How to Present a

Rock-it Science Lesson

Note: All activities in this document should be performed with adult supervision. Likewise, common sense and care are essential to the conduct of any and all activities, whether described in this document or otherwise. Parents or guardians should supervise children. Rock-it Science assumes no responsibility for any injuries or damages arising from any activities.

Contents:

About our Teacher Support Videos

Rock-it Science Teacher Support Lesson Videos are for *individual viewing only.* They may not be shown publicly or in a classroom. The video is provided solely for the teacher's reference in preparing to present a Rock-it Science Lesson. Most lessons last about an hour, but the edited videos are shorter.

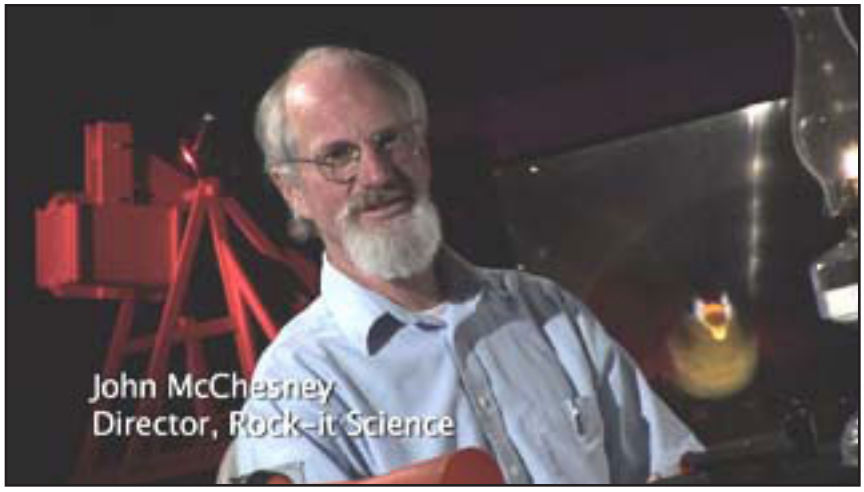
Most of our lessons were videotaped during actual Rock-it Science classes at our laboratory classroom with real students, not actors. These are very rough "behind the scenes" videos, originally intended for staff use only, not for public viewing. The lessons are unscripted and unrehearsed, and they were not staged for the camera. As a result, there's often shaky camera work, uneven audio levels, extraneous noises, and unexpected behavior from the students.

We ask our students to be reasonably quiet and attentive while the Teacher is speaking. However, we know that during the experiment itself, the noise level will often rise as the students become more enthusiastic. This is part of the Rock-it Science method, and we welcome their exuberance, as long as they follow instructions and observe safety rules.

Many of our lessons use materials that are inexpensive and readily available. Occasionally, a lesson may include a one-of-a-kind apparatus that we constructed ourselves or use supplies that are harder to come by. If you have questions about items used, please submit your question to the online **Teacher Support Forum** on our web site so everyone can benefit from the answer.

Rock-it Science
2110 Walsh Ave, Unit F
Santa Clara, CA 95050
www.rockitscience.org

Our Unique Science and Storytelling Methodology



"Children need a non-judgmental, fun place to have science. As soon as you start testing them on stuff and making them memorize vocabulary words and take data, and go through all the stuff that they need when they're in high school, that ruins it for the elementary school kids.

Elementary school kids are just interested in 'what's going to happen?' They don't care yet 'how much' it's going to happen. If they get into how much it's going to happen, that's great. If it's a contest of some sort, fine. But we don't want them taking data.

I developed my first lesson combining science and storytelling for my daughter's second grade class back in 1986. Since then, I've refined this method with thousands of students. The result is a tried and tested technique that stimulates children's natural creative problem-solving abilities and helps them remember what they've learned.

Most of the science teachers I've talked to will start off with a scientific concept, find some sort of a demo or an experiment that relates to it, and give that to the students. But when I'm creating a new lesson, I start out by experimenting with all sorts of activities that children enjoy doing. Then I try to find the science behind it and create a story that illustrates the science. So our method is pretty much backwards. And it seems to work really well because the kids enjoy what they're doing and they learn science while they're doing it. And most of the time, they aren't really even aware that they're learning a bunch of science.

We don't want a teacher to go in there and tell them, 'This is what's going to happen.' That's the kiss of death. What we want them to do is go in and say, 'We don't know what's going to happen. You're going to experiment and find out for yourself.' So it's fun because the students are on an adventure, and they're sharing ideas with each other, and they're getting to do something that they would ordinarily have no chance at all to do."

-- John McChesney, Director
Rock-it Science

The Seven Secrets of Rock-it Science

1. ***Learning with the Whole Mind***
   Children learn best when they engage their whole mind -- the visual, creative right brain, as well as the linear, analytical left brain. Rock-it Science lessons are carefully designed to appeal to children's natural creativity and imagination and to provide a whole-mind foundation that supports their regular science lessons.
2. ***A Stress-Free Environment***
   We provide a stress-free environment, with no note-taking, memorizing, homework, or tests. We make science fun, so children will become confident and excited about learning science.
3. ***The Power of Storytelling***
   Each Rock-it Science lesson introduces a scientific concept through a zany humorous fairytale involving Jack, Jill, and The Evil Mr. Fred. Kids are encouraged to think creatively and suggest possible endings for the story. There are no wrong answers, so each child's contribution is valued, boosting their self-esteem.
4. ***Hands-On Experimentation***
   Each child gets to personally manipulate objects and materials and watch how they bounce, light up, dissolve, fly, break, disappear or do other strange and wonderful things. It's not just a whole-mind experience -- it's a whole-body experience!

5. ***Observation without Expectation***
   When you don't tell kids what they're "supposed" to observe, they notice all kinds of things. So we don't tell them what the result is supposed to be -- we just give them some materials and general instructions and let them try things out and observe what happens (the first step in the scientific method).
6. ***The Joy of Discovery***
   In a Rock-it Science lesson, children get to try things out, make mistakes, make corrections, and discover how to solve problems. They don't just reproduce something that some scientist has previously discovered -- they experience the joy of discovery for themselves!
7. ***The Magic of Memory***
   Anything that triggers a child's memory of the story will also help them remember the scientific principle, and their classroom teacher or home school parent can use this later to reinforce their regular lessons. The children are also more likely to remember what they've learned, not because they've memorized it, but because they've personally discovered and experienced it!

What's Different about Rock-it Science Lessons

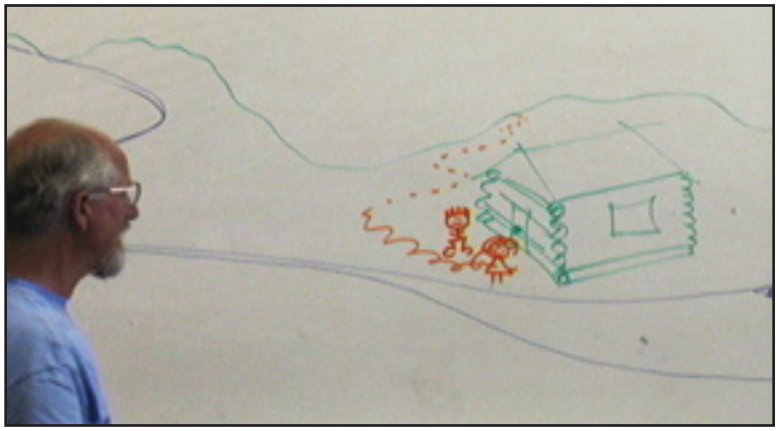
1. ***We don't teach concepts, vocabulary, and facts.*** We provide problems to solve, hidden in crazy cliff-hanger stories, and we let the students develop their own concepts, vocabularies, and facts. Students are not allowed to take notes, and there's no memorization.
2. ***We don't collect, calculate, or tabulate numbers.*** We let the students observe the experiments, and experiment with the experiments, so that they can discover what is happening.
3. ***We keep secrets.*** We don't tell the students what's going to happen in the experiments… we let them discover that for themselves.
4. ***We don't use kits or "cookbook science."*** Our experiments leave room for unexpected results and surprising discoveries.
5. ***We don't deal with real-world problems.*** Through storytelling, we create an imaginary world where the "Acme Store of Everything" allows access to anything the student may want to use. We provide conflict through Jack and Jill against the Evil Mister Fred. And we have experiments where anything can happen.

6. ***We are not serious about science.*** For instance, we might say, "Hot air rises so I'm going to build a swimming pool on the top of Mount Everest where all the hot air collects." Through the magic of humor, we let the students relax and try to figure things out for themselves.
7. ***We encourage cheating.*** If the students see someone else doing something they like, they are free to copy them to see what happens. This is what real engineers do.
8. ***We don't encourage students to work independently.*** That's too easy. We want students to learn how to work with others by hashing out some sort of compromise and completing the experiment together.
9. ***We encourage students to fail.*** A one-shot single experiment that works perfectly is nearly worthless. When students try different ideas before they achieve success, they will learn much more and will appreciate the work they did to make it work.

! ***Don't tell students what's "supposed" to happen. Let them discover it for themselves.***

The Structure of the Lesson

DO NOT allow students to watch the video. Our experience shows that this tends to make them lose interest and become restless. The personal interaction between teacher and students keeps them engaged and allows the teacher to make sure the students are following the lesson. The video is *only* for the Teacher's reference in preparing the lesson.



The teacher always tells the story "live." Students *never* see the video.

The Introduction:

The lesson begins with a brief introduction to the topic, just enough to give students a general idea of what the lesson will be about and introduce a few scientific principles in an entertaining way. If this is their first Rock-it Science lesson, tell the students to put away all pencils and papers, and let them know they won't need to take notes or memorize anything.

> ! ***The teacher always presents the lesson and tells the story "live."***

The Story:

When students walk into our classroom, they're coming from all different situations. Who knows where they've been and what they want to talk to their friends about. We have to focus their attention on the lesson for the day, so we tell them a crazy story, a humorous "fractured fairytale." These stories are designed to help students relax and stimulate their creative imagination.

As you tell the story, you'll also illustrate it on the whiteboard with simple stick figure cartoons. The drawings need to be simple enough to draw quickly and keep the story moving. You don't need artistic talent. In fact, the simple style gives students confidence that they themselves could create stories like this if they wanted to.

The Cliffhanger:

The first part of the story always ends with a cliffhanger, where our main characters, Jack and Jill, are in jeopardy. (See *"About Our Stories"* in this document for more information.) *DO NOT* present the ending of the story until *AFTER* students have done the experiment.

Imagination and Brainstorming:

When you get to the cliffhanger, ask the students, "If you were Jack and Jill, what would you do?" Then let them offer solutions for the problem. ***There are no wrong answers!*** The purpose of brainstorming is to stimulate their creative imagination, not to come up with the "correct" answer. The solutions don't

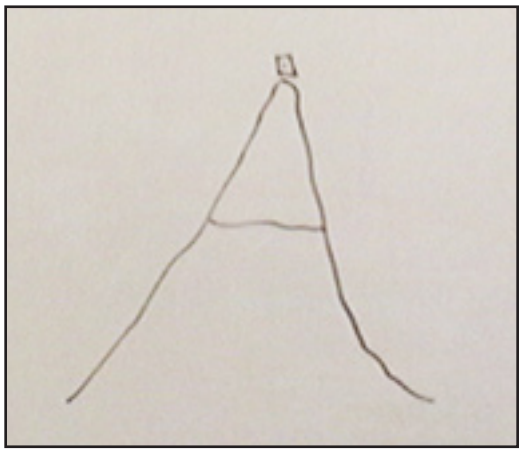
need to be realistic; in fact, the more imaginative they are, the better. This will help them think more creatively during the experiment that follows.

> ! ***During brainstorming, no one criticizes anyone else's idea.***

No one, not even the Teacher, is allowed to criticize anyone's idea. The Teacher gives only positive responses, or at least a non-judgmental acknowledgement such as, "That's an idea," or "They might do that," or simply repeating what the students has said. Don't ask for details or clarification; just accept the suggestion as the student presents it. Every student who has an idea is given a chance to share it, and those who don't are not required to. We don't want students to think they're going to be called on and put on the spot if they don't have an answer. (*Note: The students' brainstorming comments are included on the video, but are not transcribed in the Teacher Guide because they're not part of the lesson presentation.)*

The Acme Store of Everything:

Even in this nonjudgmental environment, sometimes the students don't offer really good answers and really good stories about how to solve the problem that we've presented. So we invented the Acme Store of Everything, where the children can call for absolutely anything they want to solve the problem in the story.



Acme Store of Everything atop Mount Everest

The Acme Store of Everything needed to have some kind of physical form so the students would understand that it exists in some form, but we didn't want it to have too much of a physical appearance. It had to be a kind of imaginary, almost nonexistent thing, so they can use their imagination. So we set the Acme Store of Everything to be in a very inaccessible place: it's on the top of Mount Everest. Thirty thousand feet up, all it is, is a door hovering over the top of Mount Everest. The door has no walls. You can walk all the way around it and all you see is a door. But if you open it, you can look in there and see an enormous cavernous warehouse full of stuff. And there are elves inside with big ears who can hear any request that's made anywhere in the world. The Acme Store of Everything is an anomaly in the space-time continuum. Jack and Jill and even the Evil Mister Fred can make a request of the Acme Store of Everything, and it's instantaneously delivered to them through wormholes.

This presents something the students can really grab onto. They don't know what it really is, and that's the whole idea, that whatever this thing is, everything they want is available to them simply by calling for it. So now the students are empowered to use their imagination, pick out anything they want, ask for it, and kaboom! -- there it is.

After the brainstorming, write *"To be continued"* on the whiteboard and leave the drawings there.

The Experiment:

In most science experiments, students are told what the result of the experiment is supposed to be, and if they get that result, it means they did it right. We do the opposite. We give them some materials and instructions, but we DON'T tell the students how the experiment is supposed to turn out. We want them to experience the thrill of discovery that comes from not knowing what's going to happen until they make it happen. This thrill is what makes children love science and want to do more of it, and this is the ultimate purpose of a Rock-it Science lesson.

For some experiments, students collaborate.

Don't Give Answers: During the experiment, resist the urge to give answers to the students or to explain anything beyond the information provided in the lesson. It's perfectly okay to play dumb. If a child asks, "What will happen if I do this?" just say, "I don't know. Try it." (unless, of course, there's a safety concern).

IMPORTANT: Don't comment on or quiz the students about scientific principles during the experiment, even if they've previously studied those principles in class. Just let them focus on the experiment. Don't worry about what they may or not be learning from it. Later on, during their regular lessons, you can tie in the Rock-it Science experience with their class curriculum.

Encourage Collaboration: Many of our experiments require students to work in groups of two or more. This prepares them for the way real engineers work on design teams. They collaborate, consult with each other, hash out their approach to the problem, discuss their results, notice what other groups are doing, copy their ideas and try them out, etc.

> ! ***Don't comment on or quiz students about scientific principles during the experiment, even if they've previously studied those principles in class.***

Let Gifted Students Fail: Some students, especially high-performing ones, may be reluctant to attempt the hands-on experiment unless they can figure it all out in advance, because they're afraid of failing. Encourage them to try it anyway, reminding them that there's no grade for this lesson. If they don't get the results they expect the first time, this is a good thing. Just let them keep using trial and error and see what happens. They'll learn more this way than if they got the "right" answer on the first try. Even if they don't discover what works, they'll discover what doesn't work, and that's just as important.

Using Equipment Safely: In some experiments, we use hot glue guns or other items that have the potential for an occasional "owie." If the children haven't used these items before, we demonstrate how to use them safely, in a manner that will enable them to keep themselves and others from harm. (For ex-

ample, our web site contains a brief video of students learning how to safely light a match.) In our classes, children as young as age five use glue guns with no problem.

We don't treat students like little children. If they do hurt themselves, we give them "extra points," patch them up, and carry on. If we don't make a big deal of it, they won't either. In fact, students really like the idea of "extra points," and they'll often proudly announce it to the others when they get an owie.

We teach students how to use equipment safely.

The Story Ending:

Don't present the story ending until after the students have completed the hands-on experiment. The solution that Jack and Jill use in the story will have elements of the experiment in it, but don't point those out to the students. Just tell the story. If the students notice the connection, that's fine. But otherwise, when the story ends, the lesson is over. There's no further discussion and especially, *no quizzing about what they've learned or what scientific principles were used in the lesson.*

Followup:

After the Rock-it Science lesson, give the students a day or so to process the experience before discussing it with them. If they want to talk about it amongst themselves, that's fine. In fact, we frequently hear of students discussing the Rock-it Science lesson during lunch or recess.

> ! ***Don't ask students what they learned -- ask them what they LIKED.***

Later, in your regular science classes, you can refer back to the Rock-it Science lesson to reinforce what you're teaching. Instead of asking the students what they learned in the lesson, start out by asking them what they LIKED. If they enjoyed something, they're more likely to remember it.

The benefits of Rock-it Science also carry over to other subjects. In a math class, you might present some calculations based on the Rock-it Science lesson. In language arts, students often enjoy writing their own ending to the crazy story. Many will also want to illustrate it.

The most important thing to remember is to keep the Rock-it Science experience as stress-free as possible. Once the students realize that they can engage in these lessons without worrying about being called on or tested, their enthusiasm will increase, and they'll want to start exploring science on their own, even outside of school. That's when you'll know you've succeeded.

About our Stories

As you become more familiar with the Rock-it Science methodology, you may wish to modify the stories somewhat for your own classes. Students often enjoy helping to craft the story by suggesting things like what a certain bizarre creature should look like, or whether to place the story in outer space or under the sea. This is fine as long as you maintain certain elements common to all of our stories:

Jack and Jill: We don't want our lessons to be gender-specific, so the main characters are two friends named Jack and Jill. Jack and Jill have no definite age, ethnicity, hair color or skin color. The Teacher may draw them with a blue pen one day, a green pen another day, etc. Jack and Jill are always drawn as stick figures as shown in the illustration here, so most of the time there's no specific clothing unless the story requires it (such as a space suit). Jack has short hair that stands straight up. Jill's hair is curly and grows infinitely long and infinitely fast, so it trails off over the horizon. Students really like this, because it allows her hair to be used as a rope, a net, or other handy tool in the context of some stories. At times, Jack and Jill may take the form of animals, trees, etc., but even in those forms, they retain their characteristic hair -- short and spikey for Jack, curly and infinitely long for Jill. Jill is also distantly related to Tarzan, so she can talk to animals and sometimes enlists their aid. Jack and Jill are the good guys. They *never* do evil things.

Jack always has short spikey hair, and Jill's is curly and infinitely long.

> ! ***Jack & Jill have no specific age, ethnicity, hair color or skin color.***

The Evil Mister Fred: Jack and Jill's arch-enemy is The Evil Mister Fred. He wears a black hat and has a long curly mustache. He lives in a castle and often flies around on a Hoover vacuum cleaner. He may also use other means of transport, depending on the story. Like Jack and Jill, he sometimes transforms himself into another kind of creature, but he always has the telltale handlebar mustache. Evil Mister Fred is not an evil genius, but he does come up with sneaky plans to make life difficult for Jack and Jill. His main objective in life is to make everybody else as miserable as possible and to rule the world.

Minions: Evil Mister Fred has minions, small creatures that are simple to draw. The minions always follow his orders and appear in most of the stories. Minions are not very bright, and they often mess things up when they try to carry out Evil Mister Fred's orders. They have no arms, but they have long mustaches that are very strong, so they use them to hold things. Evil Mister Fred can't give them swords because they're so clumsy they would stab each other with them. Their standard weapon is a baseball bat. They can hit each other with a bat and not get hurt very much because they have very hard heads.

Evil Mister Fred and his Minions.

Minions usually don't transform into anything else. They just remain minions.

Kick-Mes: Jack and Jill have companions called Kick-Mes (pronounced "kick-mee"), which are shaped like fat bowling pins with a target on their stomach. They have no arms or legs; they move by bouncing around. A Kick-Me is always sad unless he's being kicked into the air -- then he smiles and giggles. If a Kick-Me gets run over by a steamroller, he pops right back into Kick-Me shape. No matter how much damage is done to a Kick-Me, he always returns to his original form, happy to be kicked, chopped, blown up, etc. all over again. This makes them valuable, and Evil Mister Fred often tries to capture the Kick-Mes so he can sell them. The Kick-Mes don't appear in all of the stories, but they show up occasionally.

No Adult Rescuers: We want the students to identify with Jack and Jill as the heroes who defeat Evil Mister Fred through their own ingenuity. Occasionally, a story will include an adult character, but the adult is never the one who comes to the rescue. It's always Jack and Jill and/or their companions who defeat The Evil Mister Fred.

Jack and Jill have Kick-Mes. The one being kicked in the air is smiling.

! ***Jack & Jill or their friends are the heroes of the stories -- No Adult Rescuers.***

Questions?

If you have a question about our lessons, please ask it on our **Forum** so everyone can benefit from the answer. Thanks!

It Takes a Village

Don't try to do it all yourself. At Rock-it Science, Mr. Mac likes to do the shopping and prep work, present the experiments, tell the stories, draw the pictures, and do the cleanup. But classroom teachers don't have time to do all that. So you need to gather a team. Think of it as planning a party.

There's no rule that says one person has to present the lesson alone. For example:

- You could have someone with theatrical experience be the storyteller.
- Someone who likes art could do the drawings.
- Someone else could do the demonstrations.
- Someone else could present and oversee the experiment.
- Someone else could pass out the supplies and help with the cleanup.
- Find someone who loves shopping to go out and find the supplies at the best price or search the internet for them.
- Get some other volunteers to count out the pieces needed for each class and do any preliminary assembly that may be needed.
- Get someone who has a home workshop and power tools to do cutting, grinding, drilling, etc., if needed.
- And last but not least, put someone in charge of raising funds for the lesson materials.

> ! ***Don't try to do everything yourself. Gather a support team.***

In other words, break up the job into as many pieces as you need to. Get more people involved, and the whole project will be a lot more fun for everyone. And Rock-it Science is all about making science fun!