions:

1. Did I make each stage of life cycle of the butterfly clear?
2. Will a reader like my story? Why?
3. What pictures can I add to help tell the story?

Give students time to make edits to their rough draft. Students should also indicate which sentences will be on each page.

Next, have students use Pixie or Wixie to design the final book. You can use the booklet template, create your own template, or simply show students how to add pages and text objects.

When sentences have been added to each page, have the students use the Paint tools to create illustrations for each page. You can show them how to use the Stickers as well if you want to save time during the illustration process.

If you are sharing the books in digital format, have students narrate the text on each page of the story. If you have lots of students working in a lab, you may want to use headset microphones to cut down on extra noise. You could also have students work on their narration at a center in your classroom set up for this purpose.

As they record, listen, and rerecord they gain valuable practice with reading fluency. The final product can also serve as an example of their fluency.

If you are publishing hard copies, have students click the Print button and choose how they want to share the story. If you are going to bind the pages into a book, then full size will work great. If you want to save paper or colored ink, you can also print at postcard size (4 to a page) and have students cut before binding.

If you are going share the books in digital form, have students use the Projects button to export the project to HTML, PDF, or video.

Share

Collect the final printer versions into a classroom or media center display or collect the digital versions into a

collection on a page on your school or classroom website or even on iTunesU!

Celebrate with an author signing or reading event. Have younger students at the school stop by to read and enjoy the books as well as invite parents, grandparents, and community members to join you.

Assessment

At the beginning, you will have an easy opportunity to assess prior knowledge as you ask about butterfly sightings and discuss caterpillars. You can also evaluate analytical and creative thinking as they explain how they would investigate and prove that a caterpillar was also a butterfly. Assess comprehension about the process of metamorphosis and the various stages of a butterfly's life cycle as your class, or individual student's, develop a 4-cycle diagram.

Use the character/setting/events organizer and the 4-cycle diagram the students are using to organize their story to help you catch misconceptions. As students are writing the story, ask 5 W's questions and 5 senses questions to help them write more than the basic facts.

As students begin illustrating their projects in Pixie or Wixie, prompt them with questions about their story to encourage them to add more details and create more complete and specific illustrations. Each student's voice narration will provide you with insight into oral proficiency and reading fluency.

Resources

Carle, Eric. **The Very Hungry Caterpillar**. ISBN: 0399213015

Deluise, **Dom. Charlie the Caterpillar**. ISBN: 0671796070

Krulik, Nancy. **The Magic School Bus: Butterfly and the Bog Beast**. ISBN: 0590508342

Children's Butterfly

NeoK12 Metamorphosis Videos

Design a Polar Park

Students design enclosures for animals that live in the Arctic or Antarctic regions, reflecting the animal's natural habitat, as well as its air, water, food, shelter, and activity needs.

Apps: Pixie® or Wixie®

Task

When zoos and aquariums design animal enclosures, they make sure they are both safe and interactive for the animals. They also work hard to ensure the enclosure reflects the animal's natural habitat.

In this project, your class will work together to design a Polar Park with a variety of exhibits that showcase the animals in the Arctic or Antarctic region. It is your task to design an enclosure for a specific animal that considers the survival needs of the animal, accurately reflects their natural habitat, and helps visitors learn more about this unique species.

Engage

Begin by engaging your students in discussions about weather, climate, and animal adaptions.

Ask your students what type of weather they prefer. Do they prefer summer where the weather is warm, or winter where they bundle up to play in the snow? Ask students to explain how they do different things in different seasons and how their behavior (food, clothing, activities) changes when the temperature changes.

Ask your students which season, or weather (climate), they think animals prefer. It may take a little prompting, but students should soon see that different animals may have different preferences. Ask them to explain and elaborate using specific animals, and their characteristics, as examples.

Read a book such as **Polar Bears** or **Penguins** by Gail Gibbons. Discuss the unique adaptations and characteristics of polar animals. Discuss how the environment in which these animals live compares to the environment in which your students live.

Next, ask students if they have ever visited a zoo or an aquarium. What was their favorite exhibit? Why? What specific features made it memorable? What do they

think the animals in the enclosure felt about the exhibits?

Show students a picture of a penguin in their natural habitat.

Ask the students to describe what they see in the habitat. Which of those features could be replicated in a zoo exhibit?

Let the students know that your class will be designing a Polar Park. As a class, decide if you will focus on Arctic or Antarctic animals or if you will mix animals (but label or group them) from both regions.

Form small teams of students to design an enclosure for a specific animal. Since the focus of this project is on habitat and requirements for life, let students choose to make their exhibit any size and using any budget/materials.

Have teams begin by researching their animal. They should be encouraged to become an expert on this animal, its unique characteristics, and needs. Provide them with graphic organizers, such as clusters, to keep notes on plants and physical features that are found in this animal's natural habitat.

Create

Let the students know that they will be responsible for sharing their design through informational text and pictures, as well as formal presentation.

You may want to help provide structure to their presentation and design portfolio by establishing requirements like:

- A map of the entire enclosure.
- Textual information about what the enclosure includes.
- A detailed visual example of one part of the enclosure.
- Important things to know about the species in enclosure.
- Ways the enclosure meets these needs.
- Details about the daily routine of the animals in the enclosure.

Students can use a tool like Wixie to organize their presentation. Have them use the Paint tools to create a map, marketing important features in the animal enclosure, as well a locations where visitors can view the animal. They should also clearly mark areas that will be hidden from the guests for the caretakers to prep food, care for sick animals, and store equipment.

Students should also include a more detailed example visualizing what one area of the enclosure will look like, haring special features of that space, as well as how the animal (or animals) appear in that space.

The presentation should demonstrate their expertise about the animal itself. They should share facts about the animal as well as showcase their knowledge of its unique characteristics and adaptations that help it survive in their natural environment.

Students should also include text and pictures that describe how the enclosure reflects the animals original habitat and is uniquely suited to helping the specific animal thrive.

- What is available for the animals to stay active?
- How will they obtain their food?
- Will they have enough space to build nests or swim?
- How will visitors learn about the animal from the enclosure?

Share

Have student teams present their designs to "critical friends" in your classroom. After sharing feedback, teams should make tweaks to the design and edits to their presentation.

Invite a local zoologist, park ranger, or even veterinarian to evaluate student designs and the presentations of those designs. Student teams can each make an oral presentation of their design, or have them showcase their work more in the style of science fair, where evaluators visit each booth to learn more about their enclosure.

As a class, work together to develop a map, or design, for the entire park, showing the location of each enclosure, and discussing and describing the visitor experience.

Have your entire class showcase their work at a Polar Park Faire. Invite parents, as well as community members, interested in polar animals to talk with your student experts and tour the proposed design.

Assessment

Initial discussions with your students will help you assess their prior knowledge about arctic animals, as well as how much they have thought about animal enclosures at zoos and aquariums they have visited.

As you work together to explore and research one species together, their ability to glean facts and information from the story will provide you with a sense of their research ability. This work as a whole group will provide information that will help you group students for maximum success in the project. It will also help you determine if you need to develop additional research resources and supports to help students meet the goals of the project.

Check in with students as they complete their initial animal research and organizers to clarify misconceptions before they begin the design process.

Ask students to talk about their maps, visualizations, before they present so that they have practice articulating their work. Have teams submit descriptions and other textual information to you, so you can provide comments and feedback before they add it to their design portfolio/presentation.

Support student presentation of their materials as they share their work with one other team. Use this opportunity to ask clarifying questions. You may even want to have the teams present their work to you, when they think they are finished, so you can provide feedback before final whole group presentations.

Resources

Jackie Glassman & Lisa Bonforte. **Amazing Arctic Animals** ISBN: 044842844X

Molly Aloian & Bobbie Kalman. **The Arctic Habitat (Introducing Habitats).** ISBN: 0778729818

Barbara Taylor. **DK Eyewitness Books: Arctic and Antarctic**. ISBN: 0756690714

Switch Zoo: Build an Online Habitat

Penguin Coast: Maryland Zoo

BrainPOP: Arctic Habitats

Eureka! I've got an Idea!

Students will learn about the value of scientific thinking as they study inventions and practice research and writing skills to create a Web site about an inventor.

App: Share™

Task

Technology is all around us, and not only in cell phones, computers, and MP3 players. Technology is the application of science to solve practical problems. The result is usually an invention, a new product or a process that makes life better. In this project, your class will create a Web site to showcase advancements in everyday life made by famous, and some not-so-famous, inventors.

Engage

What would life be like without inventions? Because students are surrounded by technology, begin by focusing on inventions they use every day. Then, encourage students to think of inventions that are not related to computers. After brainstorming several inventions, ask students to describe how their lives might be different without them.

Share with your students some common tools like pencils, scissors, and paper clips. The modern pencil was invented in 1564 with the discovery of graphite. We do not know who invented scissors! Ancient Egyptians probably came up with the idea, which was modified by the Romans into the form we have today. The paper clip was not invented until 1899, only a year before the 20th century!

This process is designed to generate curiosity in your students about the origin and inventors of products they use every day. You may want to read E. L. Konigsburg's **Samuel Todd's Book of Inventions**. Depending on the age of your students, you may want to share this unique video about life without basic inventions. Let your students know that they will create Web sites that celebrate common inventions and some not-so-common inventors.

Assign an inventor to each student, or let the students choose an inventor they wish to research. For example:

American Inventors

- Jonas Salk
- Isaac Merritt Singer
- Thomas Edison
- Alexander Graham Bell
- Samuel Morse
- Jerome Lemelson

African American Inventors

- George Washington Carver
- Elijah Mc Coy
- Lewis Latimer
- George Crum
- Charles Drew
- Philip Dowing
- Garrett Augustus Morgan

Women Inventors

- Ruth Walkfield
- Mary Andersen
- Virginia Apgar
- Josephine Gares
- Bessie Nesmith

Have students research basic who, what, when, where, and how information about their inventors. Their research should also help them describe the historical, social, economic, and scientific impacts of the inventions. To help students better understand events that help shaped each inventor's perspective, have each student create a timeline of significant events in their inventor's life.

Create

Let students know that they will transform their research into a Web site about the inventor. You may want to give students guidance on what information they should include on each page of their project, such as:

- Page 1: Title
- Page 2: About the Inventor
- Page 3: About the Invention
- Page 4: A Description of Life Without the Invention
- Page 5: A Description of How This Invention Impacted History

Share

Upload all of the sites to the same location and create a menu page that links to each inventor site. You may also want to place this resource in a school media center or advertise some fun facts students learned on your school's news program or audio announcements.

Ask each student to share the highlights from their research with the rest of the class. Ask students to share both basic information and how they think the inventions changed society and impacted history.

Assessment

As you brainstorm life without inventions, you can assess students' prior knowledge. You will be able to evaluate their note-taking, summarizing, and information literacy skills as they research information for their sites

Their site and oral presentation will also help you assess their understanding of the impact of each inventor's invention.

Resources

Bender, Lionel. **Eyewitness Books: Invention.** ISBN: 0756610753.

Konigsburg, E. L. **Samuel Todd's Book of Inventions**. ISBN: 0689832028.

Lambert, David. **Great Discoveries and Inventions**. ISBN: 0816010625.

Invent Now

Zoom Inventors and Inventions

About.com: Famous Inventors

Visit Our Solar System

Students will learn about the planets as they create a sample travel journal that explains what it would be like to visit one of the planets.

Apps: Frames™, Pixie®, Wixie®, or Share™

Task

Space Tours Unlimited would like to begin offering tours to the planets. They have trained astronauts who can take people on tours of a planet aboard the Cosmos2020, the most advanced shuttle to ever launch into space. To generate business, they have asked your class to help them create an interactive presentation that will help new customers choose which planet they want to visit.

Engage

Complete a KWL chart with your students to activate their prior knowledge about the planets. You might want to read various books or plays about space, such as The Magic School Bus Visits the Solar System, to get students interested in the topic. Show your students different images of planets (you can find planet images in Pics4Learning). Discuss basic facts about each one.

Tell the students that they have been chosen to create an interactive brochure for a visit to one of the planets. On this space tour, the students will have to answer the following questions about their planet:

- What is the planet's distance from the sun?
- What is the diameter of the planet?
- Does the planet have any moons? If so, name them.
- What is the atmosphere like on this planet?
- Are there any unusual features about this planet?

Have students use library books and online resources to find answers to these questions. There are several online resources listed in the Resources area.

Create

Once the students have completed the Planet Worksheet, they are ready to begin creating their Planetary Tour as seen through the eyes of the first tourists in space. Students will present their tour and describe the things that tourists would see during a visit to this planet. Students can use their research to help them choose information for their project and a storyboard to help them organize their ideas.

Watch video on YouTube

Share

Have students present their planetary tour to the rest of the class or at a school assembly. This will help everyone learn more about the planets. You may even want to have students vote for their favorite tour.

You could also turn this into a community event by making it a travel trade show. Have each student share their tour at a planet station. Audience members can watch each tour to get an idea of which planet they would like to visit. You could also issue tickets for each tour so students and community members can choose which planet they would like to visit.

Assessment

Assess your students' prior knowledge about the solar system as you work together to complete a KWL chart. You could ask them what they know about each planet, the sun, and the moon individually to elicit more detail. Their answers will give you insight into their current comprehension. For example, a student might share that Mercury is very hot. You might respond with a question asking what they know about the temperature on Neptune. This will help lead into understanding that the distance from the sun is a factor influencing the environment on each planet.

Student answers to research questions about the planets can give you insight into comprehension, but may also simply be an indication of a student's ability to conduct online and print research. Engaging students in discussion about the information they have found will help you catch misconceptions and better assess understanding before project work begins.

Engage students by asking lots of questions as they are working on their itinerary and tour. You can assess their Frames, Pixie, Wixie, or Share projects for accuracy of facts and their comprehension of what impact distance from the sun, atmosphere, and other planetary features would have on the humans visiting the planet.

Resources

Cole, Joanne and Degan, Bruce. (1992) **Magic School Bus: Lost in the Solar System**. ISBN: 0590414291

Mitton, Jacqueline. (1991) **Discovering the Planets**. ISBN: 0816721319

Simon, Seymour. (2002) **Destination Space**. ISBN: 0688162908

Nasa-Welcome to the Planets

How Does Your Garden Grow?

Students design a functional and beautiful garden for a particular audience, developing a scale model, determining costs and materials, and creating a guide explaining how to care for the garden.

Apps: Pixie® or Wixie®

Task

Your local garden center wants to encourage people to plant their own gardens. They have asked for your help in creating a variety of small garden designs that they can show to customers who are interested in saving water, cooking with foods they have grown, or just "greening up" their home environment.

Student teams will design a small garden that is uniquely suited to a specific environment. They will work together to create a scale drawing, a list of needed non-plant materials and estimated costs, a list of suggested plants and estimated costs, as well as an instruction manual with the basics of care for the garden. Teams will present their garden designs and implementation materials at a community garden fair.

Engage

From conserving water to organic gardening, environmental issues have most students talking these days. Use this interest to help engage them in the study of plants and their role in small ecosystems.

If students' families have a home or community garden plot, ask them what crops are grown. Depending on where you live, students may also have fruit or nut trees in their yards.

If students live in apartments, prompt them to think of unique "gardens" they have seen in small spaces. For example: a cherry tomato plant on the porch, a small pot of cilantro by the sink, or a bonsai tree in the living room.

Encourage students to brainstorm other unique gardens they have seen. Botanical gardens usually have all types of plants, but students may have also heard of or visited a xeriscape garden, an aquatic garden, or even a park with a restored prairie. Engage students with an excerpt of National Geographic's Pond Stars!

You can also connect what your students are learning about American Colonial History and ecosystems in science by exploring the colonists' utilization of the "Three Sisters" style of companion planting. The Three Sisters name was coined by the Iroquois and used widely by many Native Americans groups.

In this "companion planting" style of gardening, corns, beans, and squash are grown together. Beans use the corn stalk as natural place to climb, help to stabilize the corn stalk in the wind, and boost nitrogen content in the soil, which benefits the other plants. Squash grows around the base, shading the soil and preventing both the growth of weeds and the loss of moisture. The sharp hairs on the squash also help to keep pests like mice and raccoons from eating the crops.

Once you have piqued student interest in plants and gardening, let them know that they will create a garden design and develop materials to help people interested in this type of garden implement on successfully.

Create

Form small teams of students with a science "expert" in each group to serve as the visionary who can evaluate the accuracy and quality of design.

Instead of starting with a specific garden type in mind, have the team focus on the type of person they are creating the garden for. For example, does the person want to:

- Landscape while saving water.
- Grow their own food or herbs.
- Add a water feature to their yard.
- Create a garden inside.
- Create a garden habitat native to the region in which they live.

Designing with a specific user in mind generally makes it easier to define the problem and narrow the scope of the project. It also supports a design thinking mentality of Frame-Imagine-Create.

Have them complete a cluster organizer or character trait sheet to practice descriptive writing as they identify and define who they are designing for.

Give students parameters and requirements for their work such as:

1. A scale design for a garden.
2. Suggested plants for the garden and an explanation of why these represent a healthy ecosystem or habitat.
3. A description of the design that includes information about it, as well as which type of person would benefit most from this type of garden.
4. Care and maintenance instructions for the plants in the garden.

Once you determine parameters for their work, let students choose how they will meet them. For example, their design description could take the form of a poster, brochure, slide show presentation, or even a video advertisement. You might want to brainstorm as a group different ways students can share information as well as the resources available to them.

Depending on your available resources and student experience, you may want to provide specific suggestions. For example, you may suggest the grid paper in Wixie to help with scale drawing, but also have sheets of grid paper available for those who aren't as comfortable with technology.

You may also want to choose roles for each team member, such as lead designer, architect, researcher, writer, editor, and speaker. Depending on your goals for their learning, you might also have every team member

take the role of research and writer for a day or specific component of the project.

Once student teams have chosen their audience and the type of garden they think will be most attractive to this audience, have them begin researching. They need to learn about the plants, soil, nutrients, care, and pests for a successful design.

As they explore the plants that would work in their garden, encourage them to collect research in a three-column organizer that includes the plant name, description, and pros and cons about its use. Students could also create a larger table with additional columns for size, water needs, sunlight needs, and feeding. They should not choose the first plants they find; rather, their research should help them choose the best plants from the many they learn about.

Once they have chosen plants to include, the team should work together to organize the plants into the allotted space. Encourage them to consider how the customer will access each plant for care, how it will appear (color and beauty), as well as how companion plants may be mutually beneficial.

Once they have a design created, team members need to think about how they will present a general description of their garden as well as care and maintenance instructions. They should be thinking about all of the materials they want to have available to share with potential customers at a garden fair.

Share

Have student teams present their designs to "critical friends" in your classroom. After sharing feedback, teams should make tweaks to the design and edits to their presentation.

Have students showcase their garden designs to interested community members. Host a Gardening Fair at your school or partner with a local nursery or garden center to have students present their ideas to customers at a special event. Explore additional options for distributing and displaying materials created by your students.

Assessment

Once you begin discussing the Three Sisters planting method, you will get a sense of student engagement in the topic, as well as begin evaluating prior knowledge and experience.

If you have students write about their target customers, you can evaluate their ability to empathize and write descriptively. If you implement this project more than one time, you can skip also this part and distribute/assign the first year's examples!

The research students do to develop their list of suggested plants will give you both a window into their grasp of plant needs and ecosystems as well as help you see where they need additional support in organizing research information and note taking.

The scale drawing or design of the garden is their first chance to apply the knowledge gained in their research. Evaluate their drawings' accuracy for size, complementary grouping, and maintenance. You might need to prompt the teams with questions about reaching plants to weed, prune, or pick.

Be sure to evaluate each team's overall presentation. Confirm the content accuracy and rate the effectiveness of their presentations. Did they share their ideas creatively? Were they easy to read, find, hear?

Enlist the help of gardening center staff (or parent experts) to help you evaluate the designs and the presentation of the design to potential customers.

Resources

Celebrate the Three Sisters: Corn, Beans and Squash

Companion Planting

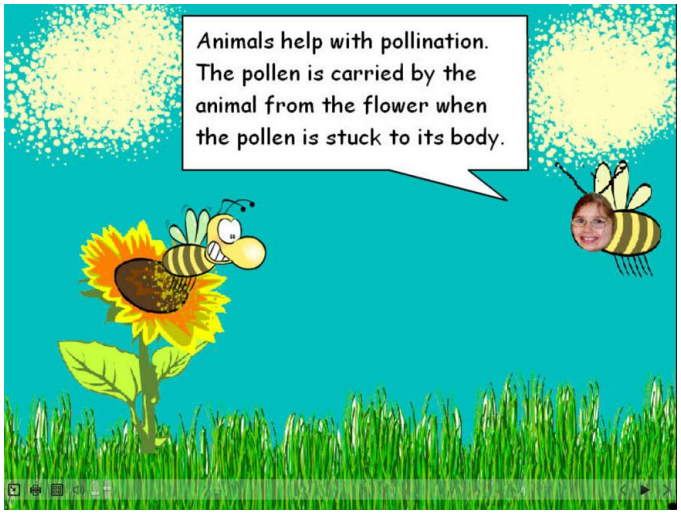
Plant care for edible gardens

Xeriscape Plant Requirements

Additional ideas from real student projects

Click the project to see the sample.

Illustrated Cycles and Diagrams

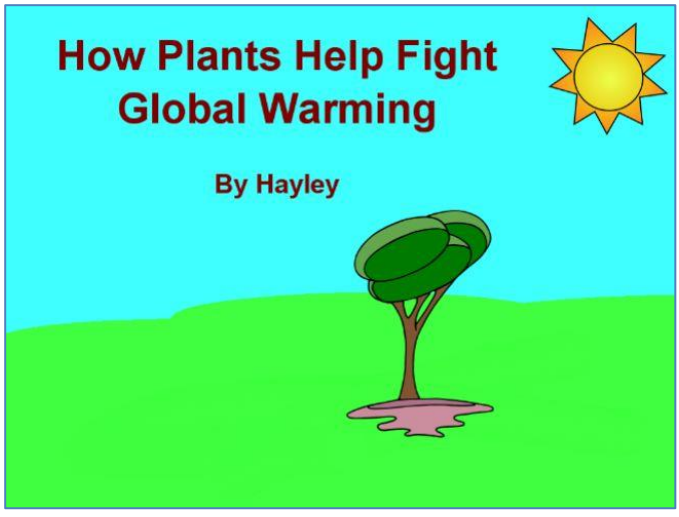


Students choose a scientific cycle, such as the water cycle, and illustrate it.

Science Topics News Broadcast

Students apply their knowledge of scientific concepts to create a news report to illustrate what they have learned.

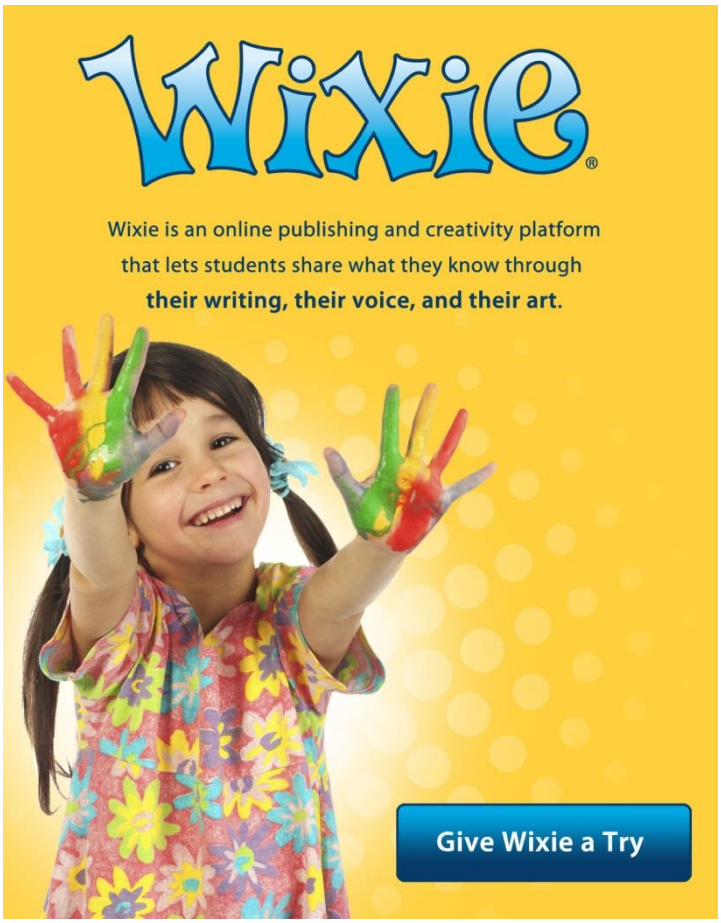
Science Reports

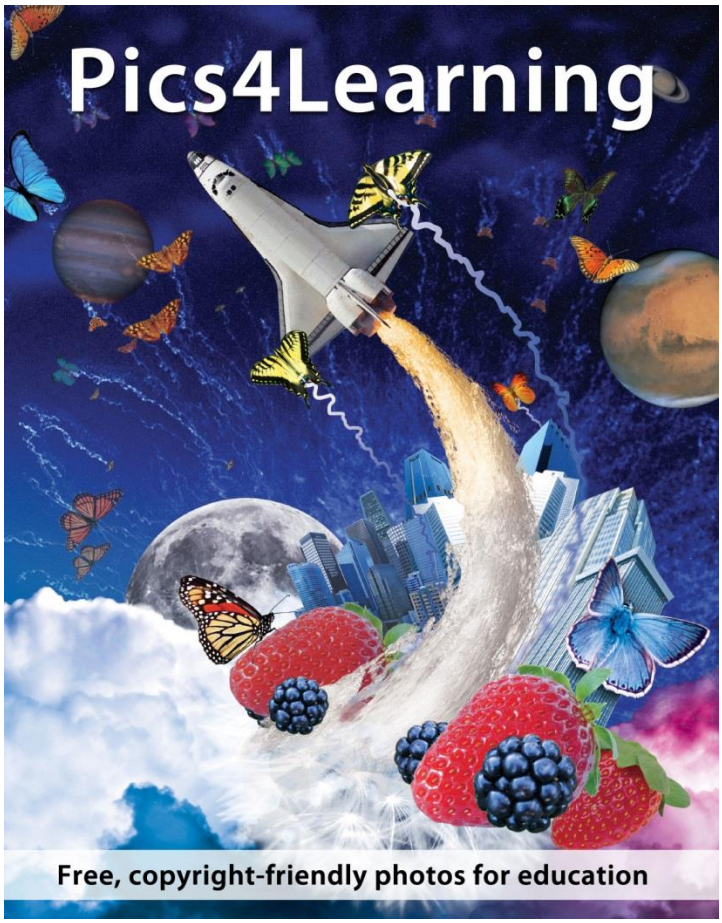


Students create a scientific report on a conservation issue and apply their knowledge by creating a real world product.

Non-fiction Science Texts

Students created their own nonfiction science books for plants, animals, or biomes.


Wixie
Wixie is an online publishing and creativity platform
that lets students share what they know through
their writing, their voice, and their art.
Give Wixie a Try


Pics4Learning
Free, copyright-friendly photos for education