Kinetic City Leader Guide Information Sheet

Club Name: _____

Crew 1 Name: _____

	Codename	Password
1:		
2:		
3:		
4:		
5:		

Crew 2 Name: _____

	Codename	Password
1:		
2:		
3:		
4:		
5:		

Crew 3 Name: _____

	Codename	Password
1:		
2:		
3:		
4:		
5:		

Crew 4 Name: _____

	Codename	Password
1:		
2:		
3:		
4:		
5:		

Crew 5 Name: _____

	Codename	Password
1:		
2:		
3:		
4:		
5:		

Dear **Kinetic City** Leader:

It's not every day that you and your after school program get to save a Universe. But that's what you and other Kinetic City clubs around the world will be doing with **Kinetic City: Mission to Vearth**.

Is this an awesome responsibility? Well, sure. But it's also lots of fun.

In each two-week mission, you and your kids will perform five exciting activities focused on a single area of science. Then, using what they've learned, your kids will play an on-line Mission to Vearth game to earn **Kinetic City Power Points** for your Club.

These Kinetic City Power Points help protect Planet Vearth from the nasty Deep Delete virus. They will also appear on your Club Web Site, showing the world what you've accomplished.

Please don't worry if you're not a computer whiz, or a science whiz. The activities in this box should be fun and easy for you and your kids to do. Most of them can be done away from the computer.

In this Leader's Guide, you will find instructions on how to get started with Kinetic City, including how to register your Club and set up your Club Web Site. There are also overviews of the four missions in this box, including copies of the five activities that correspond to each mission. If you need more copies of these activity pages, you can photocopy them or print them out from the website.

If for some reason your Club is unable to go to the Kinetic City website, simply use the paper copies of the activities in this Leader's Guide. Again, most Kinetic City activities do not require a computer.

Thank you so much for participating in **Kinetic City: Mission to Vearth**. We hope you and your children enjoy following the adventures of the Super Crew, and helping them defeat Deep Delete.

Who would've thought that saving a Universe could be so much fun?

Sincerely,

BOB HIRSHON
Executive Producer
Kinetic City: Mission to Vearth

An URGENT Message from the Kinetic City Super Crew

Wow, are we glad you're here! We're the Kinetic City Super Crew. We solve mysteries, fight crime and have fun on our incredible train, the **Kinetic City Express**. We also have an amazing computer named **ALEC**.

Maybe you've heard us on the **radio**, or read our **books**.

But now we're in big trouble, and we need your help. We live in a virtual universe inside a computer, on a planet called Vearth. A really awful guy named Gruel has attacked our universe with a computer virus called **Deep Delete**. It chews up science information from our world, and then strange things begin to happen. Gruel is being helped by our old enemy **Count Sonos,** and his unbelievably lazy nephew, **Lumbert**.

Every two weeks, Deep Delete attacks some part of our world. It might mess up gravity. Or make all our machines work backwards. Or it could do strange things to our environment.

Whatever happens, there's only one way to fix it: we need you Earth kids to figure out how the world is **supposed** to be. In other words, discover the **truth** about things. We'll help you with a set of activities called **Reality Reboots**. Once you do them, you'll be an expert on whatever it is Deep Delete is wrecking. Then you can use your smarts to go online, take a **Mission To Vearth**, and zap Deep Delete.

ALEC

To find out more, and to see what's happening today, just come to our home site at **www.kineticcity.com**

We hope to be seeing a lot of you. After all, without your help, we're in **big trouble**.

Thanks!

Your friends,
The Kinetic City Super Crew

Getting Started with Kinetic City: Mission to Vearth

The following steps are recommended to help your kids get the most they can out of **Kinetic City: Mission to Vearth.**

As always, we encourage and look forward to your comments and suggestions!

GETTING STARTED

The very first thing to do is introduce your kids to Kinetic City. Explain to them that they are about to play a new kind of interactive story-game on the Internet called **Kinetic City: Mission to Vearth.** In this game, there is a virtual world named Vearth that desperately needs their help to survive.

After this brief explanation, give each student a copy of the Urgent Letter from the Super Crew. The letter describes the situation the Super Crew is in, and why they need "Actual" kids to help them. You may also wish to read the letter aloud. Emphasize to the kids that the future of Vearth depends on their heroic efforts!

Next, pass out the letters and consent forms. These let the children's parents know that their kids will participate in a new science program; that the children will work on the Internet; and, most importantly, that they may post work to their own Kinetic City Club website. It is up to the Club to decide if their website will include a team picture or other photographs of the children. While the children are completely anonymous on the site, and while parents rarely object to having their kids' picture in their town newspaper (which is often also posted online), they still may be uncomfortable with this idea. We highly recommend you not include photos if parents object or do not return the form at all.

The next step is to pass out the Kinetic City backpack tags and ID cards. Once your Club has a name, and the children log on and register, the kids can write their code names on their cards and keep them in their backpack tags. Of course, these tags can be put on anything, from a book bag to a notebook, if they don't wish to have them on backpacks.

Now, pass out the Kinetic City Case Journals and let the kids know they'll be sent on a new mission every two weeks. They should know that they will play an important role in the **Kinetic City: Mission to Vearth** story.

NAMES AND PASSWORDS

Your first job is to form an official Kinetic City Club, and divide it up into five groups called "Crews." Have the kids spend some time coming up with a fun name for their Club. Pick something that does not identify exactly where you are (in other words, you can call yourselves the New York Brainiacs, but not the New York P.S. 138 Brainiacs). Once your entire Kinetic City Club has a name, have the children break up into five groups of roughly equal members to form the Crews. Have the Crews spend a few minutes coming up with a good name for their group. Let them know that this name will appear on their Crew's home page on the Web, and will be the name by which other players from all over the world will know them.

Finally, the children will have to make up names and passwords for themselves. They should not use their own names or other personally identifiable information. Animal names are fine (tiger, eagle, froggie), or inanimate objects (scooter, puppet, cookie), or famous characters (merlin, ariel, batman, anastasia) or even words they make up (freegle, blotz, morpholog). Their passwords should be hard to guess but easy for them to remember.

The reason they have codenames and passwords is that they will be playing games on the computer, and we need to keep track of their scores. That way, they can log on from any computer in the world and play to improve their score or look at new challenges. We don't know any of the children's identities—just the made-up names and passwords.

When they log in, the children have the opportunity to enter an email address. The only reason we give them this option is so that we can remind them of their password if they forget it. Otherwise, they'd have to start over with a new name and password, and they'd lose their points. Again, we don't use these emails for any marketing purposes, nor allow anyone else to use them. And they do not have to supply this information to play.

GOING ONLINE

To participate in Kinetic City online, you will need an Internet-connected computer with a browser (preferably **Internet Explorer**) and a free plug-in called **Flash.** (To download Flash, go to www.macromedia.com/downloads and click on "Macromedia Flash Player")

A fast Internet connection will make the wait times shorter. If you have a slower connection (for example, one that dials over a phone line), it would be a good idea to open each Kinetic City page once before the children arrive. After your computer opens a page once, it will probably save it to its memory, and it will open faster when the kids go back to it.

Once all of the kids are in Crews and the Club name is set, go online to www.kineticcity.com and have the kids register individually at the Join page. Each child will be asked to choose a code name and password. Again, if they supply their email address, we will email them their password if they forget it.

GETTING FAMILIAR WITH THE SITE

Once the kids are at the site, they can learn a little more about the Super Crew characters. Have them explore the Home Page and the Control Car especially. If you like, any of the pages on the site can be printed out and copied for the children.

Once your children are familiar with **Kinetic City**, you're ready to get started!

Evaluation and Assessment

Kinetic City: Mission To Vearth is, to the best of our knowledge, the only after-school program based entirely on national science learning benchmarks, and developed specifically with each of those benchmarks in mind. We are confident that children performing our activities will gain a new understanding of these benchmarks, and be more motivated, confident learners.

Research by independent evaluators supports this confidence. The full text of this evaluation is available at our www.kcmtv.com website. We will continue to perform these evaluations on randomized, statistically significant groups of *Kinetic City* users, and to post the results on our website.

We also include tools that allow you to assess individual child performance, built into the program. For example, all children record their activity data and results in their *Kinetic City Case Journals*, providing leaders with detailed information on how each child is progressing through the material.

Each Mission in the *Case Journals* begins with topic questions that ask children to think about the topic before they have explored it. This provides a baseline for each mission for each child.

Examining the work sheet for each activity allows leaders to check for participation and assess the conclusions children have drawn from their data. Leaders can look for progress by comparing the children's pre-mission ideas and theories with the conclusions they present after each activity. Leaders can even pose the pre-mission questions again at the conclusion of the mission, and have children discuss what they learned.

In addition, each team is encouraged to report on their activities on their *Kinetic City* Web Page, giving leaders more information on their progress.

Of course, every child plays the *Mission To Vearth* game, which poses ten multiple-choice questions for each mission. By earning *Kinetic City Power Points*, children demonstrate basic understanding of some of the key learning goals in the mission.

By building these assessments into the *Kinetic City* game itself, children record data, draw conclusions, take quizzes, etc., without thinking of any of them as "tests." They are all just part of the fun of participating in *Kinetic City*.

In addition, an independent evaluator will be creating and administering more detailed assessments for a subset of several hundred children, the results of which will help us plan and develop the *Kinetic City* program. In addition to the results of this study, we will also make available on our website the same assessment tools used by the evaluator for Club Leaders who wish to use them.

As an after-school program, *Kinetic City* will never replace a well-designed, rigorous, in-school, teacher-led curriculum. That is not our intent.

However, our assessments have shown that children who participate in **Kinetic City: Mission to Vearth** quickly out-perform other children on knowledge of standards-based content information, conceptual information, and in overall motivation toward science learning.

Overall, we feel that **Kinetic City: Mission To Vearth** has been shown to be effective by independent experts more than any other after school program. This is part of an ambitious and rigorous evaluation that will continue and, we hope, expand as we continue to improve and refine *Kinetic City*.

HELP!

Site isn't loading? Game piece missing? Fly in your coffee? Whenever disaster strikes, check www.kcmtv.com to see if your problem is addressed there. Or use our email center to contact us. When all else fails, call our toll-free sales and service line, 1-888-438-5272.

Mission Pack: Tau

In this set of four missions, children will learn about Issues in Technology, Energy Sources and Use, Global Interdependence and The Scientific Enterprise.

In RETRA ("Issues in Technology"), the focus is on the evolution and consequences of technological innovation. In the Move Crew, the children learn that new inventions often result from not one but several groups of people addressing related problems. The children are also asked to think about the drawbacks of new technologies, as well as their advantages. The Mind Game and the Fab Lab explore the technology-related problems of antibiotic resistance and air pollution from cars, respectively, and the Write Away encourages students to think about the pros and cons of other modern conveniences. Finally, the Smart Art lets students try their hand at paper recycling, a process that has been created to help alleviate the waste that modern manufacturing generates.

For ENERVIA ("Energy Sources and Use"), children turn their attention specifically to energy, the lifeblood of technology. Some activities focus on the sun, our ultimate energy source, including a Write Away that asks them to trace another form of energy back to the sun, and a Smart Art in which they build a working solar oven. Others examine the trade-offs of energy production and consumption. In the Move Crew, they'll have to balance their energy use against waste production. In the Mind Game, they'll balance cost, pollution, and energy efficiency while trying to power a virtual city. And in the Fab Lab, they'll compete against rival energy magnates while trying to build power plants in places that maximize their output.

ISOLATRIX ("Global Interdependence") transitions into social issues hinted at in the previous two units. The main idea here is that different cities and countries depend on each other for sharing resources. In the Mind Game, they'll get a

glimpse of the far-flung origins of some ordinary supermarket products. In the Smart Art, they'll find out how far some items traveled to get to their own classroom. The Fab Lab is an introduction to simple supply-and-demand economics. In the Move Crew, they'll discover that trading can mean more than just a one-for-one swap between two parties. Finally, the Write Away encourages them to think about global interdependence in a broader sense: that a single problem can be thought of in relationship to an individual, family, town, nation, or planet.

THE SLORGANIZER ("The Scientific Enterprise") covers the global nature of scientific endeavor itself. In the Mind Game, students will take a tour of scientific milestones throughout history, often in places they may not have heard of. In the Smart Art, they'll be asked to draw a scientist, and then examine and challenge the assumptions implicit in their drawing. Another key element of the Scientific Enterprise is the importance of clear communication in making one's findings accessible to others. In the Fab Lab they'll come up with a communication system using only pictures, while in the Move Crew they'll practice giving detailed instructions in the style of a computer programmer. The Write Away focuses on decoding and encoding, highlighting another essential aspect of scientific research.

Overall, these four missions help children with some important and profound scientific concepts. By the end of Mission Pack: Tau, we hope all children participating will have at least a basic grasp of these concepts and feel interested and confident enough to learn more.

Mission Overview: Retra

This two-week Mission is about practical and philosophical issues relating to technology. There are three overarching themes in this unit: First, technological innovation is often the result of cooperation between different parties with similar needs and interests. Second, new technologies tend to lead to other technologies, and to new uses for existing technology. Finally, while a technology may be designed to solve some problems, it often creates new problems or drawbacks that must be considered. Students should come to appreciate that technology is not a panacea for the world's problems, but involves making difficult decisions between competing objectives.

The activities for this mission include: **Antibiotic Attack,** which brings up the problem of antibiotic resistant diseases; **Fill 'er Up,** a demonstration of how acid rain is formed; **Necessity,** a game about the climate that leads to inventions; **Paper Maker,** in which the students make their own recycled paper; and **Pro and Con,** a writing exercise in which students are asked to consider technology from two perspectives.

To learn more about these technological issues, consult these resources:

The Oregon Museum of Science and Industry has a number of online science activities relating to technology and engineering:

http://www.omsi.edu/explore/online.cfm

The National Gallery for America's Young Inventors is a national competition dedicated to preserving and promoting the inventions of young people:

http://www.pafinc.com/

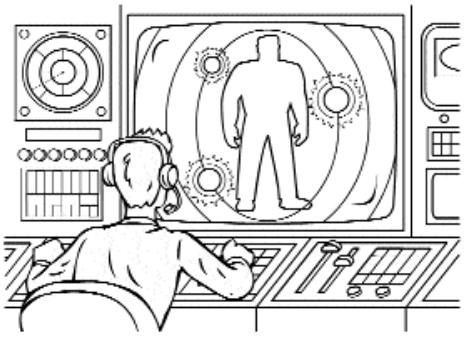
MIT's Inventor of the Week site features the biography of a different inventor from history each week, and has extensive archives:

http://web.mit.edu/invent/www/inventorweek.html

Geoff Endacott's *Discovery and Inventions* (Viking Press; ISBN 0670841773, 1991) gives an entertaining overview of a number of inventions throughout history, from the groundbreaking to the ridiculous.

ACTIVITY NOTES FOR LEADERS:

Retra

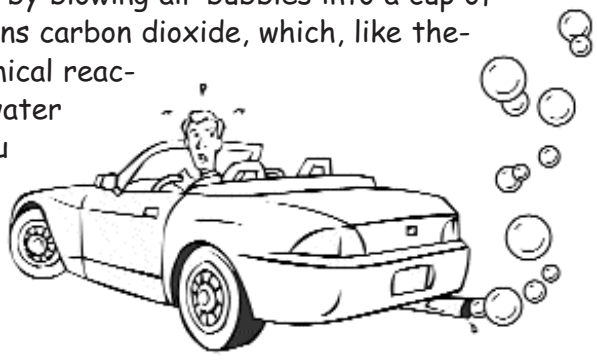


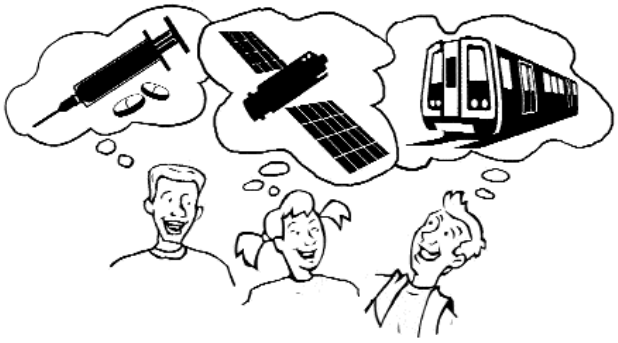
Mind Game: ANTIBIOTIC ATTACK

In "Antibiotic Attack," students have to save a body from infection with antibiotics. But there's a catch: each time they use an antibiotic, some of the germs may become resistant – which means the kids will have to trade up to a tougher antibiotic in order to fight them. This "arms race" of germs versus drugs models the real-life problem of antibiotic resistance, and encourages kids to think about the choices involved in the use of these medicines.

Fab Lab: FILL 'ER UP

Here, students mimic the effects of acid rain by blowing air bubbles into a cup of clear water. The air from their breath contains carbon dioxide, which, like the carbon dioxide in car exhaust, triggers a chemical reaction in water that forms **carbonic acid.** The water looks the same to the naked eye, but when you add BTB (an acid-base indicator) to the "polluted" and "unpolluted" water, the difference is dramatic. This activity encourages kids not only to think about the effects of air pollution, but also helps them recognize that pollution isn't always as obvious as trash on the sidewalk.



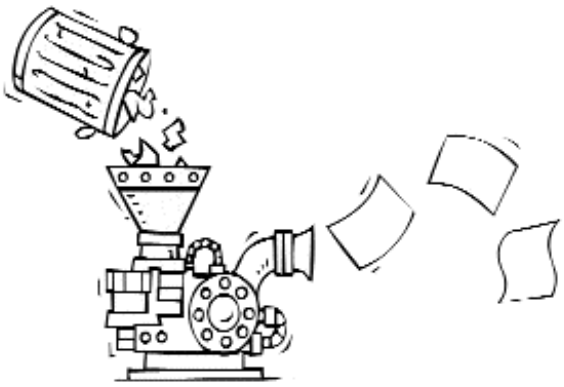


Move Crew: NECESSITY

In this game, the students are dealt a hand of cards with a variety of technological needs. Their job is to pursue inventions that will meet those needs. In playing the game, the students should discover that technologies are invented more quickly when several people are pursuing their development. This can lead to a discussion about scientific cooperation between different organizations and different nations.

Smart Art: PAPER MAKER

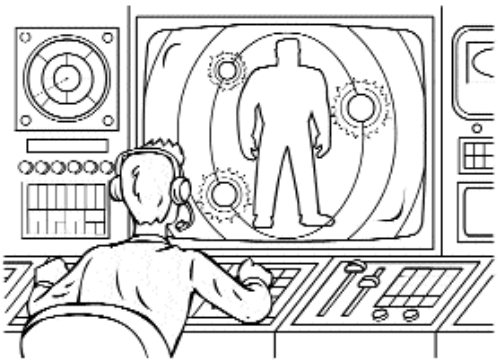
In this activity, students make their own recycled paper from paper pulp. Part of the fun is just to see how it's done. But if students find the activity challenging, this can also spark discussion about why more paper isn't recycled, how machines might speed up the process, and the importance of reducing the amount of paper you use in the first place in addition to recycling what you do use.



Write Away: PRO AND CON

This activity encourages kids to think about common, everyday technologies and to come up with good points and bad points about each one. In considering bad points, have them pay special attention to the invention's impact on the environment, including often-overlooked issues like noise pollution and the creation of eyesores. Also, ask them to think about how people's lives have changed as a result of the invention, and if those changes are all for the better. For example, has television made us more or less in touch with our fellow human beings? In many cases, there may be valid arguments on both sides.

Antibiotic Attack



Briefing

Antibiotics are some of the most important medicines around. They kill tiny one-celled creatures called **bacteria** that can make you sick. But sometimes the bacteria fight back – by mutating into tougher strains that can resist the antibiotics! In this Mind Game, you'll try and save a sick patient before the germs get ahead of you!

Activity

In this game, you'll see patients' bodies filled with nasty bacteria.

Your job is to cure as many patients as possible.

To kill the bacteria, use the mouse to highlight a part of the body, and then click to zap it with antbiotics.

But be careful – every time you use antibiotics, some of the bacteria that survive might mutate. (They'll change color when they do.) If they mutate, the antibiotic you're using won't work anymore. You'll have to move up to a new, more powerful antibiotic to keep playing. And there's no going back!

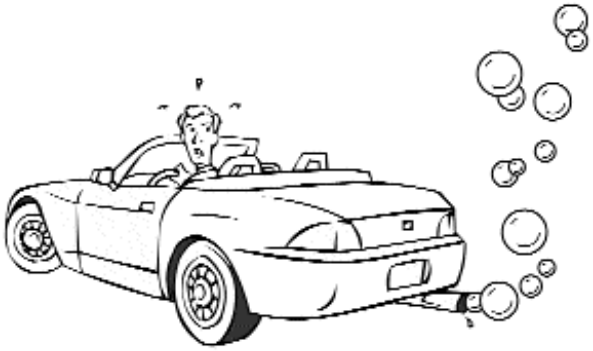
Keep playing until you've saved all the patients. If you run out of antibiotics the game is over!

Debriefing

What helped you play this game? Was it better to fire off your antibiotics all the time, or wait and use them carefully where they were needed most? If you were a doctor, when would you think twice before prescribing antibiotics?

If you've got your Case Journals, answer the questions in it now!

Fill'er Up!



Briefing

Cars are really useful inventions, but they're also big polluters! For example, the gases in their exhaust cause something called **acid rain.** You'll see how in this Fab Lab.

Activity

WHAT YOU'LL NEED:

Bromothymol blue indicator (BTB).
Clear plastic cups
Distilled water or clean tap water
Straws

WHAT TO DO:

- Work in teams of 2 to 6.
- Fill two cups halfway (not more!) with clean water.
- Squirt some BTB (at least 5-10 drops) into one of the cups and stir it. Write down what color the water turns. Set that cup aside.
- Now, pass around the OTHER cup (the one with no BTB in it). Have each kid take 30-60 seconds to blow air bubbles into the water through their straws. (This forces **carbon dioxide** gas into the water.
- After you're done, record what the water looks like. Does it look any different from before you started blowing air into it?
- Now add a squirt of BTB* and stir. Record the color you see. Is it different from before?

Debriefing

Your breath contains carbon dioxide gas, which is also found in car exhaust. When this gas dissolves in water, **carbonic acid** forms. Carbonic acid contributes to acid rain, which hurts the environment. (The BTB indicator turns greenish yellow in the presence of acid.) Other gases from cars, including nitrogen oxides, play an even bigger role in causing acid rain.

Note: If your BTB indicator turned greenish yellow in BOTH cups, try the experiment again using bottled water, or water from another tap.

If you've got your Case Journals, answer the questions in it now!

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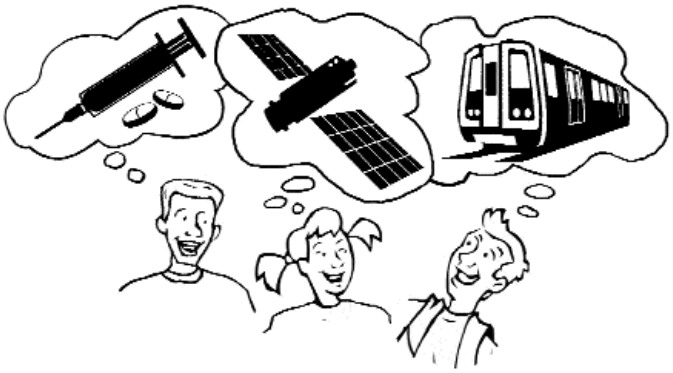
*Bromothymol blue (BTB) is a kind of **indicator** – it tells you how much acid is present in a liquid. Your school science lab probably has it. You can also get it cheaply from a pet store that sells fish.

If you can't get BTB, you can make an indicator from cabbage juice. Here's how:

Combine equal parts thinly sliced red cabbage and water. Heat to almost boiling and then cool. Strain out the cabbage, and substitute the purple juice for BTB in the experiment. (Note: Instead of turning greenish yellow, the juice will change to a slightly pinker shade of purple.)

Necessity!



Briefing

Sometimes new technologies are invented by just one person. Other times, lots of different people are involved. In this Move Crew, you'll have to solve problems with new technologies—either by joining forces with other people, or striking out on your own!

Activity

In this game, you're in charge of scientific research for an entire city. The object of the game is to "invent" new technologies to solve your problems.

WHAT YOU'LL NEED:

- A set of 20 Necessity cards.
- 10 "Technology" posters.
- A stopwatch and a pen for the Referee or Team Leader.

GETTING READY

- If you don't have a Team Leader, choose a Referee.
- Before the game begins, the Referee tapes the ten Technology posters on a wall, picture side out, with at least a foot of space in between them. Be sure to tape down both the top and bottom of the poster.
- Have everyone take a few minutes to look at the posters and read about the technologies.
- Deal an equal number of cards to each player. (If you have leftovers, set them aside.) Each card lists a problem that can be solved by one or more of these ten Technologies.

HOW TO PLAY

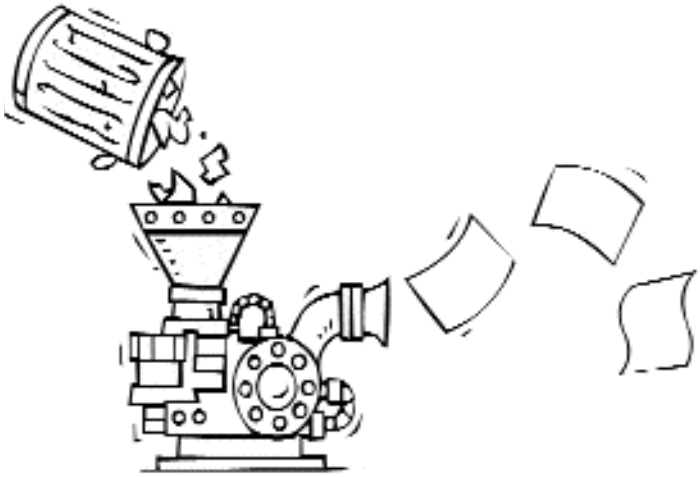
- Each round lasts 30 seconds. At the start of the round, the Referee says "Go!"
- During each round, players can talk to each other about the different problems they need to solve, and what kinds of technologies might solve them.
- By the end of the round, everyone must choose ONE technology to try and invent. Go to that poster and tag it. Up to three kids can tag the same poster.
- The Referee then goes to each poster and checks off one box for each kid that's tagging it.
- If a poster gets three check marks on it, that technology is invented! The Referee takes down the poster, and reads off the problems that are now solved.
- You can discard all the problems solved by that invention.
- Everyone benefits from new inventions; you don't have to be tagging the right poster to have a problem solved.
- The object is to get rid of all your cards as soon as possible. Keep track of first, second, third place, and so on. If two different players get rid of all their cards in the same round, they tie.
- Keep playing new rounds until everyone gets rid of all of their cards.

Debriefing

What was the best strategy for this game? Did you get rid of your cards faster if you worked alone, or if you cooperated with other people? Do you think the same thing happens in real life?

If you've got your Case Journals, answer the questions in it now!

Paper Maker



Briefing

Every single day, Americans buy
62 million newspapers. If all those papers just went in the trash, that's like throwing away half a billion trees every year! That's why it's so important to recycle. In this Smart Art, you'll make your own recycled paper!

Activity

WHAT YOU'LL NEED

- Old newspaper (1/2 sheet)
- Toilet paper (10 squares)
- Water (2 cups)
- A jar with a lid
- A piece of screen or a wire mesh strainer
- A dishpan, a large bowl, or a sink
- A rolling pin or wooden trowel
- Food coloring (optional)
- Paper Towels (4 sheets)
- A piece of aluminum foil

WHAT TO DO

- Take a half sheet of old newspaper and tear it up into small pieces, like confetti.
- Take 5 squares of toilet paper and rip them into tiny pieces too.
- Now rip the 2 pieces of paper towels like you did the others. (You'll use the other 2 pieces later.)
- Put all the torn-up paper in the jar, and add 2 cups of water. If you want colored paper, add 5 drops of food coloring now.
- Put the top on the jar, and shake it for three minutes. Now you have paper pulp in your jar! (You might try stirring it with a fork to make sure it's mashed up.)
- Put the screen or strainer over a bowl or the sink. Pour the pulp on top of it. Squeeze out as much water as you can.
- Place the screen on top of the remaining pieces of paper towel, and cover it with aluminum foil.
- Gently roll the pulp, like cookie dough, over the screen until it's flat. (If you used a strainer, just do this on a flat surface like a table.)
- Carefully remove the aluminum foil. Try and shape the pulp into a rectangle as neatly as you can (it won't be perfect). Make sure there aren't any holes in the mush.
- Let the paper dry (preferably overnight).
- Now you have your own recycled paper! You can draw on it, or use it to write an artistic letter. You can decorate it with glitter, sequins, or anything else you can find.

Debriefing

Recycling paper by hand takes a lot of work. The recycled paper you use at home or at school is made in machines. They mash up the pulp until it's super-smooth and lay it out in nice firm sheets to dry. Some recycled paper includes some amount of new paper pulp so it's easier to make. Next time you buy paper, check to see if it's "100% Recycled" or something less than that.

If you've got your Case Journals, answer the questions in it now!

Pro and Con

Briefing

Like anything else, technology has its good points and bad points. In this Write Away, you'll look at a popular kind of technology from both sides.

Activity

WHAT YOU'LL NEED:

- A six-sided die

WHAT TO DO:

1. Roll the die or pick one of the following technologies:
   - Cars
   - Air conditioning
   - Cell phones
   - Bug-killing chemicals for crops
   - Television
   - The Internet

2. On one side of a page, list three good things about this technology.

3. On the other side of the page, list three bad things about the technology.

4. Now, write a paragraph that argues one of the following two things:

a. This technology is bad and should be done away with. Explain how we would get along without it.

OR

b. This technology is so good we have to keep it. Explain how we might fix one of the problems you listed.

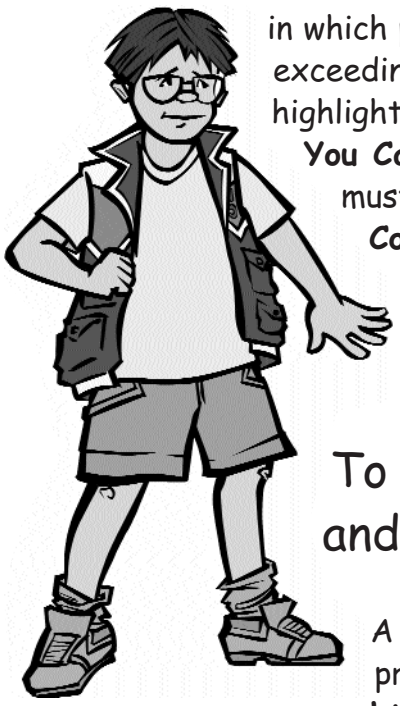
Debriefing

Had you thought about that technology as good or bad before? Was it difficult to come up with three good things and three bad things? Can you think of other kinds of technology that have good and bad points?

If you've got your Case Journals, answer the questions in it now!

Mission Overview: Enervia

This two-week Mission is about energy, where it comes from, and how it's used. Students should come to understand that energy for machines can come from simple, natural sources, like wind, water, and solar energy, as well as recognizable fuels like oil, coal, and natural gas. It's worth highlighting that fossil fuels like oil, coal, and natural gas came from the decomposed remains of ancient plants and animals. Also addressed in this unit are issues of energy conservation, and the fact that different energy sources vary in cost and the amount of pollution they generate.



The activities for this mission include: **Power Up!,** a computer game in which players try to power a town without going broke or exceeding pollution limits; **Plant Your Plant,** a board game that highlights the restrictions of where power plants can be built; **You Can't Take It With You,** a kind of race in which students must balance efficiency and speed with waste output; **Solar Cooker,** in which students make an oven that uses solar power, and **Blame It On the Sun,** which encourages students to trace all forms of energy back to their original source—the sun.

To learn more about energy sources and use, consult these resources:

A service of the California Energy Commission, that provides detailed energy education for children:
http://www.energyquest.ca.gov/story/index.html

A site sponsored by the Department of Energy that provides a comparison of renewable and non-renewable energy sources and the history of energy research: **http://www.eia.doe.gov/kids/kidscorner.html**

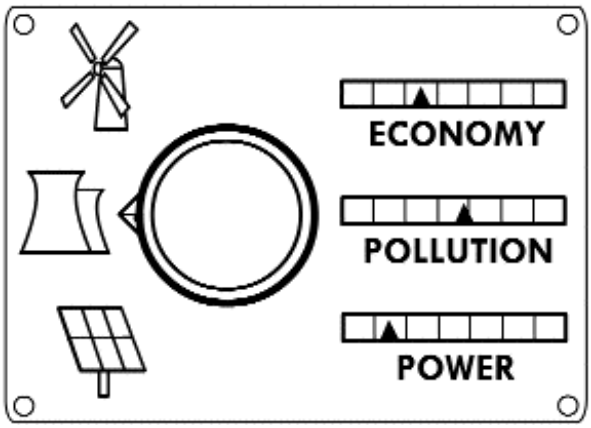
A government energy education site that provides a description of fossil fuels and their the methods in which they were created in nature: **http://www.fe.doe.gov/education/energy2.html**

Sally Hewitt's *Full of Energy!* (1998, ISBN 0-516-20792-X) from the It's Science Series, includes great information and thought-provoking exercises on the topic of energy.

Terry Jennings and Bonnie Tyler's *How Do We Know Energy Exists?* (1995, ISBN 0-8114-3881-3) is a good general reference on energy for children.

ACTIVITY NOTES FOR LEADERS:

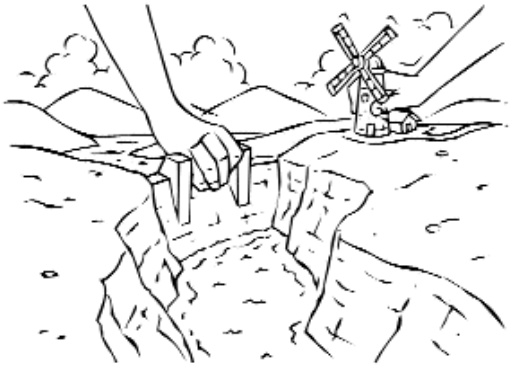
Enervia



Mind Game: POWER UP!

In this online game, students must choose between different kinds of energy sources to power a city. In doing so, they must balance the cost, energy efficiency, and pollution rates of the various options. Since the game isn't modeled on real data, students shouldn't walk out of the activity feeling like they know the "facts" about nuclear vs. coal-burning power plants. What they should gain from the activity is the understanding that different energy sources have different advantages and disadvatages, and that these qualities often counterbalance one another.

Fab Lab: PLANT YOUR PLANT

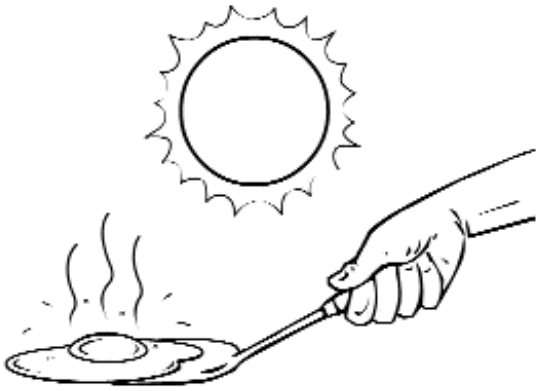


In this game, students "build" environmentally friendly power plants on a game board representing a large geographic area. The key lessons here lie in the rules of the game. Students can build power plants only in suitable areas: for example, they have to build wind plants on high ground, and they can't build trash-burning plants in populated areas. Another rule awards bonus points for building plants in contiguous groups, so that energy output can be maximized. By following these rules, the children learn that energy plants can't just be built anywhere, but rather, careful thought and consideration must be used to maximize their efficiency and minimize the disturbance to the environment.

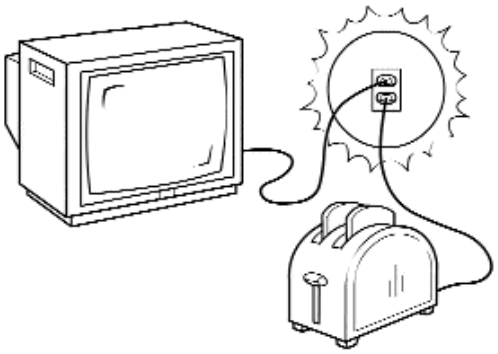
Move Crew: YOU CAN'T TAKE IT WITH YOU

Here, students have the simple goal of walking from one end of the room to the other. The catch is that each step they take uses power, and results in the generation of "waste," represented by balloons. The object of the game is to teach students that using energy always comes with an environmental cost, and ignoring the need to clean up can result in disaster (a "toxic spill" in which the student drops the balloons and must return to Start.) Remind the children throughout the game that the balloons are a direct result of moving forward, just like industrial waste or pollution is almost always the result of using energy.

Smart Art: SOLAR COOKER



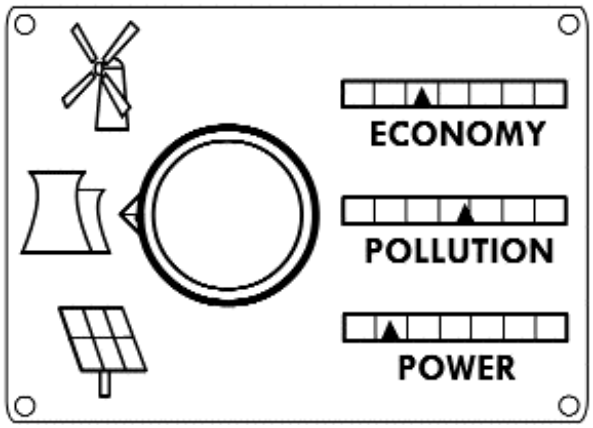
This is a craft activity in which students make a solar oven. One object is to teach children that the sun is a great source of power that can be harnessed through clever engineering. On the other hand, if students comment that the solar oven is much slower and weaker than a conventional oven, this can lead to a discussion about why some energy sources are favored over others, even if they are non-renewable and create pollution. This can heighten students' awareness of the conflict between human energy demands and the environment.



Write Away:
BLAME IT ON THE SUN

Here, students are asked to trace any kind of energy at work back to the sun. Remind them that any form of movement is an expression of some kind of energy. Encourage them to think backwards one step at a time, without rushing to get to the sun. Also remind them that energy often changes form; for example, the sun shines on plants, which helps the plants grow, and the plants are then eaten by animals and people, who use the energy for movement.

Power Up!



Briefing

Different sources of energy have different advantages. Some are cheap, some are safer for the environment, and some are very efficient. Usually, though, you can't get all three. In this Mind Game, you'll have to pull off a balancing act to keep your city going!

Activity

In this game, your job is to provide power for a gigantic city. But you need to do it without running out of money or ruining the environment.

On the screen, you'll be given three power plants to choose from. Sometimes they're the same, sometimes they're different.

For each power plant, you'll see how much power it gives you, how much it costs, and how much it affects the environment.

Click on a power plant to buy it. After you buy it, you'll get three more choices.

Keep buying power plants until you can meet your city's power demands! If you run out of money, or if you do too much damage to the environment, the game is over!

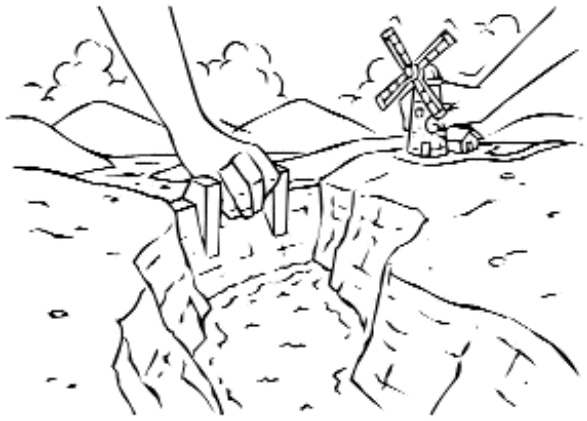
Debriefing

What worked best: buying the same kind of power plant, or using several different kinds of power plants? Was any one kind of power "perfect" across the board?

Some kinds of power plants are easier to build than others. What are some reasons why that might be true?

If you've got your Case Journals, answer the questions in it now!

Plant Your Plant



Briefing

If you want to generate energy, you can't just plop down a power plant wherever you want. You've got to go where the energy resources are—without messing up the environment. In this Fab Lab, you'll try to pump the most power possible before your opponent gets in your way!

Activity

WHAT YOU'LL NEED:

- A **Plant Your Plant** game board
- **Plant Your Plant** game pieces

HOW TO PLAY:

- In this game, you run an environmentally-friendly power company. Your job is to get the most power out to the city.
- To do this, you can build three different kinds of power plants: wind-powered, water-powered, or trash-burning.
- On each turn, each player "builds" one power plant by placing it on a square in the game board.

RULES FOR BUILDING PLANTS:

- Water plants MUST be built alongside a river—so they can use the water!
- Wind plants MUST be built on high ground (where the mountains are)—where the wind is strongest.
- Trash-burning plants CANNOT be built inside a city—they smell bad!
- If you can put two or more of the same kind of plant next to each other, you can send more energy out over the same power lines. That's good! You get extra points for that.
- If you cannot build a plant without breaking the rules, you must pass your turn.

SCORING:

- Every plant you build, by itself, is worth one point. BUT:
- If you can build two of the SAME kind of plant (trash-burning, wind, or water) next to one another (not diagonal), each of those plants is worth TWO points (4 total).
- If you build three of the same kind of plant next to one another, each of those plants is worth THREE points (9 total).
- If you build four of the same kind of plant next to one another, each of those plants is worth FOUR points (16 total!).
- The game ends when no one can build any more plants. Whoever has the highest total score at this time is the winner.

Debriefing

- What made it difficult to place the plants the way you wanted?

- Engineers in real life face challenges like these. If you were building power plants in real life, what do you think would be the hardest part?

If you've got your Case Journals, answer the questions in it now!

You Can't Take It With You

Briefing

One of the toughest things about producing energy is figuring out what to do with all the waste. The more power you crank out, the more waste you produce! You'll have to deal with that challenge in this Move Crew.

Activity

WHAT YOU'LL NEED:

- Balloons (at least 24 of them!)
- Masking Tape

GETTING READY:

Before the game begins:

- Use the masking tape and marker to mark a starting point, a finish line, and 18 steps in between on the floor. Each piece of tape should be long enough that four people can stand side by side on it.
- Blow up the balloons.

OBJECT:

- In this game, the object is to get to the finish line. You do that by moving forward.

- Here's the catch. whenever you move forward, you create waste. If you build up more waste than you can handle, you're in trouble!

HOW TO PLAY:

- All players line up at the starting point. Three or four players is ideal.

- Choose a Referee to start all turns, give out and take away balloons, and enforce the rules of the game.

- On each turn, the referee asks each player "Advance or Clean up?" If the player says "Advance!' then the referee asks "How many steps?" The player chooses 1, 2, or 3 steps, and takes that number of steps forward.

- After the player moves forward, the referee hands that player one balloon for each step taken on that turn. The balloons represent the waste you created!

- Each player must hold onto his or her balloons at all times, except during a Cleanup (see below). Balloons must be held with hands and arms; they can't touch the ground, and you can't stuff them into your clothing.

- If the player chooses to "clean up," he or she can drop up to two balloons, but cannot move forward on that turn.

- Any player who drops more than two balloons during a Cleanup, or drops a balloon at any other time, must return to Start.

- The first person to cross the finish line is the winner.

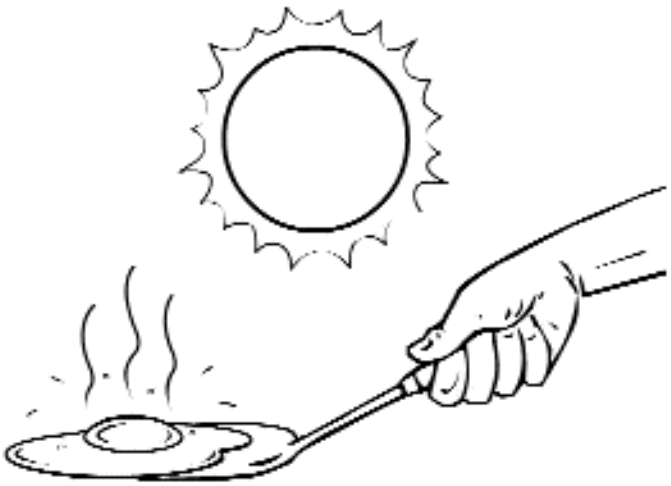
Debriefing

- What was the best strategy in this game? Was it better to go forward as much as you could, no matter how much waste you produced? Or was it better to conserve your energy and take it slow so that cleanup was easier?

- If you ran a power plant in real life, how much would you focus on producing energy, and how much would you focus on reducing waste?

If you've got your Case Journal, answer the questions in it now!

Solar Cooker



In the United States, most people cook with electricity or natural gas. But in some countries, people make ovens that get all their heat from the sun. In this Smart Art, you'll build your own solar oven!

Activity

WHAT YOU'LL NEED:

- A black box kit or a shoe box with no top
- Black construction paper (if you are using a shoe box)
- Plastic wrap
- Aluminum Foil
- Water
- 2 paper cups
- A thermometer
- Tape
- A tea bag (optional)

WHAT TO DO:

Cut off one of the long sides of the shoe box. Then cut the two short sides at an angle. Your box should look kind of like a stage.

Line the bottom of the box with black paper.

Line the sides with aluminum foil.

Cover the oven with plastic wrap. Tape it down along the edges. Leave a corner untaped so you can put stuff in it.

Now, put your solar oven in the sunniest place you can find! (The sunnier it is, the better the oven will work!)

Fill two paper cups with lukewarm water. Record the temperature of the water.

Put one cup inside the solar oven and tape it shut. Put the other one right next to the oven, outside the box.

Wait 30 to 60 minutes, then come back and take the temperature of each cup of water. Record the temperature of each.

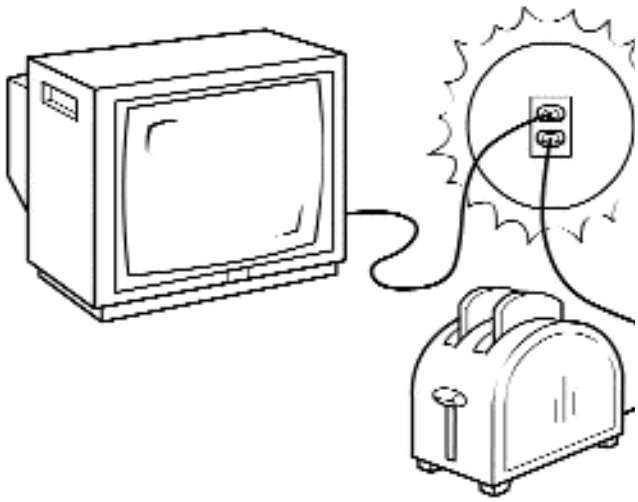
If your solar oven is cooking, try brewing a cup of tea in it!

Debriefing

What was the difference in temperature between the two cups? Did your solar oven work? Why do you think it worked (or didn't)? Can you think of ways to make your solar oven even hotter?

If you've got your Case Journals, answer the questions in it now!

Blame It On The Sun



Briefing

If you swim across a pool, that takes energy. Where does that energy come from?

Your lunch? But where does the energy in your lunch come from?

Your muscles? So where does the energy in your muscles come from?

In this Write Away, you'll trace all kinds of energy back to a single source!

Activity

All the energy on Earth comes from the sun. It's not always a straight path, because energy can change from one form to another. But if you trace back far enough, you can always get back to the sun!

- Think of anything on Earth that moves: a person, an animal, a car, a bike, and so on. Write down what that moving thing is.
- Now write down where that thing gets the energy to move. Maybe it comes from food, or fuel, or heat, or something pushing against it.

- Now write down where THAT energy comes from.

- Keep on doing this until you trace it back to the sun.

Debriefing

How many steps did it take to trace your motion back to the sun? What do you think would happen if the sun burned out? How long could life on Earth survive?

If you've got your Case Journal, answer the questions in it now!

Extra Info Page

The energy from the sun can change in a whole lot of ways. Sometimes it's obvious, sometimes it isn't. Here are some examples:

The sun's energy makes **plants** grow. Plants provide energy in the form of food for many animals. Other animals might eat the plant-eating animals to get their energy.

The sun's heat energy **warms the air,** which creates differences in air temperature and pressure that create **wind.**

Fossil fuels, like coal, oil, and natural gas, come from plants and animals that died long ago. Those plants and animals relied on the sun's energy to grow.

The sun's **heat** makes water **evaporate** from oceans and other bodies of water. When the water evaporates, it forms clouds. Eventually the water falls as rain or snow. The rain runs off the land and into rivers. We can capture the energy of this flowing water by building dams that help generate electricity, or just riding on the current.

Waves in the ocean are mainly caused by wind, which is mainly caused by the sun. (The sun heats up the Earth unevenly, and the air moves from the cooler areas to warmer areas.)

Mission Overview:
Isolatrix

This two-week Mission is about global trade and the interdependence of regions and countries around the world. The main lessons here are that trade occurs between countries and between regions within the same country; that many products we use every day either came from another country or are made up of components or ingredients that came from one or more countries; and that the actions of one country can affect another.

The activities for this mission include: **Return to Sender,** a computer game in which students learn where everyday products originated; **Supply and Demand,** a trading game that helps students understand simple economics; **Foreign Exchange,** an exercise in negotiating multi-party trades; **Where on Earth?,** a scavenger hunt for products of international origin, and **Zoom In/Zoom Out,** which encourages students to think about different issues on both a local and global scale.

To learn more about global interdependence, consult these resources:

Cultural Connections is a Web site that features information about daily life in cultures all over the world:
http://library.thinkquest.org/50055/

The American Museum of Natural History's online exhibit "You've Got the Whole World in Your Shopping Bag" shows the far-flung origins of many everyday food products:
http://www.amnh.org/nationalcenter/it_takes_all_kinds/e/e.html

Passport Kids, by Sesame Workshop, is an online site where kids aged 6-12 around the world can learn about each other:
http://www.sesameworkshop.org/passport/

Rebecca Clay's *Ties That Bind: Family and Community* (1995, ISBN 1-56711-126-2) describes how families work together in a variety of cultures around the world.

Caring, Sharing and Getting Along: Children's Activities in Social Responsibility. (1993, ISBN 1-56071-119-1) focuses on how children can act responsibly in social groups.

Steve Pollock's *Atlas of Endangered Peoples* (ISBN 0-8160-3283-1.) discusses groups of people throughout the world that are facing pressures which could cause their group to vanish from the Earth.

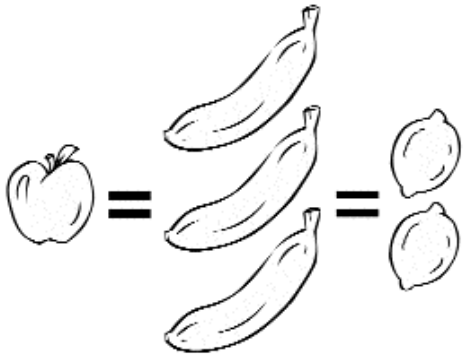
ACTIVITY NOTES FOR LEADERS:

Isolatrix

Mind Game: RETURN TO SENDER

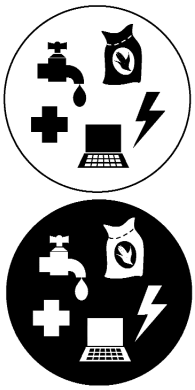
This is an online game in which students try and guess where different products (mostly food ingredients) come from. Students should not expect to have much prior knowledge of this material; instead, they should use the game as an opportunity to make educated guesses and learn new things. If possible, you might encourage them to think about the kind of climate that a particular item might grow best in, then try and find the countries offered as choices on a globe and make their guess based on that information. Even if the guesses are random, the end result should be a new awareness that different products that we use every day have their origins all over the world, including many countries your students may not have heard of.

Fab Lab: SUPPLY AND DEMAND



As the title implies, this game models a basic economic concept: that the value of something increases when the supply is short and/or the demand is high. Students should discover that they are able to negotiate better "prices" when they possess chips that are in high demand. They should also notice a difference between even exchanges (Sarah and John each have a chip that the other needs, so they trade one-for-one) and uneven exchanges (Sarah has something John needs, but not vice versa, so Sarah might raise her prices.) They may also discover principles of competition. Students should also be asked if their past behavior influenced future trades; for example, did they offer better prices to those who treated them fairly in the past?

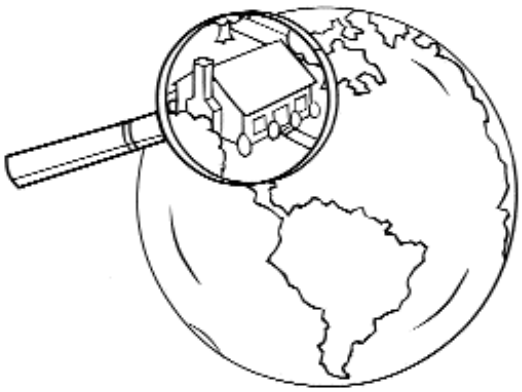
Move Crew: FOREIGN EXCHANGE



This is another trading game, but unlike Supply and Demand, it is cooperative rather than competitive. Students are given the team objective of re-distributing resources among the players in a single turn. In order to do this, they'll have to talk among themselves and come up with complex trading patterns that will achieve their group goal as quickly as possible. This game helps introduce the idea that trading isn't just about one-for-one swaps. Rather, it shows that sometimes trades have to be worked out among several countries, with goods moving around in sophisticated patterns, in order for everyone to get what they need.

Smart Art: WHERE ON EARTH?

This is a kind of scavenger hunt, in which the kids will look for products that came from "somewhere else" (another country, state, etc.) They'll need to find labels, tags, publishing information, and other clues that will tell them where each item came from. As a Team Leader, you'll need to set the boundaries for this game: are the kids allowed to look in other rooms? Can they rummage through closets? Can they move or pick up equipment that is owned by your school or center? The more the kids can look at, the better, but it's critical to set the ground rules that will work for you before the game begins.



Write Away: ZOOM IN/ZOOM OUT

In this writing exercise, the kids are asked to reflect on how different issues can be dealt with at different social levels, from the personal (what can I do about this?) to the global (what can world leaders do about this?). After they've completed the exercise, see if you can encourage them to identify relationships between the levels. For example, how does one leaving trash on your sidewalk affect how your city takes care of the environment?

Return to Sender

Briefing

A lot of stuff we use every day comes from other countries. Sometimes the whole thing was made somewhere else. But even products that are made here at home often use key ingredients from other parts of the world.

In this Mind Game, you'll try and send everything back to where it came from!

Activity

HOW TO PLAY:

In this game, the screen is split into three parts.

On the left side of the screen, you'll see something you can buy in your local grocery store.

In the center, you'll see a key ingredient that goes into that item.

On the right, you'll see three countries. Your job is to guess which country this ingredient is most likely to have come from. To make your guess, click on the ingredient and drag it onto the country you've chosen. If you're right, it'll go back where it came from!

Keep in mind that many different countries make each of these ingredients. In this game, the correct choice will be a country that makes a LOT of that ingredient, and the other countries will make very little of it or none at all.

If you're correct, you'll move on to the next round. If not, you'll have a chance to try again!

Debriefing

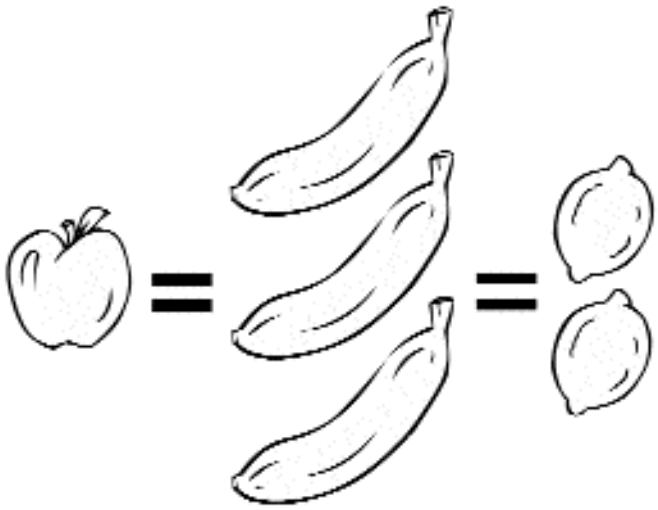
Did you know that all of those items came from so far away? Can you think of anything else that you use all the time that came from another country?

If you've got your Case Journals, answer the questions in it now!

Supply and Demand

Briefing

Roses cost a lot more on Valentine's Day than on March 14 or September 23. Why do you think that is? In this Fab Lab, you'll see for yourself how people's wants and needs affect how much something is worth!



Activity

WHAT YOU'LL NEED:

- Trading chips
- Supply and Demand cards

GETTING READY:

You'll need four players (teams are okay). In this game, each player (or team) is a different country. Make up a name for your country.

All the countries have one big natural resource, but they also need to get materials from other countries. The object is to get everything you need without trading away too much!

At the start of the game, each country gets 10 chips, all the same color. These are your "natural resources." In other words, this is the stuff that your country makes on its own.

There is also a pile of chips in the center, containing 6 chips of each color. This is the "bank."

HOW TO PLAY:

At the start of each round, each country draws a card from the deck. The color shows you the kind of material you need to get in this round. Put your card face up in front of you.

If you already have this color chip, put the chip on top of the card. (One is enough.)

If you don't have that color, you'll need to trade with another country to get it. Find one that has that color and strike a deal! You can make any kind of trade you want, as long as both countries agree to it.

If you can't find anyone to trade with, or if you don't like your other choices, you can go to the "bank" and trade in any three of your own chips for one of the color you need. (If you don't have three chips, you can't go to the bank.)

The round keeps going until everyone has the correct chip on top of his or her card. These chips stay on the cards throughout the rest of the game. Your country still owns them, but you can't use them over again.

To start the next round, everyone draws a new card. Play the round just like the last one. When the round is finished, leave the second chip on the second card and deal the cards again.

Anyone who can't put a chip on his or her card in any round is "bankrupt" and eliminated from the game. When someone goes bankrupt, their chips (including the ones on the cards) go back to the bank.

The last country to go bankrupt is the winner!

Debriefing

What happened when everyone needed the same kind of chip? Did the "price" of chips change? When you had chips that other people wanted, was it better in the long run to demand as much as you could get, or to charge a fair price?

If you've got your Case Journal, go ahead and answer the questions in it now!

Foreign Exchange

Briefing

When countries trade with each other, there's only so much stuff to go around. So they have to figure out how much to trade, who to trade with, and what to keep. You'll face that kind of challenge in this Move Crew!

Activity

WHAT YOU'LL NEED:

- Playing cards
- Colored "Resource" Balls
- A stopwatch or watch with a second hand

HOW TO PLAY:

The object of the game is for your team to score as many points as possible. You score points by trading and getting the resources you need.

Choose the deck of cards that matches the number of players you have (3, 4, or 5). This is very important!

Choose one player to be the referee. Assign the other players numbers: 1, 2, 3, 4, and 5 (up to the number of players you have).

Each player is given two colored balls at random. They may be the same color, or different colors. (The balls represent different kinds of resources: Water, Food, Medicine, Energy, and Computers). Use the same number of colors as you have players (for example, four different colors for a four-player game).

Have everyone stand in a circle. You should be far enough apart that your fingers are barely touching if you stretch your arms all the way out on both sides.

The referee draws a card from the top of the deck. The card will list what resources each player needs to get. The referee goes around to all the players and tells them what they need.

Now, come up with a trading plan to make sure everyone gets what they need. You have as much time as you want to talk about your plan. Your plan should make it possible for everyone to get what they need, IF EVERYONE TOSSES THEIR BALLS TO EACH OTHER AT THE SAME TIME. Only ONE simultaneous toss will be permitted.

If you forget what you need, ask the referee and he or she will remind you.

When everyone is ready, tell the referee. The referee will check your distance again, then count to three and then yell, "Throw!" When this happens, EVERYONE THROWS! (You may have to throw your balls to two different people at the same time, and/or catch balls from people you're not throwing to.)

If a ball is thrown to you, and you don't catch it, don't pick it up. It doesn't count.

After the throw, score one point for each color that you needed that's in your hands. The total number of points is the team score.

Play two more rounds. See if your team can get the highest score in the room, or beat a score of 20 points in three rounds.

Debriefing

Was that simple? Not always? Well, trading isn't always simple. For example, instead just of swapping one resource for another, you might have sometimes formed "triangles" (for example, you give Water to player A, who gives Food to player B, who gives Energy back to you). Countries form trade triangles too, and other complicated schemes, in order for everyone to sell what they have and get what they want.

If you've got your Case Journals, go ahead and answer the questions in it now!

Where on Earth?

Briefing

You don't have to look far to find things that were made far away. For example, there's a good chance that something you're wearing right now was made in another country. (If you can, check the tags on your clothes and find out!)

In this Smart Art, you'll see how stuff came from all over the world to get to where you are.

Activity

WHAT YOU'LL NEED:

- A map of the world
- Index cards
- String
- Stuff to draw with
- Tape or pushpins

WHAT TO DO:

You're about to go on a scavenger hunt. The goal is to find as many items as you can from as many different places as possible.

First, tape the map up on a wall where everyone can get to it.

Next, check out everything in the room: your clothes, your belongings, stuff in the closets, the computers, furniture, and so on. See if you can find tags or stamps that say where things were made.

Good places to look include the bottom or back of an item, the inside cover of a book (to see where it was printed), the collars or tags of clothing, or the shipping labels of boxes. (Make sure to get permission before looking through closets or drawers, or moving large objects!)

Once you've found out where something came from, draw a picture of it on an index card and label it. Put your picture somewhere on the outside of the world map.

Then, using the string and tape or pushpins, connect your picture to the state or country where it was made. Everyone else should do the same. Stop after 20 minutes, or after you run out of things to look at.

Debriefing

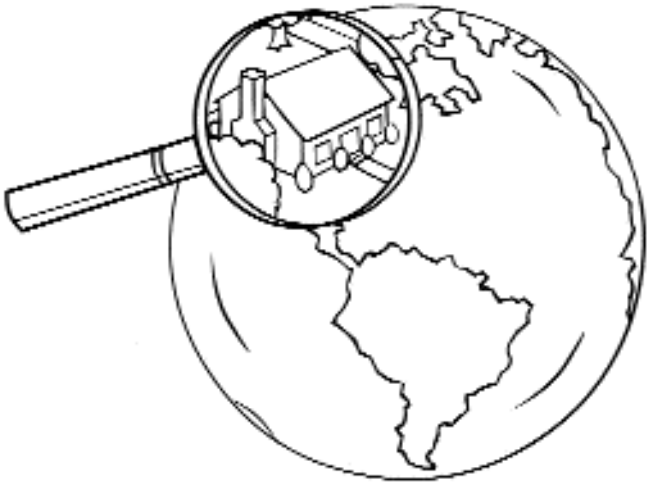
Look at the map and all the pictures connected to it. How many different states and countries are represented in the room you're in?

If you needed to find out more about where these items came from, what could you do?

Zoom In/Zoom Out

Briefing

Pollution is a big problem. How can we stop it? Get the factories all over the world to spew out less smoke? Or make sure people don't throw their used gum in the streets? In this Write Away, you'll think about problems like these in big and small ways.



Activity

WHAT YOU'LL NEED:

A target-style Zoom In/Zoom Out diagram

WHAT TO DO:

Divide your target into four equal sections, like a pie.

On the outside of each of the four sections, write the following words: FOOD, ENVIRONMENT, SAFETY, and TRANSPORTATION.

Now you're going to write on the inside of the target. Start with the section that says FOOD. Look in the center of the bull's eye, which says ME.

Ask yourself the question, "What can I do to make sure everyone has enough to eat?" Write the answer in this section of the bull's eye.

Now look at the next ring out from the target. It says FAMILY. Ask "What can my family do to make sure everyone has enough to eat?" Write your answer in that part of the target.

The next section says CITY. Ask "What can my city do to make sure everyone has enough to eat?" Write your answer in that section.

Do the same with the COUNTRY and WORLD sections of the target.

Now one-quarter of your target should be filled in. Fill in the rest of the target in the same way, asking these questions:

In the ENVIRONMENT section: "What can (I/my family/my city/my country/the world) do to protect the environment and keep it clean?"

In the SAFETY section: "What can (I/my family/my city/my country/the world) do to make sure people are safe?"

In the TRANSPORTATION section: "What can (I/my family/my city/my country/the world) do to help people get from one place to another?"

Fill in all the sections of your target if you can!

Debriefing

Was it hard to fill in all the sections of the target? Were there any sections of the target that you felt you couldn't complete? Look at someone else's target. What ideas did they come up with that you hadn't thought of?

If you've got your Case Journals, answer the questions in it now!

Mission Overview:
The Slorganizer

This two-week Mission is about the "Scientific Enterprise" – specifically, about the kinds of people who do science, and how science is done. The two main threads here are that science is an activity that has been done by many different kinds of people all over the world for many centuries, and that clear communication is essential to scientific work.

The activities for this mission include: **Call Our Bluff,** in which students must separate real scientific milestones from fictional ones, **The Big Picture,** which emphasizes the need for clear communication between teams working on separate parts of a project; **Metal Heads,** a game about giving detailed instructions; **The Face of Science,** which elicits and challenges assumptions about the kinds of people who do science, what they do, and where they do it; and **Code Cracker,** a decoding game.

To learn more about the scientific enterprise, consult these resources:

Project LABS is a cooperative program for science teachers, featuring over 110 hands-on science experiments:
http://www.rohmhaas.com/company/plabs.dir/

The Franklin Institute Online offers a wealth of kid-friendly science information and rotating online exhibits:
http://sln.fi.edu/

"4000 Years of Women in Science" includes biographies of many female innovators, both famous and overlooked, throughout history:
http://www.astr.ua.edu/4000WS/

This page, sponsored by Dow, profiles African-American scientists and inventors:
http://thechalkboard.com/corporations/Dow/Programs/Inventors

The Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) runs the Biography Project, which compiles bios of current Chicano/Latino and Native American scientists.
http://www.sacnas.com/Biography

Steve and Mary Woods' *Ancient Communication: From Grunts to Graffiti* (2000, ISBN 0822529963) gives an overview of the origins of communication technology in early times.

Scientists Within You: Women Scientists from Seven Continents (1995, ISBN 1-884414-12-5), by Rebecca Lowe Warren and Mary H. Thompson, includes biographies of women scientists around the world and hands-on activities that highlight their fields of interest.

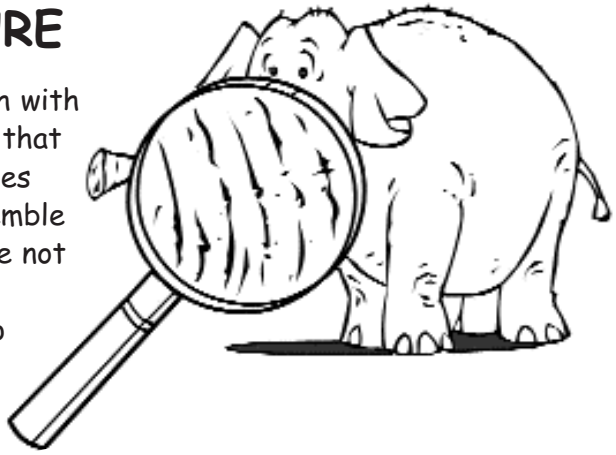
ACTIVITY NOTES FOR LEADERS:

The Slorganizer

Mind Game: CALL OUR BLUFF

In this online game, students are shown a number of related scientific breakthroughs (or almost-breakthroughs) throughout world history, and are asked to spot the fake. Many of the facts used in this game are intentionally obscure. The goal of the game is not for students to demonstrate prior knowledge, but for them to begin to recognize that important scientific work has not been restricted to North America and Western Europe in the past few centuries. In trying to identify the false event, they should be amazed and intrigued by the true ones.

Fab Lab: THE BIG PICTURE



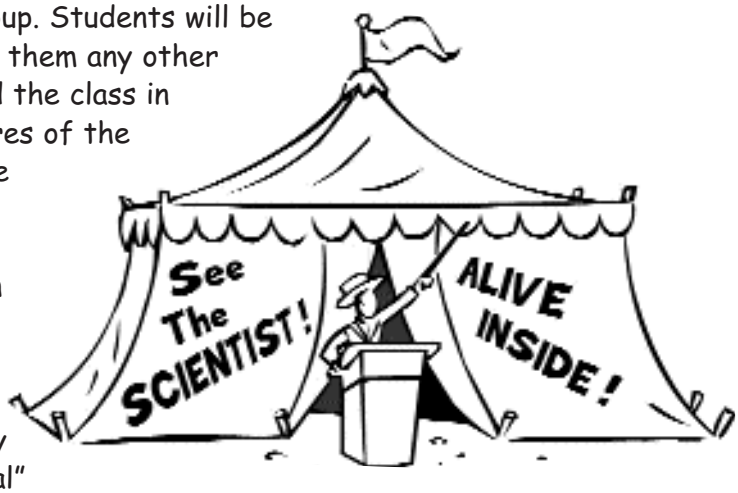
In this activity, students work in teams, each with specific jobs, to try and re-create a picture that is being kept in another room. One team copies parts of the picture; the other must re-assemble those parts into a whole. Since the teams are not allowed to communicate verbally with one another, they must work together to develop a system that allows the picture to be communicated faithfully. Both successful and problematic communication strategies should be discussed.

Move Crew: METAL HEADS

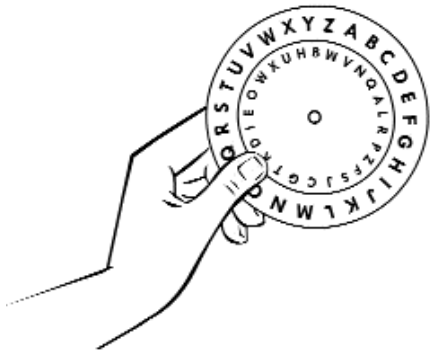
Here, one student pretends to be a robot, while another gives him or her instructions to complete a simple task. The goal here is to learn to give the kind of elaborate, highly detailed instructions that must be given to computers and machines. The student playing the robot should be instructed to do EXACTLY what the other student tells them to do, nothing more. Instructions like "Go get the pencil" should be rejected as too vague. The

"programmer" must carefully dictate the robot's every move. The kids can use this exercise as a jumping-off point to discuss the limitations and advantages of using machines for tasks once done by humans.

Smart Art: THE FACE OF SCIENCE



This activity works best in a large group. Students will be asked to "draw a scientist" (don't give them any other leading directions at first). Then, lead the class in tallying up and analyzing all the features of the scientists they drew. How many people drew a man rather than a woman? A white person rather than a person of color? Was the scientist working in a lab with test tubes, or diving underwater looking for rare ocean creatures? The activity then points the students to Web sites where they can see examples of "non-stereotypical" scientists and their activities. It is important that students understand that drawing a white man in a lab is not wrong, but rather that it is just one of many possible images that can accurately depict a scientist at work.



Write Away: CODE CRACKER

This is a simple encoding and decoding game. Understanding codes is an important part of the scientific enterprise, as many scientific questions are solved through decoding techniques. Examples range from the genetic code that serves as a basic blueprint for all life, to the fossil clues that paleontologists piece together to understand life on Earth millions of years ago. A key concept is the idea that solving parts of the code makes it easier to solve other parts.

Call Our Bluff

Briefing

Just like your family has roots all over the world, science and technology does too. For example, the earliest kind of calculator was the **abacus:** a counting tool invented separately in China and Babylon five thousand years ago! In this Mind Game, you'll try to guess fact from fiction as you trace the roots of different inventions and technologies.

Activity

On the screen, you'll see a map of the world.

At the top of the screen, you'll see a category relating to science and technology.

Four arrows will appear on the map. They'll point to different places in the world where some event, big or small, relating to that area of science or technology happened. They'll also tell you when it happened, and who did it (if we know).

Three of these arrows will be telling the truth. One of them will be made-up. Click on the one you think is NOT real.

If you're right, we'll tell you. If you're wrong, you'll get a second chance!

Debriefing

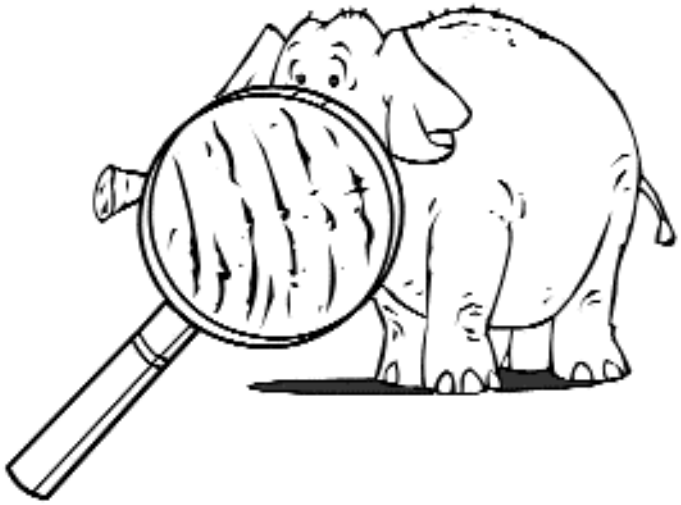
Were you surprised by what you learned? What countries and places were in the game that you didn't expect to hear about?

If you've got your Case Journals, answer the questions in it now!

The Big Picture

Briefing

Most science mysteries aren't solved all at once. It takes years or even centuries for scientists all over the world to uncover little pieces of a big puzzle. In this Fab Lab, you'll get a taste of what that's like!



Activity

WHAT YOU'LL NEED:

- A "Big Picture" Spyglass
- Paper and pens
- A complete drawing

HOW TO PLAY:

Send half the kids out of the room (or to another side of the room). This will be the "Research Crew."

The kids who stay put are the "Lab Crew."

Ideally, there should be 2 or 3 kids on each Crew. If you have more players, make two or more teams, each with its own Lab Crew and Research Crew.

RESEARCH CREW:

Leave the room with one of the printable drawings. Make sure nobody on the Lab Crew can see it!

Once you're out of the room, pick one player to go first. He or she looks at the large drawing through the Spyglass. Then this player draws, on the attached pad of paper, ONLY WHAT CAN BE SEEN IN THE WINDOW OF THE SPYGLASS.

Next, this player runs over to the Lab Crew and hands over his or her drawing. The Research Crew CANNOT communicate with the Lab Crew in any other way: no words or gestures are allowed!

Meanwhile, another kid puts the spyglass in a different place and makes a new drawing.

HINT: Try and come up with a system for making your drawings, so it's easier for the Lab Crew to piece them back together.

LAB CREW:

The Lab Crew's job is to re-create the original drawing, using only the smaller drawings from the Research Crew.

Once you think you have enough drawings, start drawing what you think the original picture looked like.

At any time, you can call over someone from the Research Crew and show them what you've got. If you're right, they should tell you. If you're not there yet, they can't give you any hints – they just need to bring you more drawings!

See how many drawings you can re-create in 15 minutes. Or, have two or more teams race against each other. The first team to accurately re-create the original drawing is the winner!

Debriefing

Were you able to effectively communicate the original drawing? What helped? What made it tougher?

Can you think of any scientific discoveries that were pieced together after many years of clues? Are there any scientific "discoveries" that are still being pieced together today?

If you've got your Case Journal, go ahead and answer the questions in it now!

Metal Heads

Briefing

When it comes to giving instructions, scientists, like computer programmers and robotics engineers, have to re-train their brains. That's because robots and computers understand EXACTLY what you tell them – nothing more, nothing less. You'll see how different that is in this Move Crew.

Activity

HOW TO PLAY:

Find a partner and work in pairs. Choose one player to be the "robot" and one to be the "programmer."

Programmers, think of something you want to get the other player to do. It should be fairly simple, but it should involve a few steps. (For example: pick up a pencil, walk across the room, and put the pencil on a desk.)

Guess how many steps you think it will take to get them to do it. Write the number down on a piece of paper.

Now, give your instructions, one at a time, to your robot. They should be very exact. For example:

- Take 2 steps toward the pencil.
- Open your fingers.
- Move your arm until your hand touches the pencil.
- Bring your fingers and thumb together to grab the pencil.
- And so on.

Speak each command one at a time. (It's like a very exact game of Simon Says) Write down each command that works.

Robots, follow the instructions EXACTLY. Do whatever you're told, but don't do anything you aren't told to do. You can move only the parts of your body that the Programmer tells you to move. If something isn't exact enough (like "Go get the pencil") say "Command not understood – try again!"

When you're done, count the number of commands it took to get the job done, switch places and start over.

Debriefing

How many steps did it take to do the job? More than you expected? In real life, problems that seem easy to a person often have to be broken down into several commands in order for a computer to follow them. If the wording isn't precise, the whole program can break down!

If you've got your Case Journal, answer the questions in it now!

The Face of Science

What does a scientist look like? There's more than one answer to that question! You'll come up with a bunch of them in this Smart Art.

Activity

WHAT TO DO:

This activity can be done alone or in a group.

STEP ONE
Draw a picture of a scientist at work. If you're in a group, don't look at anyone else's drawings until you're all finished.

STEP TWO
Using the form on page 68, take an inventory of the features of your drawing.

Is your scientist using any tools, instruments, or special equipment? What?
If you're working alone, check off the features that describe your scientist.
If you're working in a group, have each person report on his or her drawing, keep track of everyone's answers, and total up the numbers on each side.

"THE FACE OF SCIENCE"

In each space, put a check next to the word that best describes your drawing.

If you're working in a group, have each person fill this out and then add up the total number of each kind of response.

AGE OF SCIENTIST: Old ____ Middle Aged ____ Young ____

GENDER OF SCIENTIST: Male_____ Female _____

MY SCIENTIST IS: White _____ African-American ____
Asian _____ Middle Eastern _____ Hispanic or Latino _____ Other _____

Where is the scientist working? Inside _____ Outside _____

Describe the scientist's workplace:

_____

What is your scientist wearing?

_____

STEP THREE
Look at the features of your scientist, or the features that were used most often in drawings by the group. Were most of the scientists male or female? Old or young? Discuss why you think some features were more common than others.

STEP FOUR
See if you can find examples of scientists who have features that are very different from what came up in your drawing, or in most of the drawings the group made. If you want some ideas, go to these Web sites:

http://www.idrc.ca/library/document/102386/portrait.html
(Portraits of Development Research)

http://www.csy.com/MISProgram.htm
(Minorities in Science Program)

http://www.astr.ua.edu/4000WS/4000WS.html
(4000 Years of Women in Science)

http://www.extremescience.com/GalleryofScientists.htm
(Extreme Scientists Gallery)

http://www.sacnas.com/biography
(SACNAS Biography Project)

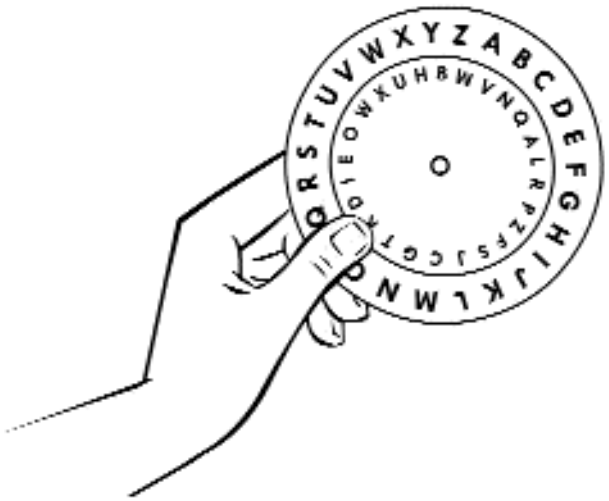
http://thechalkboard.com/Corporation/Dow/Programs/Inventors
(Profiles of African American Scientists and Inventors)

Debriefing

Why do you think certain ideas pop into your head when you hear the word "scientist?" Are these ideas always accurate? What kinds of scientists did you come across in your research who didn't fit the first image you thought of?

If you've got your Case Journal, go ahead and answer the questions in it now!

Code Cracker



Briefing

Whether it's the genetic code, an ancient language, or patterns of light in a distant galaxy, scientists often have to play the role of decoder. In this Write Away, you will too!

Activity

WHAT YOU'LL NEED:

- Construction paper or cardboard
- Something to write with
- Scissors
- A paper clip or brass fastener
- A compass or something round to trace

WHAT TO DO:

STEP ONE: CODE IT!

- First, make an alphabet wheel to create a secret code.
- Use a compass to trace one circle that is 6 inches across, and another that's 5 inches across.
- Cut the circles out.
- Connect the centers of the circles by poking holes in the middle and attaching them with a brass fastener or paper clip.
- Now draw lines to divide up the circles into 26 sections. You'll need 13 lines. You'll have to work around the paper clip or fastener!
- Write the alphabet around the edge of the outer and inner circles.
- Now, you're ready to make your code. To do it, turn the inside circle so its letters line up with different letters on the outside circle. When you're writing code, look at the outside circle for the letter you want, but write down the letter you see on the inside circle.
- Write a message in your code. It should be at least six or seven words long. When you're done, trade messages with other kids in your group.

STEP TWO: DECODE IT!

Now it's your job to decode the message you've been given! Here are some hints:

- You know the code was created using this wheel – so if you can figure out what one or two of the letters are, you can figure out the whole thing.
- Look to see what letters come up the most in the code. These might be common letters like the vowels E, A, O, or I, or the consonants T, R, S, N, or L.
- Think of words that you know, like "the," "in," "on," "at," "and," and so on. Do any patterns in the code match the patterns of these little words?

- Lots of words end in "s." Are there words that end in the same code letter in your message? What if that letter stood for the letter S?
- Try decoding the message in several different ways. If a code doesn't work, try again!

Debriefing

The decoding techniques you used, like looking for common letters, watching for familiar patterns, and trying different things until something works, are the same ones that scientists use when they're decoding. Often, their job is much tougher because they don't know the coding system (like the letter wheel), or because the codes they're trying to crack are much more complicated.

Can you think of some puzzles that a scientist might have to decode?

If you've got your Case Journal, answer the questions in it now!

Here's the coded message:

JINRXVCYBVCZINP. MIY LVKU QVPCUXUO CLU PTZBBP CI OUJIOU CLZP QUPPVRU.