

CaveSim suggested answers for The NEA Foundation's "Student Achievement Grant"

by Dave Jackson, CaveSim LLC

The NEA Foundation offers grants of \$2000 and \$5000. As shown on [this NEA page](#),
"Educators frequently need outside funding for classroom resources. With our Student Success grants, NEA members are helping students learn how to think critically and solve problems. The NEA Foundation has successfully provided funding to thousands of educators to enable them to take the lead on a wide range of projects to improve student learning."

The NEA Foundation has a nice list of Frequently Asked Questions on [this NEA FAQ page](#), and we see that they prioritize projects that help students with STEM subjects:

"We give funding preference to projects that incorporate STEM and/or global learning. The NEA Foundation also strongly encourages Education Support Professionals to apply for funding in any area."

CaveSim (www.cavesim.com) is strongly focused on STEM education, so be sure to emphasize this in your grant application. Also, you might want an "Education Support Professional" at your school to apply for the grant so that the NEA looks more favorably on the application.

The pages that follow have been copied from [the NEA Application Instructions page](#). They use several different fonts and colors, and we (CaveSim staff) use highlighted text to show you some suggested answers to some of the questions. Here's a key to our highlighting:

Black text in yellow highlighting is a suggested written by CaveSim staff

Red text in yellow highlighting [with square braces] is text that you're supposed to replace with your own data. Here's an example: [school name]

Black italic text in green highlighting is some commentary from CaveSim staff. The commentary is meant to help you answer a question but should be deleted before submitting the application.

It may help you to refer to the CaveSim standards alignment documents. We don't have documents for all states, but we have up-to-date alignment for [Arkansas](#), [Colorado](#), [Oklahoma](#), and [Texas](#). Click your state, and on the page that comes up, click the link for your school type (Elementary, Middle, or High School). A pdf with alignment info will open in a new browser tab.

At CaveSim, we're not grant writing experts, but we are here to help. Reach out any time: jacksondmit@cavesim.com or 914-330-7824. Thank you for working with us!

Sincerely,

Dave Jackson, inventor and lead educator, CaveSim LLC

Below, you'll find descriptions of every component of the Student Achievement grant application. To ensure that your proposal qualifies for review, make sure that you complete all required fields.

Lead Applicant

The lead applicant will be the NEA Foundation's contact person for award notification, reporting, publicity, and other grant-related activities.

Administrators may not serve as either the lead or partner applicant. Applications missing lead applicant data will not be considered. The lead applicant must be a current member of the National Education Association.

*On the FAQ page we see that any teacher, counselor, or "Education support professional" who is an NEA member can apply. "Education support professionals include: para-educators, school bus drivers, maintenance and custodial staff, food services staff, school nurses and student services workers, clerical and office assistants, school security officers, and technicians." Note that principals and assistant principals are **not** allowed to apply.*

Partner Data

All proposals must include partner information. The partner should be prepared to assume leadership of the project should the lead applicant be unable to complete the work.

Administrators may not serve as either the lead or partner applicant. Applications without partner data will not be considered. The partner applicant must be a current member of the National Education Association.

On the FAQ page we see that, "...the educators assigned as the lead and partner must be NEA members, [but] non-members can certainly take part in the project."

Fiscal Sponsor

The Fiscal Sponsor is most likely just your school.

If you want to have a fiscal sponsor for your grant funds, enter the fiscal sponsor information in this section. Some of the information may already be entered from your registration information.

If you are not designating a fiscal sponsor, the information in this section should be that of the lead applicant. In this instance, grant funds will be made payable to the lead applicant and reported to the Internal Revenue Service. The grant funds may be

considered taxable income, so the lead applicant may wish to consult with his or her tax advisor before submitting the application.

View our [About Fiscal Sponsors](#) page for more information on fiscal sponsor designation.

Narrative

SUMMARY

In 100 words or fewer, give a summary of the project you're proposing. Write in a way that you'd feel comfortable with the NEA Foundation sharing on our website to describe your project. (For examples of how to write a summary, please view our [Grantee Archive](#) for descriptions of our recently funded grants.)

Important note: please remember to do a word count on this section to ensure that you have 100 words or fewer. This is the only section with a word count restriction.

[school name] students will learn STEM by studying caves. They will design and build waterproof caving flashlights. To learn chemistry, students will observe carbide lamp experiments. Students will ascend a 12' vertical caving tower to learn physics, and explore a CaveSim mobile cave brought to [school name]. While exploring 60' of tunnels, students will try to avoid touching formations (stalactites). If students touch a formation, artifact, or critter, sensors give the students feedback. The inventor will show students how skills learned at MIT were used to create CaveSim. The exciting subject of caves will get students excited about STEM careers.

GOALS

Describe your project. What are your goals for student learning? How will you measure outcomes? Be sure to include the standards with which you will be linking your work.

Our project has several goals. First and foremost, we want our students to gain a new appreciation for how important education is to their long-term success. By giving our students the opportunity to meet the inventor of CaveSim, and by allowing the students to have exciting experiences with several of this inventor's inventions, our goal is for the students to have insights about the things that they could do with their own education. We want our students to understand that no matter what they are passionate about, they can take what they learn in school (in all their subjects) and apply it to their passion to improve the world around them. In order to measure outcomes of this goal, we will have students reflect (in writing) on the skills required to be an inventor, and on what positive changes they would like to make in the world.

Another goal of our project is for students to gain first-hand experience with invention and product design. By allowing our students to design finished products from scratch (i.e., without using kits), our aim is to demystify the inventive process, and help students feel empowered to

create. Additionally, we want students to gain increased confidence in the safe use of tools. We will gauge the outcomes of these goals by having students reflect (both before and after the design process) on the types of tools and skills needed to design a working product.

A third goal is for our students to learn important core curriculum in a memorable way. We would like our students to learn concepts about chemical reactions, waves, geology, biology, simple machines, and measurement skills. Our project will address *[name of standards, e.g., "Oklahoma SDE" or "Texas TEKS" or "Colorado CDE"]* standards in *[list the general categories of standards that we will address. For example, "3rd through 5th grade standards in Life Science, Earth Systems Science, Physical Science, and Math"]*. We have provided more detailed standards alignment information in the "Activities" section below. A pre- and post-assessment will be used to determine what our students have learned from the various activities.

Our final goal is for the students to have fun while being physically active and learning. We would like to remind our students that learning is enjoyable, especially if approached creatively. After the program, we will ask students to talk about their favorite parts of the experience so that we can assess how successful we were with this goal. As an additional note, we will be addressing *[list PE standards here. For Oklahoma: "Physical Education S5: Recognize the value of physical activity for health, enjoyment, challenge, self-expression and/or social interaction."]*

NEED

What are the student needs for this project? Prioritize academic need, but you should describe sociological, economic, emotional, and/or cultural issues as well.

What follows is just an idea for what you might write. You may find that what we've written is way off for your school, in which case you should feel free to throw out what we've written and start again.

[school name] is a diverse school in many different respects. One way in which our students are diverse is in their academic rigor. Some students are driven to work hard and succeed in school, while other students struggle to find meaning in their academic work. Our project is designed to give all of our students a wide variety of hands-on experiences that will help them get excited about school, and help them to see that learning can be fun and worthwhile. We also want our students to get hands-on experience with a variety of different engineering tools (both mechanical and electronic) to help them better understand STEM fields. Quite a few of the students at *[school name]* come from working class families, and they sometimes have a hard time seeing the connection between academic work and the work that their parents do (one of our major industries is *[name of industry]*). These students desperately need to see the connection between school and working life in order to stay motivated.

Our school is also diverse in terms of the cultural and ethnic backgrounds of our students. A significant portion of our students are *[name of ethnic group, followed by a description of what this ethnic group needs. For example, you might say, "A significant portion of our students are*

Native American. We believe that it is important for these students to value their Native American heritage, and we are excited that we've come up with a project that will teach all our students about the importance of preserving Native American art found in caves. Similarly, we have a significant number of students from the Pacific Islands. By showing students cave art from around the world, our project will help all our students to see similarities in ancient art from around the globe. This will help our students feel more connected with people from different cultures, which we feel is important in our community.”]

Some of our students struggle with self-confidence, and we feel that they need the opportunity to face and overcome some personal challenges. Our project will address this need by giving students a wide variety of challenges to overcome (from exploring an artificial cave, to being lifted up a 12' A-frame, to riding in a cave rescue stretcher). We're excited about using a Challenge By Choice approach to help our students set manageable goals of varying difficulties, and we will work with our students to help them see that they can gain confidence by working toward their goals.

ACTIVITIES

What activities will you and your students engage in to reach your goals? In this description, address how the activities will engage students in critical thinking and problem solving.

Our project is a collaboration between the teachers at our school and staff from CaveSim. We will have CaveSim bring a mobile cave and other hands-on activities to [school name] from their home base in Colorado. CaveSim has been doing programs in [your state] since [year; for Oklahoma, the answer is 2016; for Texas, the answer is 2013; for Colorado, the answer is 2010], and during CaveSim's visit to our school we will divide students into groups of about half a class so that they can rotate through four stations. CaveSim staff will collaborate with us on three of the four stations, and parent volunteers will help with the fourth station.

At the first station, students will put on helmets with working lights in order to crawl and climb through 60' of artificial cave tunnels in the 26' CaveSim trailer. The students will try not to touch cave formations (e.g., stalactites), artifacts, or critters (e.g., invertebrates, salamanders, and bats). All the objects are artificial, and each object contains an embedded electronic sensor. If a student touches a formation, artifact, or critter, the student will hear a beep and a recorded lesson about the object. After students exit the cave, they will view their careful-caving score on a computer. The inventor of the system will facilitate this station, and will talk with the students about the process used to write the scoring software, create the electronic sensor network, build the structure, and create the formations and other objects. The inventor will also talk with the students about what they saw in the cave, and teach lessons about the science, history, and art behind each object. For example, students may report seeing a cave painting or a piece of pottery, and the inventor will share first-hand experiences seeing indigenous artifacts in order to teach the students about Central American indigenous culture. As part of this lesson, students will learn about the importance of artifact conservation. As

another example, students may say that they saw a bat in the cave, and the inventor will teach the group about bat habits and habitats. The inventor and the other CaveSim staff will use the Socratic method to help students think through each of the mini-lessons. At this station, the following standards will be covered: *[look at the CaveSim standards alignment document, and copy/paste the standards addressed by Horizontal Cave Exploration (typically on page 3 of the alignment documents). For Oklahoma elementary school programs, see <https://cdn.shopify.com/s/files/1/0305/6321/files/CaveSimProgramsForOklahomaElementarySchools.pdf?85>. The Oklahoma elementary standards that we cover with this activity are: Sci 5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment; Sci 5-LS2-1: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment; Sci 5-LS2-2: Use models to explain factors that upset the stability of local ecosystems; Sci 3-LS1-1: Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.]* Some of our students have physical and developmental disabilities *[delete this sentence if untrue]*, and the CaveSim cave has accommodations which will allow these students to explore like other students.

At a second station, students will put on helmets to take turns being lifted in a harness up a 12' A-frame (which CaveSim will bring to the program). A CaveSim staff member will run this activity with help from a teacher, and the students will get the chance to try different pulley systems, each one affording a different mechanical advantage. Students will learn about simple machines, forces, friction, and multiplication/division. The CaveSim staff member will also tell students about her experiences exploring some of the world's deepest caves. By having a woman cave explorer teach the students about vertical cave exploration, we will help the students at our school understand that exploration is equally open to women and men. At this station, we will address the following standards: *[look again at the CaveSim standards alignment document, and copy/paste the standards addressed by Vertical Cave Exploration (typically on page 4 of the alignment documents). Sci 5-PS2-1: Support an argument that the gravitational force exerted by the Earth is directed down; Math 4.N.1: Solve real-world and mathematical problems using multiplication and division; Sci 3-PS2-1: Plan and conduct investigations on the effects of balanced and unbalanced forces on the motion of an object.]* Like the cave trailer, the vertical caving activity is accessible to students with physical and/or developmental disabilities.

At a third station, a CaveSim staff member will help our students practice teamwork and communication by doing activities with a real cave rescue stretcher. Students will take turns riding in the stretcher while being carried by staff and other students. The students will work together to move the stretcher in various directions, and they will have the chance to take turns directing the movements of the other students. At this station, the students will also get to try moving through a "crawlbox", which is an adjustable-height box that CaveSim will bring to the program. Students will use a tape measure to quantify how small a space they can fit through. At this station, we will cover the following standards: *[look again at the CaveSim standards alignment document for your state and type of school (ES, MS, HS), and copy/paste the standards addressed by Squeezebox And Math and Rescue Stretcher (typically on pages 9*

and 10 of the alignment documents). For Oklahoma, we address these standards: Math 5.N.3: Add and subtract fractions with like and unlike denominators, mixed numbers and decimals to solve real-world and mathematical problems; Math 3.N.3: Understand meanings and uses of fractions in real-world and mathematical situations. Physical Education S4.E4 Working with Others.] Like the previous activities, this station is accessible to students with physical and/or developmental disabilities.

At the fourth station, students will learn about bat biology, bat migration, and the ways that bats help humans. Students will play two games facilitated by parent volunteers. The first game will be a special form of tag in which students use their voices as a proxy for a bat's echolocation to locate (and tag) a prey species (other students). In the second game, students will read printed cards located along a fence to roleplay migratory bats. Students will use dice to determine how to move through the game. Students will find that they don't survive in some rounds of the game, and they will learn about the dangers that bats face, both from humans and from the natural environment. These two games will address the following standards: [look again at the CaveSim standards alignment document for your state and type of school (ES, MS, HS), and copy/paste the standards addressed by "Bat games and lessons" (typically on page 7 of the alignment documents). For Oklahoma, we address these standards: Sci 4-LS1-2: Use a model to describe that animals' receive different types of information through their senses, process the information in their brain, and respond to the information in different ways; Sci 1-LS1-1: Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs; Sci 3-LS4-3: Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all; Sci 1-ESS3-1: Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment; Sci K-LS1-1: Use observations to describe patterns of what plants and animals (including humans) need to survive.]

All students will get to participate in all stations, and in between the rotations the CaveSim staff will do demonstrations with all groups together.

In one demonstration, CaveSim staff will use working cave rescue telephones to teach electromagnetics concepts. Students will be able to see their voices on a screen (oscilloscope) to learn about the types of equipment that engineers (like the CaveSim inventor) use to design and test circuits. CaveSim staff will talk about electromagnetic waves, and will use homemade waterproof speakers to show students that electromagnetic waves can be converted to mechanical waves (sound). Students will be able to see waves produced by the speakers, and they'll see that the waves can move a floating object across the surface of the water. By using homemade speakers (instead of store-bought), CaveSim staff will be able to emphasize how easy it is for students to make their own technology with hardware store materials. This activity will cover the following standards: [look again at the CaveSim standards alignment document for your state and type of school (ES, MS, HS), and copy/paste the standards addressed by "Cave Rescue Phones" (typically on page 6 of the alignment documents). For Oklahoma, we address these standards: Sci 4-PS4-1: Develop a model of waves to describe

patterns in terms of amplitude and wavelength and to show that waves can cause objects to move; Math 2.D.1.4: Draw conclusions and make predictions from information in a graph.]

Another whole-group demonstration will be done with working carbide lamps. CaveSim staff will talk about experiment safety, and will show students calcium carbide. Staff will then place carbide and water in separate compartments of an old carbide lamp, which will allow the two ingredients to mix slowly, producing acetylene gas. A candle-sized flame will then be lit to show students that the solid and liquid reacted to produce a flammable gas. Students will be able to feel warmth at the base of the lamp where the reaction occurred, which will help them to understand the concept of an exothermic reaction. A second demonstration will be done using a laboratory-grade version of the lamp, which will allow us to teach students about conservation of mass (using a digital gram balance). Staff will wrap up the demonstration with a discussion about fire safety. This activity will cover the following standards: *[look again at the CaveSim standards alignment document for your state and type of school (ES, MS, HS), and copy/paste the standards addressed by “Cave Rescue Phones” (typically on page 6 of the alignment documents). For Oklahoma, we address these standards: Sci 5-PS1-4: Conduct an investigation to determine whether the mixing of two or more substances results in new substances; Sci 5-PS1-2: Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.]*

Other demonstrations will include lessons about bats (with a real bat skeleton and real bat guano in sealed containers), geology (with the application of a weak acid to carbonate and non-carbonate rocks, and the physics of friction (CaveSim staff will use the friction between two Nylon ropes to slice through one of the two ropes in about 15 seconds).

The activities and demonstrations described above are just one part of our project. We also want our students to learn by doing several hands-on labs.

Our first lab will be for the 5th grade students, and will allow them to make their own waterproof flashlights. With 1:1 supervision from CaveSim staff, students will solder a basic circuit (using a battery pack, LED, switch, and wire). All components will be certified Lead Free. After making their circuit, students will design a waterproof enclosure for their light. The design will start on paper, and then students will use recyclable bottles and other scrap materials to build their design. With 1:1 supervision from teachers and CaveSim staff, students will use tools like drills, saws, and hot glue. The students will then test their designs in a bucket of muddy cave water. If their designs leak, they will have the chance to refine their design. The project will conclude with having the students write their reflections about the project, including ideas for how they could further improve their design.

Our second lab will be for 4th grade students, who will use safe household materials (like sugar and sand) to design models of cave landscape in paper cups. The students will add water around the outside of their cups (to represent groundwater), which will quickly dissolve the sugar in their cave landscape models. Sinkholes will form, and we will use the Socratic method

to help students understand the chemistry behind their experiments, and also to help them understand why humans need to be aware of the hazards of building on karst (cave landforms). CaveSim staff will use a large-scale version of the sinkhole experiment (with a garden hose) to show students how the dissolution of carbonate rocks causes the formation of sinkholes.

Our third lab will be for 3rd grade students, and they will make cave formations (like stalactites) using safe household materials like baking soda and water. Students will practice following written directions, and will work in pairs to practice teamwork. After the experiments are finished, students will observe that different groups have different outcomes, and we will talk about variability in the scientific process. Students will learn that oil from their hands may have altered some experiments.

All the activities described above will occur over a three-day period, and we will wrap up our program by inviting the CaveSim inventor to talk about how education played a vital role in his ability to develop CaveSim. For the benefit of our visual learners, the inventor will show a variety of objects that he used to build the mobile cave and the climbing A-frame. Each object is labeled with a school subject, and students will get to see that every single school subject was used in the making of CaveSim. The CaveSim inventor will encourage our students to work hard in school in preparation for designing their own amazing careers in STEM or other fields.

SUSTAINABILITY

Describe how this project will be sustained beyond the grant period and/or how it provides a model that can be used by other educators.

We would like to collaborate with CaveSim by having them return to our school each year, with different students participating during each program so that we can create an entire generation of students who appreciate STEAM subjects and environmental conservation more thoroughly. In order to do this, we need to show *[district name]* district-level staff and community members that this program is worth funding. Our goal is to use an NEA Foundation funded program this year to show the stakeholders in our community that this program is worthy of long-term funding. Toward that end, *[lead applicant name]* and *[partner applicant name]* will take pictures and video during the activities and labs, and we will collect student and teacher quotes to use in future grant applications. I will also invite key community stakeholders to the program, including *[list some relevant people, like principals, superintendents, education foundation board members, the PTO chairperson. Specific names aren't needed, just a list of positions]*. We will use the data that we gather to apply for funding from *[list some possibly funding sources like a local education foundation, district-level funding, the name of a specific big local business, DonorsChoose, etc.]* in subsequent years.

BUDGET

Provide a line item budget for the proposed work. Your request must total either \$2,000 or \$5,000. Identify any additional support (cash or in-kind) from other sources, including

that provided by your school/district/college/university. Your budget must be in the form of a Word, Excel, or PDF document.

The NEA Foundation suggests that your budget be as cost-efficient as possible. Please ensure that all items are directly related to your proposed work, as your budget will be assessed by how realistic, clear, and frugal it is.

It's easy for us to write a detailed budget for you. Let's talk about exactly what you want to see (number of days, number of students, number of labs, number of staff, etc.), and then we can write you a budget. Thanks!

SELECTION CRITERIA

- Proposed goals for student achievement are challenging and rigorous
- Proposed work engages students in critical thinking and problem solving
- There is alignment between goals, assessment, activities, and budget
- The project is collaborative and can be sustained in future years and/or adopted by other educators