

# Standards-Aligned CaveSim Programs for Colorado Elementary Schools

Prepared by Dave Jackson, CaveSim creator and lead educator. Contact

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*Right: Awestruck at a program in Los Alamos, NM, 2017*



## Teacher quotes:

“Science Days was a rousing success and everyone is raving about how good your stations were. The cave, obviously, but I have also heard especially good things about the bats and echolocation games being perfect for the younger kids and I saw the bigger ones enjoying it as well. I’ve had a number of teachers say they want you back.” — **Julie Haverluk, Academy International Elementary School, Colorado Springs**

“CaveSim was amazing. I had students come up to me the next day, give me a big hug and say ‘Thank you Ms. Jones for having the cave at our school. It was so fun.’ The students were able to understand cave formations, organisms and cave safety. You and the other cave experts were fantastic. You were able to share important content related to earth science and life science. Each part of the presentation was aligned to our science standards. They particularly loved climbing through the cave and the ‘tower’. Mike was great. Thanks for all that you do. We would love to see you back next year.” — **Patricia Jones, teacher, Houston Elementary, Austin ISD**

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## Summary

Thank you for your interest in CaveSim! The centerpiece of our programs is our mobile CaveSim system, which we'll bring to your school from Colorado Springs in a 24' trailer. The cave is filled with formations, critters, and ancient artifacts (all artificial), and students get a computerized score based on how carefully they avoid the stalactites and other objects as they explore.

We'll also bring you an entire program of CDE CAS<sup>1</sup>-aligned hands-on lessons/activities with the mobile cave. Our elementary programs are tailored specifically to elementary standards, and cover a wide range of subjects including science, math, engineering, and even PE and art.

Our programs are led by CaveSim inventor, educator, and MIT-trained engineer Dave Jackson. Dave and his wife Tracy are both real cavers, and have been doing CaveSim programs at schools around the country since 2010 (for over 30,000 students). Our lessons are designed by Tracy, who has a Masters of Art in Teaching from Colorado College, and brought to you by Dave and other highly skilled CaveSim staff.

In addition to learning a wide range of classroom subjects, students also learn that they can do what Dave and Tracy have done: take what they've learned in school and use it to follow their passions to make the world just a little bit better.

We look forward to bringing CaveSim to your school to engage your students in a whole new way, and we're excited about working with you.

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<sup>1</sup> CDE=Colorado Department of Education; CAS=Colorado Academic Standards. See <https://www.cde.state.co.us/standardsandinstruction/coloradostandards-academicstandards>

### **Colorado schools that have done and loved our programs (by district, alphabetically)**

Aurora (city enrichment programs): Peoria Elementary; Fulton Academy

Boulder Valley School District: Ryan Elementary; Aspen Creek K-8

Buena Vista: Avery Parsons Elementary

Canon City Re-1 School District: Canon City High School caving club

Cheyenne Mountain D12: Gold Camp Elementary

Colorado Springs Academy D20: Academy International Elementary

Colorado Springs School District 11: Queen Palmer ES, Tesla EOS, Holmes MS (online), Taylor Elementary YES club; Buena Vista Elementary YES club

Cripple Creek/Victor: Cresson Elementary

Douglas County School District RE-1: Arrowwood Elementary

Elizabeth C-1 School District: Legacy Academy

Falcon D49: Falcon Middle, Springs Ranch Elementary (online)

Fountain Fort Carson D8: Carson Middle; Patriot Elementary; Aragon Elementary; Abrams Elementary

Harrison D2: Atlas Preparatory School, Centennial Elementary (online)

Lewis-Palmer D38: Palmer Lake Elementary

Manitou Springs School D14: Ute Pass Elementary, Manitou Springs Elementary

Park County Re-2: Lake George Charter School

parochial schools: Good Shepherd School

Pueblo County School D70: Cedar Ridge Elementary

private schools: Ben Franklin Academy; The Colorado Springs School; The University School of Colorado Springs

Salida: Longfellow Elementary

State Charter Institute School District: Mountain Song Community School



Weld County School District Six: University Schools (middle school)



Widefield School District 3: Watson Junior High (online)



## Standards Alignment and Program Details


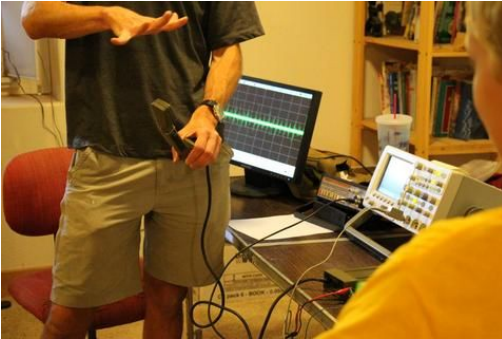
Standard components are included in the cost of the program. Programs are typically conducted by having students work with us at a series of different stations/lessons, as follows:


CaveSim program element: Horizontal Cave Exploration	Corresponding CDE standards	Photos of past CaveSim programs
<p>In CaveSim mobile cave (contains 60' of passage with multiple levels in a 24' trailer), students explore in small groups (while wearing helmets) and:</p>		
<ul style="list-style-type: none"><li>Try to avoid bumping into artificial cave formations. Students learn that oil &amp; water do not mix, &amp; that touching formations can cover them with skin oil, which stops formations from growing.</li></ul>		
<ul style="list-style-type: none"><li>Look for cave biota (critters, all artificial), and discuss the cave ecosystem after they exit the cave. CaveSim staff teaches about the cave food web, including the amazing lampshade spider, which eats fungus gnats, which eat fungus, which eat deceased bats, etc.</li></ul>	<p>4th Grade: 2. Life Science 1. All living things share similar characteristics, but they also have differences that can be described &amp; classified; 2. Comparing fossils to e/o or to living organisms reveals features of prehistoric env'ments &amp; provides info. about organisms today; 3. There is interaction &amp; interdependence b/w &amp; among living &amp; nonliving components of systems</p>	<p><i>Thrilled to explore CaveSim in Glenwood Springs, CO, 2018. Photo by Chelsea Self, Post Independent.</i></p>
<ul style="list-style-type: none"><li>Learn about how cave passage forms. CaveSim staff talk about special bacteria that use enzymes to eat limestone (breaking chemical bonds to get energy). We can also discuss the formation of sinkholes, and the benefits / dangers that they afford humans. Demo available upon request: dissolution of carbonate rocks using weak acid. Discussion of how humans use cave-based resources (e.g., limestone, guano)</li></ul>	<p>5th Grade: 3. Earth Systems Science: 1. Earth and sun provide a diversity of renewable and nonrenewable resources; 2. Earth's surface changes constantly through a variety of processes and forces.</p> <p>2nd Grade: 2. Life Science: 1. Organisms depend on their habitat's nonliving parts to satisfy their needs.</p>	
<ul style="list-style-type: none"><li>CaveSim staff explain how aqueous cave formations (helictites, soda straws, gypsum) form. Topics covered: water flow is usually downhill due to gravity; sometimes water flows against gravity due to capillary action (examples: water climbing up a towel, water flow inside cave formations). Students expand vocabulary with "capillary action."</li><li>Look for modern equipment in the cave, including rescue cache and vertical caving rope ladder (etrier). Students learn that the etrier (rope ladder) is named after the French word for stirrup. Students expand vocabulary with the word "cache."</li></ul>		
<ul style="list-style-type: none"><li>Look for artifacts and rock art. Discuss the importance of artifacts to native people and to archaeologists and anthropologists. Hear a real story about a CaveSim staff member's experience with artifacts while exploring caves in Mexico. Students discuss why we don't take native artifacts or damage native art. Differences between graffiti and art are discussed.</li><li>Available upon request: prior to entering the cave, students are asked to make cave paintings with black paint on butcher paper. Students are encouraged to reflect on their paintings and write a few sentences about what story their picture tells. During exploration of the mobile cave, students are given extra time in the cave to make sketches of the cave paintings that they find. After they exit the cave, students are given time to write a few sentences on their sketch to tell a story about what they saw in the cave paintings. As a group, students are invited to share the stories that they wrote.</li></ul>	<p>2nd Grade PE: 1. Movement Competence &amp; Understanding: 1. Demonstrate the elements of movement in combination with a variety of locomotor skills; 2. Demonstrate control &amp; balance in traveling &amp; weight-bearing activities using a variety of body parts &amp; implements; 3. Use feedback to improve performance</p> <p>2. Physical &amp; Personal Wellness: 1. Recognize the importance of making the choice to participate in a wide variety of activities that involve locomotion, nonlocomotion, and manipulation of objects outside of physical education class, 2. Identify good brain health habits; 3. Emotional and Social Wellness: 1. Demonstrate positive and helpful behavior and words toward other students</p> <p>4. Prevention &amp; Risk Management: 1. Apply rules, procedures, &amp; safe practices to create a safe school environment.</p>	
<p><u>Space required:</u> the 24' trailer is typically kept outside. See <a href="http://www.cavesim.com/site-logistics">www.cavesim.com/site-logistics</a> for more details. In inclement weather, we may close the trailer and do indoor activities.</p>		

CaveSim program element: Vertical Caving	Corresponding CDE standards	Photos of past CaveSim programs
<p>On CaveSim portable 12' A-frame w/ crash pads:</p> <ul style="list-style-type: none"> <li>While wearing helmets, students use a Bosun's chair, ropes, and pulleys to learn about mechanical advantage afforded by 1:1 and 5:1 pulley systems, and learn that work is unchanged when a mechanical advantage is introduced. Students work together to lift a fellow student up the tower using the different systems. Students use their understanding of fractions to determine that the 5:1 pulley system reduces the required lifting force by a factor of 5.</li> </ul> <hr/> <ul style="list-style-type: none"> <li>CaveSim staff use harnesses and mechanical ascenders to ascend the A-frame. CaveSim staff discuss the ascender mechanics, as well as equipment safety and the important differences between caving and rock climbing equipment. Students learn the words "ascend," "descend," "vertical", and "horizontal." Students learn about current events in vertical caving, including ongoing efforts in Mexico to find the world's deepest cave. Students learn that some of the cavers who help with CaveSim have been over 6000' underground.</li> </ul> <hr/> <ul style="list-style-type: none"> <li>With the help of students, CaveSim staff demonstrate the power of friction to rapidly destroy Nylon rope. Before the demonstration, students are encouraged to develop hypotheses about what will happen when two ropes are rubbed together, and then develop hypotheses about which rope will break first. After the two ropes are rubbed together rapidly and the larger rope breaks, students are encouraged to try to figure out why the larger rope broke. CaveSim staff explain the outcome by introducing the concept of "concentrated" (because of the way the experiment is done, the heat is <i>concentrated</i> in just one spot on the larger rope, and spread out on the smaller rope, hence the melting of the larger rope).</li> </ul>	<p>2nd Grade: 1. Physical Science: 1. Changes in speed or direction of motion are caused by forces such as pushes and pulls.</p> <p>5th Grade PE: 1. Movement Competence and Understanding: 1. Demonstrate mature form for all basic locomotor, non-locomotor, manipulative, and rhythmic skills; 2. Demonstrate understanding of how to combine and apply movement concepts and principles to learn and develop motor skills.</p> <hr/> <p>5th Grade PE: 2. Physical and Personal Wellness: 1. Understand and apply basic principles of training to improving physical fitness; 2. Demonstrate understanding of skill-related components of fitness and how they affect physical performance; 3. Connect the health-related fitness components to the body systems.</p> <hr/> <p>4th Grade PE: 2. Physical and Personal Wellness 1. Explain how the health-related components of fitness affect performance when participating in physical activity; 3. Recognize the benefits derived from regular, moderate, and vigorous physical activity.</p> <hr/> <p>3rd Grade PE: 2. Physical and Personal Wellness 1. Identify the benefits of sustained physical activity that causes increased heart rate and heavy breathing.</p> <hr/> <p>4th Grade: 1. Physical Science: 1. Energy comes in many forms such as light, heat, sound, magnetic, chemical, and electrical</p> <hr/> <p>4th Grade PE: 4. Prevention and Risk Management 1. Identify and describe the benefits, risks, and safety factors associated with regular participation in physical activity.</p>	 <p><i>Above, a student in Colorado uses mechanical advantage to lift herself up the A-frame.</i></p> <p><i>Below, students in Montana work together under direct supervision from staff to lift a fellow student .</i></p> 
<p><u>Space required:</u> typically outdoors on flat ground. May also be placed indoors where ceiling height is &gt;12'6". Footprint is 8' x 9'.</p>		


CaveSim program element: Carbide Demonstrations	Corresponding CDE standards	Photos of past CaveSim programs
<p>To illustrate chemistry and physics concepts, CaveSim staff bring working carbide lamps and carbide to programs. Demonstrations can include:</p> <ul style="list-style-type: none"> <li>• CaveSim staff light a working carbide lamp by placing carbide and water in the lamp to produce a small (and safe) quantity of flammable gas. The resultant gas (acetylene) burns to produce light and heat, but the lamp body also becomes warm because of the exothermic reaction between the carbide and water. Students can touch the lamp body to get a better understanding of the concept of an exothermic reaction. Older students gain an understanding of the concept of reflectors by observing the behavior of the reflector on the lamps. New vocabulary explained by CaveSim staff: "exothermic," with connection drawn to "exoskeleton."</li> <li>• CaveSim staff place carbide and ice in an open pan. As the ice melts, the water reacts with the carbide, producing the aforementioned acetylene gas. CaveSim staff discuss states of matter (solid ice turns to liquid water as it's heated by the carbide, and then to vapor as it boils). For older students, the concept of limiting reactants is introduced. By watching the exciting reaction occur, students gain a more intuitive understanding of the concept of a chemical reaction. New vocabulary taught by CaveSim staff: "reaction", "reactant."</li> <li>• Science experiment safety is emphasized (e.g., firmly close containers when not in use).</li> <li>• Fire safety is emphasized, with an emphasis on who is allowed to make a fire (a responsible adult), what must be present (a method of extinguishing the fire), where the fire should be made (in a safe container away from other fuel sources).</li> </ul> <p><u>Space required:</u> typically conducted outdoors, but cannot be done in the rain. May be done indoors in an appropriate lab setting where a small quantity of smoke may be safely produced without setting off alarms or creating hazardous conditions. The smoke produced in this activity is equivalent to the smoke produced by extinguishing about a dozen birthday candles.</p>	<p>5th Grade: 1. Physical Science: 1. Mixtures of matter can be separated regardless of how they were created; all weight and mass of the mixture are the same as the sum of weight and mass of its parts.</p> <p>4th Grade: 1. Physical Science: 1. Energy comes in many forms such as light, heat, sound, magnetic, chemical, and electrical</p> <p>3rd Grade: 1. Physical Science: 1. Matter exists in different states such as solids, liquids, and gases and can change from one state to another by heating and cooling.</p> <p>1st Grade: 1. Physical Science: 1. Solids and liquids have unique properties that distinguish them</p>	 <p>Above, carbide lamp demonstration by CaveSim staff at a program in Colorado.</p>  <p>Below, stock photo of the lamps we use.</p>





CaveSim program element: Cave Rescue Phones	Corresponding CDE standards	Photos of past CaveSim programs
<p>Hands-on lessons about basic circuits using a pair of wired cave rescue phones. Activities include:</p> <ul style="list-style-type: none"> <li>We bring two cave rescue phones to our programs. The phones are connected by wire, which allows us to discuss basic circuits, and demonstrate that a circuit requires at least one complete loop to function. Students can disconnect and reconnect wires for hands-on learning about conductors and insulators. Students talk with each other over the phones. CaveSim staff discuss the relationship between wire length, electrical resistance, electrical energy dissipation in the wire, and phone volume. Electrical circuits involving the earth as one of the conductors are discussed.</li> </ul> <hr/> <ul style="list-style-type: none"> <li>Available upon request: Demonstrations with an oscilloscope (see <a href="https://whatis.techtarget.com/definition/oscilloscope">https://whatis.techtarget.com/definition/oscilloscope</a>) by CaveSim owner Dave Jackson, who has designed high speed computer chips for oscilloscopes. The oscilloscope produces a graphical representation of voltage on the cave rescue phone wire vs. time, which allows students to visualize their vocal energy on a screen. We discuss graph axes, and the relationship between time-based and frequency based graphs. Resonances/oscillation of electrical and sound signals are also discussed. This activity is typically done for middle/high school, but can be adapted to older elementary students.</li> </ul>	<p>4th Grade: 1. Physical Science: 1. Energy comes in many forms such as light, heat, sound, magnetic, chemical, and electrical</p> <hr/>	 <p>Two friends enjoy talking on the cave rescue phones during a 2013 CaveSim program in Colorado.</p>
<p><u>Space required:</u> typically outdoors for convenience, but can also be done in any classroom or indoor setting. Oscilloscope demo must be done indoors if raining. The oscilloscope has a VGA output, which can be projected to a smartboard, projector, or computer monitor for better viewing by students.</p>		 <p>A CaveSim staff person teaches students about electricity and magnetism using cave rescue telephones and electronic test equipment (oscilloscopes).</p>

CaveSim program element: Bat games and lessons	Corresponding CDE standards	Photos of past CaveSim programs
<p><b>Bat skeleton and guano</b> demonstrations and lessons:</p> <ul style="list-style-type: none"> <li>• Discussion of similarities and differences between bat wing structure and human hands. Discussion of evolutionary pressures that may have created the similarities and differences.</li> <li>• Discussion of bat tail structure and usage of the tail in steering, balance, and in catching insects.</li> <li>• Discussion of different types/sizes of bats, and the role that they play in helping humans. Real-life lesson about bat eradication by farmers and the impact on their crops.</li> <li>• Photographic and/or video demonstration of the ongoing White Nose Syndrome (WNS) epidemic that has killed nearly 6 million bats in the last ~10 years. For older grades, lesson about the WNS fungus (<i>Pseudogymnoascus destructans</i>) and how it eats (metabolizes) bats alive.</li> <li>• Discussions about history and the role that caves played in the civil war (as sources of saltpeter for the production of gunpowder).</li> </ul> <p><u>Space required:</u> typically done by the trailer to engage students as they wait to explore. Can also be done anywhere inside.</p> <p><b>Bat echolocation game:</b> Two at a time, students take turns roleplay a bat and a moth. The bat (blindfolded) tries to locate and tag the moth using only the “bats” voice and their hearing. The other students form a circle to contain the two students playing the bat and moth. Students learn about echolocation, and gain personal confidence.</p> <p><u>Space required:</u> may be played indoors or outdoors. If outdoors, a safe surface must be used (to allow a blindfolded student to move in a small circle of other students without tripping on uneven ground).</p> <p><b>Bat Migration Challenge game:</b> Working individually or in groups (depending on grade level), students act out the lives of bats as they encounter daily challenges and opportunities. Students learn about the ways in which humans can act to help or harm bats.</p> <p><u>Space required:</u> may be played indoors or outdoors.</p>	<p>5th Grade: 2. Life Science: 1. All organisms have structures and systems with separate functions; 2. Human body systems have basic structures, functions, and needs.</p> <p>3rd Grade: 2. Life Science: 1. The duration and timing of life cycle events such as reproduction and longevity vary across organisms and species.</p> <p>2nd Grade: 2. Life Science: 2. Each plant or animal has different structures or behaviors that serve different functions</p> <p>1st Grade: 2. Life Science: 1. Offspring have characteristics that are similar to but not exactly like their parents’ characteristics; 2. An organism is a living thing that has physical characteristics to help it survive.</p>	 <p><i>CaveSim program lead Dave Jackson teaches kids about bat biology in Glenwood Springs, CO. Photo by Chelsea Self, Post Independent.</i></p>



CaveSim program element: Geology	Corresponding CDE standards	Photos of past CaveSim programs
<p><b>Cave Formation:</b> Students learn about how caves and cave formations grow</p> <ul style="list-style-type: none"> <li>• CaveSim staff explain how aqueous cave formations (helictites, soda straws, gypsum) form. Topics covered: water flow is usually downhill due to gravity; sometimes water flows against gravity due to capillary action (examples: water climbing up a towel, water flow inside cave formations). Students expand vocabulary with “capillary action.”</li> <li>• Learn about how cave passage forms. CaveSim staff talk about special bacteria that use enzymes to eat limestone (breaking chemical bonds to get energy). We can also discuss the formation of sinkholes, and the benefits / dangers that they afford humans. Demo available upon request: dissolution of carbonate rocks using weak acid. Discussion of how humans use cave-based resources (e.g., limestone, guano)</li> </ul>	<p>3rd Grade: 3. Earth Systems Science: 1. Earth's materials can be broken down and/or combined into different materials such as rocks, minerals, rock cycle, formation of soil, and sand – some of which are usable resources for human activity.</p> <p>1st Grade: 3. Earth Systems Science: 1. Earth's materials can be compared and classified based on their properties</p>	 <p><i>CaveSim program lead Dave Jackson teaches kids about limestone solubility in weak acid during a demo in Austin, TX. Photo by Austin Parks &amp; Rec staff.</i></p>

CaveSim program element: Squeezebox and Math	Corresponding CDE standards	Photos of past CaveSim programs
<p>We bring an adjustable-height wooden box through which students can crawl to safely test their ability to navigate tight spaces. Students use a tape measure to quantify how tight a space they can move through.</p> <p><u>Space required</u>: typically set up near the stretcher (see above). Any indoor or outdoor setting is fine.</p>		 <p>Students at a 2018 Austin, TX program use a tape measure to quantify their squeezebox skills.</p>
CaveSim program element: Rescue Stretcher	Corresponding CDE standards	Photos of past CaveSim programs
<p>We bring a cave rescue stretcher (Sked) to our programs. Students take turns getting into the stretcher. With the direct supervision of CaveSim staff, the student in the stretcher is carried through and around obstacles by fellow students. Students learn teamwork, communication, and leadership.</p> <p><u>Space required</u>: any indoor or outdoor setting. May be done in classrooms or even hallways.</p>	<p>5th Grade: 3. Emotional and Social Wellness 1. Assess and take responsibility for personal behavior and stress management; 2. Choose to participate cooperatively and productively in group and individual physical activities; 3. Identify personal activity interests and abilities.</p> <p>3rd Grade PE: 1. Movement Competence and Understanding: 1. Demonstrate a variety of motor patterns in simple combinations while participating in activities, games, and sports; 2. Perform movements that engage the brain to facilitate learning.</p> <p>3rd Grade PE: 3. Emotional and Social Wellness: 1. Demonstrate positive social behaviors during class</p>	 <p>With direct supervision from CaveSim staff, a team of kids gets ready to lift and carry a friend in the stretcher.</p>

**The value of education:** As an inventor and educator, Dave encourages students to study hard, find their passion, and understand that education is very important in life. During each program, Dave uses his personal story (including getting multiple degrees from MIT) to teach students that education leads to great success and adventure.



*Keynote presentation in Lake George, CO.*

## **Labs**

Standard programs (above) can be enhanced by adding our labs. Labs provide an in-depth educational experience in a specific subject, like biology or engineering. We never use kits because our goal is to teach students that engineering and science projects are accessible to them without the use of pre-prepared materials. We emphasize conservation by using post-consumer recyclable materials in our engineering labs. Labs require extra funding for materials and staff time. Contact us for pricing.

**Engineering Lab:** Students create circuits using LEDs, switches, batteries, and other components to create an LED light system. They get hands-on experience with soldering (with supervision from CaveSim staff), and then design and make their own caving flashlight enclosure from recyclable materials. After creating their lights, students test their work in water to see if their lights are waterproof. Students have the chance to revise their designs if needed.

**Subjects covered:** Electromagnetics, product design, material science, and mechanical engineering.

**Recommended time:** 55 to 90 minutes.    **Recommended class size:** Up to 25 students.    **Recommended grade levels:** 5th grade and up



*Above, students work on the Engineering Lab*

**Biota Lab:** Students culture cave biota in Petri dishes, and learn that single-celled organisms can demonstrate intelligence. Students choose from multiple experiments, and discuss the factors that impact the outcome of their experiments.

Subjects covered: Experiment design, scientific method, and biology concepts.

Recommended lab time: 30 to 45 minutes, with a follow-up on a second day (with or without CaveSim staff present).

Recommended class size: Up to 30 students.

Recommended grade levels: 4th grade and up.

*High school students at a two-day program in Oklahoma get ready to inoculate their Petri dishes.*





**Karst Lab:** Students make karst topography (cave landforms) with safe household materials. Students learn hydrology, geology, chemistry, landforms, states of matter.

Recommended lab time: 30-40 minutes.

Recommended class size: Up to 30 students.

Recommended grade levels: Spring-semester 3rd grade and up.

**Formation Lab:** Students make cave formations (e.g., stalactites) using safe household materials. We also do exciting demonstrations with the safe chemical sodium acetate (from reusable heat packs). Students learn hydrology, geology, basic chemistry, states of matter.

Recommended lab time: 30-40 minutes.

Recommended class size: Up to 30 students.

Recommended grade levels: 2nd grade and up.



*Above, 5th graders in Colorado work on the Karst Lab*

**Waves and Energy Lab:** After watching a demo with real cave rescue phones, students make their own version using cups and string. Students conduct several experiments with their phones and record their observations. Students learn about waves, energy, and graphing.

Recommended lab time: 30-40 minutes.

Recommended class size: Up to 30 students.

Recommended grade levels: 2nd grade and up.

**Geology Lab:** Using small collections of rocks, students conduct geologic tests including hardness, solubility, density, and magnetism. Students record findings on a worksheet and compare results with classmates to gain an understanding of the three major rock types, geologic classification, soil formation, etc. Students learn about the many ways in which humans use rocks and minerals in our everyday lives.

Recommended lab time: 30 minutes.

Recommended class size: Up to 50 students (two simultaneous classrooms).

Recommended grade levels: 2nd grade and up.

**States of Matter and Chemical Reactions:** Students watch several safe combustion demos with carbide lamps to learn about chemical and exothermic reactions, states of matter, pressure, and other physical science concepts. Students conduct several experiments with vinegar, water, and powdered laundry detergents. Students record observations on a worksheet and compare with the class. Allergy accommodation: if students have concerns about contact with laundry soap, please let us know and we will provide Latex-free gloves for those students.

Recommended lab time: 30 minutes.

Recommended class size: Up to 50 students (two simultaneous classrooms).

Recommended grade levels: 4th grade and up.

**Bat Science:** Students learn about a disease that is killing millions of bats, but which does not hurt humans at all. Using fluorescent dye in test tubes, students role-play bats and learn about how diseases spread among animal populations. As a group, we graph the results of the game to learn about the basics of graphing. Students also get to see an exclusive interview that CaveSim staff did with a bat rehabilitation expert.

Recommended lab time: 30 minutes.

Recommended class size: Up to 25 students.

Recommended grade levels: 4th grade and up.

**Cave Art:** Students use charred wood and water to make a simple, safe paint. Students then use the Bernoulli principle to blow their paint onto paper with straws. Students use their hands or stencils to make art the way that prehistoric people did.

Recommended lab time: 30 minutes.

Recommended class size: Up to 25 students.

Recommended grade levels: 2nd grade and up.

## **Pricing and FAQ**

**How much do programs cost?** This depends on factors like travel distance, number of days, and number of students. Our average price is \$1658/day plus transportation costs, and includes everything except labs. Please contact us for a quote.

**Are deposits or contracts required?** No. We will reserve your program date(s) once we agree on a price and you send us an email stating that you want us to visit your school at the agreed-upon price.

**How are payments made?** By check, made out to CaveSim LLC, as specified on the invoice that we'll email you. W9 available upon request.

**Does CaveSim carry insurance?** Yes. Once you commit to working with us, please let us know if you need a Certificate of Additionally Insured.

**Are permission slips required?** Yes. Paperless and printable versions in both English and Spanish are available: [www.cavesim.com/waiver](http://www.cavesim.com/waiver).

**How much space is needed? Is power required?** See [www.cavesim.com/pages/site-logistics](http://www.cavesim.com/pages/site-logistics)

**Is this an outdoor activity?** Typically yes. The cave stays inside the trailer (we don't move it into your school). Some activities can be moved inside in inclement weather (the tower can be moved indoors if you have 13+ foot ceilings in some part of your school). In light to moderate rain/snow, we put up tents to protect students and the cave.

**Is the cave heated and air conditioned?** Yes. Please provide access to 1 working 20A outlet in summer, and 2 outlets (15A and 20A) in winter.

**How much setup and takedown time are needed?** Typically 1.5 hours for setup, and 1 hour for takedown.

**Does CaveSim do multi-day programs?** Yes. We have done as many as six days in one school district.

*How many students can participate in a day?* For elementary, 150-200. For MS/HS, 100-150. Educational value and number of students are inversely related. We're excited about working with you to size your groups for the best possible educational experience.

Contact us: Email [jacksondmit@cavesim.com](mailto:jacksondmit@cavesim.com) or call 914-330-7824.

### COVID-19 precautions

We are quite cautious about SARS-CoV-2, and we take numerous steps to protect everyone involved in our programs:

- All staff wear N-95 masks at all times during our programs.
- Some staff have already been vaccinated.
- We decontaminate the cave after each day of program.
- We continuously ventilate the cave with an HVAC system on the roof of the trailer
- Between groups, we open large doors on the trailer and use portable fans to replace the air in the cave with fresh outdoor air.
- We use an ultraviolet decontamination lamp and sanitizing wipes to clean high-touch surfaces such as helmets.
- We are developing an in-cave UVC decontamination system which will be deployed soon.
- We make hand sanitizer available to everyone.

If you have any questions or concerns about any of these steps, or would like to ask us to take additional precautions, please contact us.

### Safety and special needs

Teachers/staff can explore the cave, and students with special needs (physical or otherwise) may be assisted by school staff, students, and/or CaveSim staff. While each student is different, numerous wheelchair-bound students have explored CaveSim. Some students may have more difficulty avoiding cave formations, and our only requirement is that each student understand their goal of not touching the formations (for the safety of the system and students). Students who are unable to understand the careful-caving goal may participate in our other activities. CaveSim has cameras for checking on students as they explore. We have five access points to let participants out of the trailer if needed.

We follow the [BSA's Youth Protection](#) policy, which includes no 1:1 student/adult interaction.

### Challenge by Choice

Most students love exploring CaveSim. Occasionally we have a student who is unsure, uncomfortable, or afraid. We encourage him/her to set a goal for themselves and see if they can attain that goal. We teach Challenge by Choice, and have plenty of activities for students to try.

### Classroom management

We've been doing our programs since 2010, and our staff includes former classroom teachers, so we have a good handle on classroom management. Because we spent over two years creating CaveSim, we set expectations at the start of the program: we expect students to respect the equipment and everyone involved in the program. We rarely experience discipline problems, but when we do we ask students to either change their behavior or take a break from the activity until they are ready to participate properly. Our goal is to work as a team with you, so please feel free to communicate with us about any issues that you foresee.