

Exploring New Worlds

Teacher's Guide

The Rock by Rock Changemaker projects are a great addition to instruction either as a whole class or small group interdisciplinary unit or as a self-directed learning opportunity. Each project includes character growth, reading, writing, science, social studies and the arts.

At Rock by Rock, we believe that children learn best when they are having fun and are deeply engaged in rigorous, hands-on learning that has real-world application. We also believe that habits and character education are a core part of instruction. By infusing habits with academics we can better prepare children to thrive in our ever-changing world and to help make the world a better place.

The Hybrid Learning Series is ideal for students in 3rd-5th grade.

Classroom Application and Module Structure:

Each module in the Hybrid Learning Series can be done together as a class, in small groups or individually as a self-directed project. Each project centers around one mission that is focused on how we can take small actions to address environmental or social challenges.

Each project has a real-world mission that empowers students to take action. Each project follows an inquiry arc:

1. **Invest:** Invest students in the Mission / Project.
2. **Reflect:** Reflect on the life habit focus: Learner, Creativity, Curiosity, Empathy, Courage, Kinship, Impact Awareness.
3. **Explore:** Understand the problem and real-world needs through reading, video and activities that enable students to connect personally to the issue or problem through writing and art.
4. **Take Action:** Engage in a take action project that involves taking action through writing, art and making (crafts, performance, etc).
5. **Share:** Enlist others to work towards or rally around a cause.
6. **Reflect:** Reflect on what students learned about themselves as leaders and how they grew in their life habits.

At Rock by Rock, we believe in creating flexible tools teachers can adapt based on student needs. Each project is a teacher-designed, interdisciplinary unit that can be flexibly customized. Teachers can follow our recommended lesson flow, or tailor activities to cater to specific student needs.



Use Case	Integrated as part of ELA instructional time.	Specific Science or Social Studies Learning Time	Self Directed Learning
Grouping	Whole Class , Small Group or Individual		Individual
Purpose	<ul style="list-style-type: none"> ● Authentic Application- Reading is a means to learning - I want learners to see real world applications of reading. ● 21st century literacies - I need my learner to be developing reading and writing skills in modern day multimedia formats (i.e. podcast, videos, dramatic play etc...). ● Word and world Knowledge - My learners need to continue to develop their vocabulary and word and world knowledge to aid in literacy development. 	<ul style="list-style-type: none"> ● Hands-on Learning: I want learners to use multiple modes of learning from literacy to hands-on experiments to the arts. ● Real-world Relevance: My learners need to see how what they are learning is relevant to their lives today. ● Global Citizenship/ Science Citizenship: Foster global citizens that are engaged in taking action and developing the life habits that they need. 	<ul style="list-style-type: none"> ● Enrichment: More advanced students can do projects independently to enhance learning. ● Remediation: Teacher uses projects with small groups to provide high engagement opportunities for learning.
Time Period	Used during a language art or interdisciplinary/ humanities block.	Used to replace Science or Social Studies time and/or a specific project based learning time during the week.	Used as a learning center during traditional guided reading or small group rotations. Some kids engage independently while teachers pull groups to support as needed.
Structure	Whole Group Reading Lessons - Pre/During/Post Reading Close Reading or Read A-loud	Science and Social Studies Lessons	Guided Reading or Centers Time Independent Learning.

Materials and Technology:

Materials:

- **Student Mission Log:** You have the choice between a print Mission Log where students can write and take notes by hand or a digital Mission Log you can share with students in a variety of ways. Mission Logs have editable text to enable teacher customization.
- **Project Materials:** In the first lesson of the online module we outline all of the materials that students will need for the project and activities. Most materials are things that can be found in a classroom and/or purchased easily through amazon and/or teacher stores (i.e. discount school supplies).

Materials List:

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| <ul style="list-style-type: none"> - Thermometer - Clear containers - Water - Leaves from 4 different plants - Rocks - Magnifying Glass - Scissors - Split Pins | <ul style="list-style-type: none"> - Thick Paper - Tempera Paint - Paint brush - Eye Dropper - Pom Poms |
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Technology: All technology requirements include technology found in most classrooms.

- If doing this as a self directed project we recommend every student have access to a laptop/computer, WIFI, Chrome browser and headphones.
- For teachers who are interested in whole group instruction we recommend additional technology such as a projector or smartboard and speakers.

Standards Alignment:

Each project is aligned to national and state standards for reading, writing, science, social studies and the arts. Each module was designed to help students progress towards standards holistically. There is not a 1-1 correspondence between each standard and each lesson. Research shows that reading and writing standards develop holistically and more effectively when approached as a whole rather than teaching standards and skills in isolation. Our modules build NGSS aligned science content and practices, CCSS aligned reading, writing, listening and speaking skills, and 21st Century SEL competencies. While many lessons address all clusters of standards, one standard cluster often leads over others.

This modules specifically supports:

Subject	Standards
Reading CCSS	Reading Informational Text: Key Ideas and Details: 1-3 Craft and Structure: 4, 5 Integration of Knowledge and Ideas: 7, 9 Text Complexity: 10
Writing CCSS	Text Types and Purposes: 2,3 Product and Distribution: 4-6 Research to Build and Present Knowledge: 7-9

	Range of Writing: 10
Listening and Speaking CCSS	Comprehension and Collaboration: 1-3 Presentation of Knowledge and Ideas: 4,6
Science NGSS	<p>Performance Expectations (PE):</p> <ul style="list-style-type: none"> 3-PS2-2: Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. 5-ESS1-1: Support an argument that differences in the apparent brightness of the Sun compared to other stars is due to their relative distances from the Earth. 5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. 5-LS1-1 Support an argument that plants get the materials they need for growth chiefly from air and water <p>Science and Engineering Practices (SEP):</p> <ul style="list-style-type: none"> Using Mathematics and Computational Thinking Planning and Carrying Out Investigations Analyzing and Interpreting Data Engaging in Argument from Evidence Developing and Using Models <p>Disciplinary Core Ideas (DCI):</p> <ul style="list-style-type: none"> 5-ESS3-1: Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. 5-ESS1-1: The Sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth. 5-PS3-1: The energy released [from] food was once energy from the Sun that was captured by plants in the chemical process that forms plant matter (from air and water). 5-ESS1-2: The orbits of Earth around the Sun and of the Moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the Sun, Moon, and stars at different times of the day, month, and year. 3-PS2-2: The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. 5-PS2-1: The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. <p>Crosscutting Concepts (CC):</p> <ul style="list-style-type: none"> Systems and System Models Scale, Proportion, and Quantity Cause and Effect Energy and Matter Patterns
SEL	Life Habit: Empathy

21st Century Skills/Arts	<p>CASEL:</p> <p>Social Awareness:</p> <ul style="list-style-type: none"> • Taking others' perspectives • Recognizing strengths in others • Demonstrating empathy and compassion • Showing concern for the feelings of others <p>Self-Awareness:</p> <ul style="list-style-type: none"> • Identifying one's emotions • Linking feelings, values, and thoughts <p>Responsible Decision Making:</p> <ul style="list-style-type: none"> • Demonstrating curiosity and open-mindedness • Learning how to make a reasoned judgment after analyzing information, data, and facts
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This Project's Focus: Exploring New Worlds

Real-World Mission	Real-World Project	Character Focus
Should we be moving to outer space?	Create a time capsule, including a letter, to educate people in the future about some of the conditions humans would need to survive.	Empathy: How can we use empathy to help others cope with changes they are experiencing?

Types of Lessons within a module:

Type	Description	Student Output.
Informational Text Based Lessons	<p>Lessons that develop informational text skills (reading, graphic organizers, charts, graphs, science concepts, social studies concepts). All lessons follow a similar flow:</p> <ul style="list-style-type: none"> • Pre-reading: Intro/hook • During Reading: Interactive Questions • Post Reading: Application activity - many times the post activity can lead to a discussion or supplemental activity aligned with particular class or student needs. 	<ul style="list-style-type: none"> • Student mission log • Group discussion.
Hands-on Activities	<ul style="list-style-type: none"> • Experiential learning opportunities that are hands-on and require learners to go offline to learn by doing and making. • Focused on leveraging different learning modalities to engage learners and increase motivation, support internalization of content and aid retention. 	<ul style="list-style-type: none"> • Student mission log • Activity products.
Habit Focus and Reflections	<ul style="list-style-type: none"> • Integrated life-habit lessons that develop a 21st century skill/habit. • Each project starts and ends with a habit reflection to show growth. 	<ul style="list-style-type: none"> • Activity products. • Student reflections

Take Action Project	<ul style="list-style-type: none"> • Short texts/videos/lessons that develop foundational project content (i.e. what is podcast) and project skills (i.e. how do I create effective podcasts?). • Short and quick application of the lesson as a guided practice before applying it to the project to ensure kids have internalized the concepts. • Creation of a take action project that leads to genuine impact. Projects use a modern day multimedia form of communication. • An opportunity to share with an authentic audience where kids present what they have learned. 	<ul style="list-style-type: none"> • Student mission log • Take action project • Share/presentation
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Unit Overview: *(Whole Class or Small Group)*

What will Earth look like by 2050? Will it be the same or different than what we see today? Scientists are predicting that the Earth in the future will be filled with many environmental challenges. The weather will be hotter, oceans will be warmer and our air may be less breathable. Seasons will change, the amount of sunlight we get will be different and access to clean fresh water may be more difficult. It's why many organizations like NASA, SpaceX and Blue Origin are exploring space to see if there are other planets humans could inhabit in the future.

Whether we decide to explore new worlds, or decide to preserve the one we live in we need to understand what makes our Earth habitable. Our universe is vast and includes a solar system of planets and stars that are pulled together by gravity. One important part of what helps us live on Earth is gravity, or the force that pulls us to the center of the Earth. Another important fact is Earth's closeness to the Sun. As the Earth revolves around the Sun, Earth experiences changes in weather and temperature that we know as seasons. Our understanding of seasons have helped us grow civilizations throughout history, including learning about time, building shelter, and growing food for our bodies. The Sun is a key component of our world that provides us clean air, fresh water and livable temperatures. Without the Sun, our Earth would freeze. We cannot survive without sunlight, and it is what keeps our environment healthy and our bodies alive.



As we explore our solar system, particularly Earth and Mars, we will consider the conditions that make a planet habitable.

Virtual Field Trips

	<p>Ekta Patel</p> <p>In this module, students meet Ekta Patel, an astronomer who studies galaxies. Ekta will teach students about the work of astronomers, what a light year is, why the Sun appears larger than other stars, and the importance of orbits in our solar system.</p>		<p>Chelsea Blake</p> <p>In their Take Action Project, students meet conservator Chelsea Blake. Chelsea teaches students how to make a time capsule that sends a message to people in the future. Chelsea teaches students how to determine a clear message, how to select artifacts to communicate that message, and how to write a letter to better explain their message.</p>
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Unit Goals: Exploring New Worlds

1. Understand, identify and exhibit traits of an empathetic learner and citizen.
2. Differentiate between Earth's rotation and orbit and explain the importance of each.
3. Analyze how the Sun's energy impacts life on Earth.
4. Evaluate the impact of the Sun's gravitational pull and Earth's gravitational pull.

Key Vocabulary

gravity	rotation	axis	atmosphere	solar system	orbit
n. an invisible force of attraction	n. the circular movement of an object around an axis	n. an imaginary line about which an object rotates	n. a jacket of gasses that surrounds our planet	n. the Sun and everything that orbits, or travels around it	v. to move in a curved path around another object



Pro Tip

Before you begin your planning, we suggest you read this teacher's guide, the student Mission Log and that you skim the online course to become familiar with the content. If you want to build your own background knowledge about gravity, space and the rotation of the Earth, you can complete the online module as a student.

At-A-Glance

Module	Description	Activities
1: Your Mission 1-2 Days	<p>Students are introduced to their "Exploring New Worlds" mission and begin to consider what life might look like in 2050. Students consider what life would be like if</p> <ol style="list-style-type: none"> Earth's climate continues to change and people decide to remain on the planet. People address climate change and continue to make technological advancements. Earth's climate continues to change and people decide to move to another part of the Universe <p>Students leave with understanding their mission is to answer the question "Should we be exploring a new planet to live on by 2050 or try to be saving our Earth?" and that their take action project is to create a time capsule that shares with people in the future what makes Earth livable today.</p>	<p>Online:</p> <ul style="list-style-type: none"> Mission Introduction Read fictional scenarios to better understand what life on Earth might look like in the future. Learn about space exploration and people and organizations who are exploring parts of space as a potential future home for humans.
2: Empathy 1-2 Days	<p>Students define empathy and explore how empathy can be used to help others cope with change, including changes associated with environmental challenges and the potential need to move to another place in the Universe.</p>	<p>Online:</p> <ul style="list-style-type: none"> Students develop a definition of empathy. Students complete empathy maps to consider what a child living in 2050 might think, feel, hear, see, and do. Students reflect on how they have used empathy in the past in order to prepare them to use empathy in their project.
3A: Our Place in the Universe - The Sun, Moon, and Stars 2-4 Days	<p>To determine if we should be moving to outer space and exploring new worlds, students start by learning about our Universe and the objects found in the universe. While exploring this topic, students discover that our Sun appears bigger and brighter than other stars because it is the closest star to Earth.</p> <p>Virtual Field Trip: Students meet Ekta Patel, an astronomer who studies galaxies. Students learn about what an astronomer</p>	<p>Online:</p> <ul style="list-style-type: none"> Engage in multiple activities to learn about the Universe and the sizes and distances between objects in the Universe. Virtual Field Trip to meet astronomer, Ekta Patel.

	does and how astronomers describe a galaxy.	
3B: The Sun: Earth's Main Energy Source 2-4 Days	<p>Students then start exploring what are the conditions that make Earth livable. They learn that Earth's proximity to the Sun provides us with the energy we need to survive. Students also learn about photosynthesis and how all food chains begin with producers getting energy from the Sun. Then, students learn about Earth's atmosphere, the greenhouse effect, and how an increase in greenhouse gasses has caused Earth's climate to change.</p>	<p>Online:</p> <ul style="list-style-type: none"> Use various texts, diagrams, and interactive features to learn about how energy from the Sun supports life on Earth and how some human actions are leading to environmental challenges. <p>Hands On:</p> <ul style="list-style-type: none"> Oxygen Production: While conducting an investigation, students observe and analyze the amount of oxygen produced by different types of leaves. They then use their data to reflect on the following: How might planting more of these types of plants benefit humans and other animals? Air Temperature: Students complete an investigation to compare the temperature of air in the sun with the temperature of air in the shade.
3C: Earth's Movements 2-4 Days	<p>Next, students learn about Earth's rotation and orbit around the Sun and how that impacts other important conditions that help us survive on our planet.</p> <p>Students explore some of the patterns caused by Earth's movements, including day and night, seasons and changing daylight hours. While learning about these movements and patterns, students consider how they support life on Earth and what could be applied to any new planet we might explore.</p>	<p>Online:</p> <ul style="list-style-type: none"> Explore Earth's rotation and orbit, some of the patterns caused by these movements, and how these movements and patterns support life on Earth. <p>Hands On:</p> <ul style="list-style-type: none"> Make a Model: Students create a model of the Sun-Earth-Moon system and use it to observe the movement and interactions of these three objects.
3D: How Gravity Impacts Earth 2-4 Days	<p>Finally, students learn that gravity is an invisible force that keeps Earth in orbit around the Sun. Students also learn that mass and distance impact the strength of an object's gravitational pull which explains why the moon orbits Earth while Earth orbits the Sun. Students consider what life would be like without gravity and conclude that we would not be able to survive without this force.</p>	<p>Online:</p> <ul style="list-style-type: none"> Learn that gravity keeps Earth and the other planets orbiting around the Sun. Explore some of the ways gravity affects life on Earth and consider what life without gravity would be like. <p>Hands On:</p> <ul style="list-style-type: none"> Gravity Art Challenge: Students observe painting patterns that were created using gravity, then use what they have learned to recreate those patterns.
3E: Who Is Helping and How Can We Help?	<p>To learn more about what people are doing to further space exploration, students continue to read about the work of SpaceX. To learn more about what people are doing to address</p>	<p>Online:</p> <ul style="list-style-type: none"> Students learn more about space exploration and actions that can help protect Earth before engaging in a debate

<p>2-4 Days</p>	<p>climate change, including how different businesses are trying to get to net zero goal, governments creating climate policies and young people working to better our world. Students also learn about actions they can take to help protect Earth. This leads to a debate and students take all they have learned to apply it to their time capsule project.</p>	<p>about whether we should continue to spend money on space exploration or focus more on addressing climate change.</p>
<p>4A + 4B: Take Action Project: Build a Time Capsule</p> <p>3-6 Days</p>	<p>Students apply what they have learned and create a time capsule.</p> <p>Virtual Field Trip: Students meet archeological conservator Chelsea Blake. Chelsea teaches students about using a time capsule to: 1) Send a clear message to people in the future. 2) Selecting artifacts that align to their message (and have physical properties that prevent them from decomposing). 3) Including relevant information in a letter included in a time capsule. Students also learn what a conservator does and what time capsules have been found to inform our world today about the past.</p>	<p>Online:</p> <ul style="list-style-type: none"> • Virtual Field Trip: Meet Chelsea Blake and learn key components to building a time capsule that sends a message to people in the future. <p>Hands On:</p> <ul style="list-style-type: none"> • Create Time Capsule: Students create a time capsule (including a letter) to teach people from the future about some of the conditions humans would need to survive elsewhere in the Universe.
<p>4C: Share & Reflect</p> <p>1 Day</p>	<p>Students present their time capsules and letters to an authentic audience to teach the audience about some of the conditions humans would need to survive on another planet or somewhere else in the Universe.</p> <p>Finally, students reflect on what they've learned about empathy and how they can extend those skills to other areas of school and life.</p>	<p>Hands On:</p> <ul style="list-style-type: none"> • Share: Students share their time capsules and letters with an audience. • Reflect: Engage in personal reflection (1-1, small group, whole group) to reflect on ways to use empathy beyond the scope of this project.

Sample Lesson Flow

This project could be done in as little as 1-2 weeks with several full days devoted to project-based learning or as many as 4 weeks depending on how much time each day teachers allot to the project and how much depth they choose to explore with each activity. The below lesson sequence is designed to be a flexible jumping-off point for teacher planning and should be modified based on student need and teacher discretion.

Category	Objective and Description	Materials Needed	Standards Alignment
Invest			
Module 1: What will Earth look like in 2050?			
1-1	<p>Your Mission: What conditions would we need to survive in space?</p> <p>Objectives:</p> <ul style="list-style-type: none"> Build investment and curiosity in the idea of living in outer space as a way to cope with future environmental challenges. Explain that the mission of the Exploring New Worlds project is to learn about some of the ways our solar system supports life on Earth and create a time capsule and letter to educate others about the conditions humans would need to survive elsewhere in our universe. <p>Methods:</p> <ul style="list-style-type: none"> Intro Video: Watch the intro to the project and mission video to build investment, excitement, and curiosity about the problem. Quiz: Answer true/false questions to build investment in learning more about the conditions humans would need to survive on a different planet in outer space. Time Capsule: Watch a short intro video to learn how time capsules are used to send messages to people in the future. Mission Log: Students understand how to use their Mission Log throughout the project to journal important information that will help them with their project. 	<ul style="list-style-type: none"> Project Module Mission Log 	<p>NGSS: DCIs:</p> <ul style="list-style-type: none"> 5-ESS3-1
1-2	<p>Life in 2050</p> <p>Objectives:</p> <ul style="list-style-type: none"> Consider some of the experiences people living in the future could 	<ul style="list-style-type: none"> Project Module Mission Log 	<p>NGSS: DCIs:</p> <ul style="list-style-type: none"> 5-ESS3-1

	<p>face.</p> <ul style="list-style-type: none"> • Use predictions of the future to write a newspaper headline and draw a photograph and matching caption. <p>Methods:</p> <ul style="list-style-type: none"> • Leo's Life: Students listen to three fictional scenarios to begin imagining what life on Earth might look like in 2050. • Headlines from the Future: Students use what they have learned about what life might be like in 2050 to write a newspaper headline and a corresponding image and caption. 		
1-3	<p>Predict The Future</p> <p>Objectives:</p> <ul style="list-style-type: none"> • Learn about some of the major events in space exploration. • Learn about how some people are working to save the Earth. • Reflect and predict what we think the impact might be if we chose to move to outer space. <p>Methods:</p> <ul style="list-style-type: none"> • Space Exploration Timeline: Use a timeline to learn about some of the major historical events related to space exploration. • Artemis Video: Watch a video to learn about the Artemis mission and how it connects to exploring Mars as a possible future home. • Innovations to Preserve Earth: Students learn about different innovations created to help preserve our planet. • Agree, Disagree, Unsure?: Students start to form opinions about what they think will happen knowing that they will learn more about this throughout the project. 	<ul style="list-style-type: none"> • Project Module 	
Reflect			
Module 2: Life Habit: Empathy			
2-1	<p>What is Empathy?</p> <p>Objectives:</p> <ul style="list-style-type: none"> • Reflect on what it might be like to move to another planet. • Define empathy and begin to think about how empathy could be used to help people navigate changes such as moving to Mars. 	<ul style="list-style-type: none"> • Project Module • Mission Log 	<p>CASEL:</p> <ul style="list-style-type: none"> • Social Awareness • Self-Awareness

<p>3-2</p>	<p>Our Place in the Universe</p> <p>Objectives:</p> <ul style="list-style-type: none"> • Explain the relationships between a universe, galaxy, and solar system. • Explore some of the objects found in the universe. • Sequence objects in the universe from smallest to largest. <p>Methods:</p> <ul style="list-style-type: none"> • Pre-Reading: Students take a warm-up quiz to engage them in the content and activate prior knowledge. Questions are centered around the universe and objects in the universe. Students also view a hotspot as they begin to explore the relationship between the universe, galaxy, and solar system. • During-Reading: Read page 1-11 in the zine. During this time, students will focus on understanding "Our Place in the Universe". This includes answering questions such as: <ul style="list-style-type: none"> ○ What can we learn from exploring space? ○ How big is our universe? ○ What is a solar system? ○ What are some of the objects found in the solar system? ○ What is the difference between the Sun, moon, stars, and planets? • Post-Reading: <ul style="list-style-type: none"> ○ Sequencing Activity: Students use the sequencing interactive feature to put the objects found in space in order from smallest to largest. ○ Is There Life on Mars?: Students watch a video to learn more about Mars and whether life exists on this planet. 	<ul style="list-style-type: none"> • Project Module • Zine 	<p>CCSS:</p> <ul style="list-style-type: none"> • CCSS.ELA-LITERACY.RI.5.2 <p>NGSS:</p> <p>DCIs:</p> <ul style="list-style-type: none"> • 5-ESS1-1 <p>Crosscutting Concepts:</p> <ul style="list-style-type: none"> • Systems and System Models • Scale, Proportion, and Quantity
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End of Preview

If you want to see the rest of the teacher's guide, sign-up for a free-trial.

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