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Academics and Outdoor Skills: Integrating Outdoor Skills and Academic Content in Classroom and Small Group Settings

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Academics and Outdoor Skills

Integrating outdoor skills and academic content in classroom and small group settings.

Melissa Boyer
Honors Senior Project
Fall 2006-Winter 2007

Advisor: Janet Mock
HONORS THESIS

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ACADEMICS AND OUTDOOR SKILLS

Integrating outdoor skills and academic content in classroom and small group settings.

Overview of Project

Topics and Format

There are many concepts that tie outdoor skills with education (see Appendix A). To model the idea, I picked one main concept (heat) and three outdoor skills topics attached to that concept. The three skill areas are wood fires, cooking with charcoal, and clothing and hypothermia. There is a focus on safety in the outdoors in all three areas.

The three areas follow the same format. At the beginning of the section are several charts outlining key ideas, prerequisites, and possible extensions. This is followed by information providing a background in both outdoor skills and academics for the instructor. Finally there is a lesson on the topic suitable for a small group (such as a Camp Fire club) and a lesson suitable for a classroom. (The section about charcoal has only one lesson, which can be adapted for both environments.)

The lessons have not been tested as they are here. I’ve made changes since teaching some of the lessons and have combined or adjusted things I’ve already taught. I tried to make them as suitable for as diverse of circumstances as possible, but your individual situation and experience will affect exactly how you use them. I’ve made every effort possible, both in lessons and in background information, to provide the highest-quality and most current instruction and information.
One day, in a high school biology class, my teacher decided to teach the class how to use a compass. She said that it was a good skill to know and it was consistent with her goal of exposing us to areas of science beyond biology that were frequently in school. I assume the connection between compasses and science that she was referring to was magnetism, but it was never discussed explicitly. Before class, she had created a compass trail and gathered enough compasses for each small group to have at least one. She stood up in front of the class—wearing a thick belt with a large metal buckle—and showed us how to use a compass.

Although her idea was great, there were a few problems. First of all, her experience with compasses consisted of one lesson from her Boy Scout son. I don’t know whether her son wasn’t taught well, her son hadn’t learned all the information yet, or she didn’t remember everything, but the technique she demonstrated and some of the information she provide wasn’t correct. A more serious problem was the course was impossible to follow, because she was wearing her belt when she made the course. (A large chunk of metal right by a compass prevents the compass from working.) A few of the groups got frustrated and she tried to help them, but most of us wandered around campus for about forty-five minutes until we decided that we were probably expected back in class.

There were two main reactions to the lesson. Those of us who did know how to use a compass thought that learning about them in school might be cool, but that her lesson was a joke. Those who didn’t know how to use a compass thought that compasses
I occasionally teach outdoor skills at local Camp Fire events. Last spring, at a camporee run by the Samish Camp Fire Council, I was teaching pacing and compasses to clubs at Camp Kirby. When I'm teaching pacing, I help kids calculate their pace. As I was explaining what to do, it reminded me more and more of what I had been learning in my Teaching K-8 Mathematics course. On the drive home I started thinking of the many connections between outdoor skills and academics. I realized as I learned more about education as a pre-service teacher, I slipped more and more academic connections into my outdoor skills lessons.

I started thinking, "Why not introduce or review academic concepts through outdoor skills? For that matter, why not introduce outdoor skills in a lesson focusing on an academic content?" If taught properly, there would be benefits in both areas, including a deeper understanding of academic concepts and outdoor skills.

**Philosophy**

While completing this project I developed four main ideas about lessons connecting academics and outdoor skills. My ideas are based on what I have learned in Woodring College of Education and my personal experience. I think this philosophy is also valid for integrating other areas with academic content.

The first principle is that you should have clear, standard-based objectives for each of the subjects that you are teaching. Objectives provide goals and direction that are necessary for quality instruction and assessment. I recommend that your objectives are
based on accepted outdoor skill and academic standards, for two reasons. First, it is a
simple way to verify that experts consider your topic valuable. Second, it is important to
make sure that the goals of your lesson match with the overall goals of your community,
school, or program.

The teacher, instructor, or leader should be knowledgeable in all areas he or she is
teaching. This does not mean that someone using the lessons I created needs to be an
expert in science, math, and outdoor skills, but it does mean they need some background
information in each subject from a reliable source. If an instructor has not learned
appropriate background information they are likely to teach the topics incorrectly. In
Richardson and Simmons' (1996) article, "Recommended Competencies for Outdoor
Educators," the authors suggested training or background for anyone teaching in the
outdoors which included knowledge and skills regarding the outdoor subject, education in
general, how children learn, outdoor education, environmental understanding,
instructional methodologies, and different learning environments.

My third principle is that all instruction should be developmentally appropriate.
In academics this means only teaching things that the child has the capacity and past
experience to understand. In outdoor skill this means following an appropriate
progression of skills whenever possible. For example, car camping skills should be
taught before backpacking skills. In all areas the length and type of instruction, as well as
activities, should be age appropriate.

Finally, I think it is important to remember that you don’t need to teach
everything. It is easy to become enthusiastic and overdo it. I would like outdoor skills to
be part of the curriculum in the classroom, but they should only be a very small part. In
outdoor skills lessons it is important to make explicit connections to what students are learning in schools, but the activity isn’t likely to be very fun if you lecture extensively on academic topics. Moderation in both cases is crucial.

Standards and Framework

In each lesson, I included specific academic or outdoor skills goals (GLEs or Camp Fire awards) created by recognized organizations. When creating lessons I used well-known expert sources to determine what the most important things were to know and to be able to do.

Washington state public education uses a set of Essential Academic Learning Requirements (EALRs) to direct their teaching. These are based on national standards and best-practice in each field. The EALRs include specific Grade Level Expectations (GLEs) of what students should know at the end of each year in each subject. I used the GLEs – with the support of other documents – to structure the academic portion of my lesson and to determine what was age-appropriate.

There are a number of quality sources for information and standards regarding outdoor skills. They often work together, and the information they provide is fairly consistent. I used the three that I’m most familiar with: American Camping Association, Camp Fire USA, and Leave No Trace. (Further information about these sources is available in Appendix B.)

American Camping Association (ACA) serves a variety of functions, such as accrediting children’s camps. They have produced a series of texts discussing how to teach outdoor living skills, with a focus on safety and limiting environmental impact.
Their program is divided into levels; each level has skills to learn in different content areas. Level is based on previous experience rather than age. Most of the skills that I used were from levels two and three.

Camp Fire USA is a youth organization for boys and girls up to 17 years old. The Camp Fire program has several awards related to outdoor skills. Starting in third grade, children can earn beads for specific tasks, such as outdoor skills. Additionally, there are a series of emblems in the Progression in Outdoor Action (commonly called the POA or Progression in Outdoors). Each emblem is earned by mastering a number of skills at the same level of progression. It usually takes a year or two to earn one emblem. Outdoor education varies from council to council, but usually includes adult trainings, overnight or one-day events for kids, and summer camps, as well as activities done by individual clubs.

Leave No Trace (LNT) is a program that focuses on principles for low-impact outdoor recreation. They work with different organizations to provide a number of trainings for adults and children, as well as a variety of written information.

Why Integrate Academics and Outdoor Skills?

*What are outdoor skills and why are they beneficial?*

The term “outdoor skills” is often used interchangeably with “outdoor education” and even “environmental education.” When someone says that they are going to teach outdoor skills, they usually mean that they are going to teach skills needed for a camping trip or a hike, such as use of pocket knives, fire building, and setting up a tent. When someone hears a person say that they are going to teach outdoor skills – particularly in a
school environment – they usually think of learning about nature or about the impact
people have on the environment. For the purpose of this project I am defining outdoor
skills as skills used in a natural outdoor setting, particularly those that help a person
survive comfortably in the outdoors with minimal environmental impact.

Most people – especially children – enjoy being in an outdoor natural setting.
The majority of people who are initially uncomfortable in the outdoors enjoy themselves
after gaining experience and knowledge. Scheder (2002) cites peace, quiet, fresh air,
“getting away from it all,” no electronic distractions, no daily stresses, freedom,
opportunity to be a cooperative member of a group, the spirit of adventure, and enjoying
a challenge as reasons children and adults love the outdoors.

_The Outdoor Book_ (Camp Fire Boys and Girls, 1980) suggests that the outdoor
experience allows children an opportunity to gain self-reliance. Outdoors can help fill
needs for “positive self esteem, meaningful socially responsible roles, decision making
skills and a positive support system,” (p. 11). Most people who teach outdoor skills agree
that outdoor activities often seem to increase a person’s confidence or self-esteem,
particularly for girls.

Learning outdoor skills gives children an opportunity to succeed in an area that
they might think beyond them. It is extremely empowering for a teenage girl, who is
really good at doing her nails but is afraid to sleep in a tent, to be able to chop wood, or
for a fifth grade boy who is teased for being a “wimp” to go on a challenging
backpacking trip. When teaching outdoor skills, one of the things that I hear the most
often is “Look! I can do it!” Many kids – and adults – are thrilled to think of themselves
as a capable person, someone who can get the fire going in the rain, who can plan and
prepare breakfast outdoors, and who can use a map and compass to find the way back to
the trail when the group is lost.

Many of the most popular forms of recreation worldwide – from camping in the
backyard to mountain climbing – require outdoor skills, (Scheder, 2002, p. 13) perhaps
because people find being in the outdoors enjoyable and the activities rewarding.
Unfortunately, a large portion – perhaps the majority – of the injuries and deaths that
occur from outdoor activities are the result of incorrectly performing a skill, rather than
because of inherent risk. For example, people die of hypothermia were usually wearing
inappropriate gear and frequently were with a group that did not recognize the signs of
hypothermia. Teaching outdoor skills – with an emphasis on safety – can prevent these
tragedies.

Additionally, the large number of people participating in outdoor activities has a
negative effect on the environment. Ironically, people travel to “pristine” areas to enjoy
the simplicity and pureness of nature...and leave candy wrappers and toilet paper behind.
Teaching children how to participate in these enjoyable activities with minimum impact
on the environment is necessary for the future. Educating people about minimum-impact
camping (also called low- or no-impact or no-trace camping) involves teaching
environmental awareness and training in skills that allow people “to live comfortably
outdoors with minimal impact on the surrounding environment,” (Scheder, p. 45).

Finally, there may be cognitive benefits to teaching outdoor skills. I believe that
outdoor skills education provides experiences that students can use to help better
understand academic concepts. Cronin-Jones (2000) did a study, with third and forth
graders, comparing environmental science instruction in a traditional classroom with
environmental science in school yards. She found that both improved scientific knowledge and attitude towards the environment, but activities outside had a far stronger effect. She proposed the likely explanation that the outside activities were more hands-on, which would improve interest and understanding of science.

*Why teach two subjects at once?*

Traditionally each school subject or discipline was taught separately. Now many educators are trying to integrate subjects in the classroom to create a more authentic, effective learning experience. Martin (1997) states that science can’t be isolated, that to understand and apply a scientific concept, you must connect it with language, math, technology, other areas of science, and so forth. It is common to look for connections between two academic subjects and between an academic subject and a non-academic subject (such as visual art or music). For example, a book (literacy) can be used to introduce a mathematical subject, or students can discuss sound waves and vibration when learning to play a stringed instrument.

Teaching two subjects together – or even providing connections to another area of study during a traditional lesson – is a valuable practice for students. Problems and discussions focus around real life, authentic issues, which leads to a higher level of student engagement in learning. Academic skills – such as math, science, and literacy – don’t exist in a vacuum, so integrating subjects allows students to better understand and apply new skills.

Martin (1997) described two approaches to integrating subjects in the classroom. The first, which he called the “daisy” model, involves teaching one main subject (for
example, science) and connecting other subjects (outdoor skills, math, and communications). The main subject is the center of the “flower” in his model, and the other subjects serve as “petals.” The second method is a true interdisciplinary model. He called it the “rose” model. All subjects (or petals) are intertwined to solve a problem.

Rakow and Vasquez (1998) suggested three main strategies to integrate activities. Literature-based integration uses children’s literature to explore, introduce, or summarize other areas of study. Theme-based integration uses one central-theme or concept to connect all the disciplines. A unit on water could involve science (evaporation), social studies (history of water and cities), literacy (stories), and so forth. Project-based integration uses a problem or goal, such as improving a problem with equipment at recess, to incorporate subjects. In this example, writing and math could both be involved by students writing letters to the school board after estimating the cost required to fix the problem.

Has this been done before?

People have been using outdoor skills in the classroom for years. There are two common approaches.

The first approach is using an outdoor environment as a setting for teaching academic skills. There is a focus on nature and environmental education. Most often, students learn about what they see outside (nature, including plants, animals, and rocks) and connect it to science. For example, outdoors can be used as a location to teach and practice scientific observation, (Glatfelter, 1997). Many of these programs discuss the impact individuals can have on aspects of the environment such as erosion. This type of
education can vary from a single lesson to experiential education programs. The academic subject is generally science, but there are a few activities involving applied math or a historical tour of an area. For example, one teacher (Basile, 1999) used an outdoor setting to collect data with her young students, encouraging students to look for patterns to learn about the outdoors and math.

The second approach is teaching outdoor skills in an outdoor education program run by the school. Programs usually are three to seven days long, and focus on learning outdoor skills in an adventurous setting. One educator (Mahler, 2000) set up a camping program at her school that ran somewhat like a club. Outdoor skills are generally taught by guest experts, rather than teachers. Guest teachers are generally not educated in teaching academic subjects.

Both approaches are an excellent way to introduce kids to the outdoors through school. What they do not do is provide an explicit connection between academics and frequently used outdoor skills. Knowing about nature is a valuable outdoor skill, but it is less practical and less used than knowing how to cook dinner outdoors. There are very few lessons filling this gap.
WORKS CITED


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### TOPIC: Wood Fires

#### KEY CONCEPTS:

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<tr>
<th>Outdoors</th>
<th>Academic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire safety – g, c</td>
<td>Making observations – g, c</td>
</tr>
<tr>
<td>Minimizing environmental impact – g, c</td>
<td>Human impact on the environment – g, c</td>
</tr>
<tr>
<td>Fire building methods – g</td>
<td>Heat as a form of energy – g, c</td>
</tr>
<tr>
<td>Stick cookery – g</td>
<td>Differences in soils – c</td>
</tr>
<tr>
<td></td>
<td>Using a chart to record observations – c</td>
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</tbody>
</table>

*Concept included in small group lesson – g*

*Concept included in classroom lesson – c*

#### LESSON SUMMARIES:

<table>
<thead>
<tr>
<th>Small Group Lesson</th>
<th>Fire Building</th>
</tr>
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<tbody>
<tr>
<td><strong>Title</strong></td>
<td>During the first session, students learn how to build fires using food to represent different parts of the fire. During the second session, students build and light real fires. Concepts (especially safety) are reviewed. Students have a chance to observe a fire burning while cooking marshmallows or other snack.</td>
</tr>
<tr>
<td><strong>Overview</strong></td>
<td></td>
</tr>
</tbody>
</table>
| **Prerequisites/ Age** | • Adventure level (preferably 4th grade) and up  
|                     | • Completed Pathfinder; working on Fire Tender |
| **Academic Standards** | GLEs - science  
|                     | • 1.1.4 (4th grade)  
|                     | • 1.2.2 (4th grade)  
|                     | Benchmarks - health  
|                     | • 2.3.1b |
| **Camp Fire Awards** | Beads  
|                     | • TE124  
|                     | • TE290  
|                     | • TE292  
|                     | • TE293  
|                     | • TE294  
|                     | POA  
|                     | • Fire Tender 6  
|                     | • Fire Tender 7 |

(continued on next page)
### Background Information
- Safety
- Minimizing environmental impact
- Preparing to build a fire (adults)
- Gathering fuel
- Building a fire
- Extinguishing a fire
- Stick cookery
- Heat
- Making Observations

### Classroom Lesson

<table>
<thead>
<tr>
<th>Title</th>
<th>Classroom Lesson</th>
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</thead>
<tbody>
<tr>
<td><strong>Fire Impact</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Overview</strong></td>
<td>Students study the impact of fire on soil, by examining soil from below a fire pit and soil in a similar area that has not been burned. They discuss Leave No Trace principles and safety issues related to fire.</td>
</tr>
</tbody>
</table>
| **Prerequisites** | • 3<sup>rd</sup> grade and up  
• Some experience making scientific observations (or do extension activity first) |
| **Academic Standards** | Science GLEs  
• 1.1.5 (3<sup>rd</sup>)  
• 3.2.4 (3<sup>rd</sup>, 5<sup>th</sup>) |
| **Camp Fire Awards** | Beads  
• TE124  
• TE190 |
| **Handouts**   | • Chart – key questions and chart to record data |
| **Background Information** | Safety  
• Minimizing environmental impact  
• Heat – Heat, Temperature, and Energy section  
• Making Observations  
• Variables  
• Working with soil |
| **Extensions** | • Making Observations: A sample activity to teach observation. Collect enough leaves or small rocks for each child in your class to have one. Give them time to examine their object closely. Ask for detailed descriptions of their objects properties. Then put all the objects together in one pile, and have students try to find the object that they originally had.  
• Sorting Soil: Provide small samples of diverse types of soil that have been burned by a fire and that have not been near a fire. Do not label or organize the samples. Ask students to sort them based on whether they are “fire” soil or not. Are there other ways they can sort the soil? |
**Wood Fires**

**ADDITIONAL RELATED ACADEMIC CONTENT:**

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Content (GLE)</th>
</tr>
</thead>
</table>
| 6th, 7th    | Surface area – Tinder lights on fire easier because it has greater surface area than small fuel  
  - Math 1.2.1 (working draft)  
  - Math 1.2.6 |
| 4th, 6th, 9th | Friction – is needed to light matches  
  - Science 1.2.2 |
| 10th        | Energy and Heat – Further understanding of the definitions of energy and heat, related to particles  
  - Science 1.2.3  
  - Science 1.1.4 |
| 4th, 6th, 7th | Transfer and Transformation of Energy – How marshmallows cook, fire warms/burns  
  - Science 1.2.2  
  - Science 1.3.3 |
| 2nd, 4th, 5th, 7th | Heat and Change of State – The role heat plays in the change of a substance’s state  
  - Science 1.3.3 |
|              | Combustion – the three things needed for fire to burn are three big ideas for combustion (oxygen, heat, fuel) |
Wood Fires

In this section, I discuss wood fires (fire made out of wood rather than charcoal) used in the outdoors. They are additional things to consider for indoor fires or charcoal fires. I use the word “fireplace” to refer to anywhere your fire is built.

SAFETY

Keeping a safe area
- Don’t ever leave matches or lighters lying around.
- Keep your fuel away from the fire.
- If you are building a new fireplace or using one that you aren’t sure is safe, consider the following:
  - It is important to look at what the fire is built on. A large base of rock, a bunch of pine needles, or soil filled with rotting wood is hazardous. You want a foundation of “mineral soil” (dirt, sand, and only small pieces of rock) for several inches below the surface.
  - Also look for exposed tree roots. Fire can travel underground along roots and come up in another place.
  - Be carefully when building on rock or surrounding your fire with large rocks. Some rocks may be water-saturated and explode, such as limestone, shale, or layered rocks. Do not gather rocks for your fire from a stream-bed.
  - Clear the area of flammable items within three feet of the fire. This area can also serve as your “kitchen” or cooking area if you are with kids. (They aren’t allowed in there unless they are working.)
  - Things you want your fire close to: the area where you are preparing wood or eating. Things your fire should be further away from: logs, stumps, tree trunks, your tent, your woodpile.
  - Look above your fireplace for low branches. You should have at least a thirty foot clearing.
  - Make sure that your fireplace is contained. This limits how big your fire can get. Surrounding a hole in the ground with rocks is a common method. Making a mound fire (directions in next section) does the same thing and is more environmentally friendly.

Materials to have on hand
- Keep a bucket or pan full of water, near the fire. Know where you can get more water. Possible sources include water bottles, a faucet, or a nearby lake.
- A shovel or trowel can be used to put soil on a fire. This keeps the fire from spreading.
- If you are cooking with grease, make sure you and your group are ready to put out a grease fire.
  - Water makes it worse. Use salt, flour, baking powder, or a lid of a pan.

Personal Safety
- Tie back long hair.
- If wearing loose clothing, remove it, tuck it in, or roll up sleeves. Nothing should be hanging over the fire when you are cooking or lighting it.
Wood Fires

• Be careful of synthetic clothing (such as windbreakers or running pants). When an ember lands on this material it melts, which can lead to serious burns.

Tending the Fire
• Never, ever leave the fire unattended. Someone should always be in the area monitoring it.
• Keep the fire small; only as big as absolutely necessary.

Emergencies
• You are unlikely to have a fire get out of control if you follow all other safety precautions. Still, it is important to be prepared.
• Know how to report a forest fire or a fire that has gotten out of control. Know the address you are at or your location on a map, and have an evacuation plan ready. (This can be as simple as: everyone loads into the van without grabbing their belongings. If the main road is blocked, this side road will get us out too.)
• If the fire gets out of control IMMEDIATELY get your group safe and report the fire.

MINIMIZING ENVIRONMENTAL IMPACT

Forest Fires
• There are many negative effects of wood fires on the environment. The biggest is the potential of accidentally starting a wildfire. Following safety rules is the best way to minimize this risk.

Other Options and Clean Air
• Fires are nice to sit around at night, convenient for outdoor cooking, and – in my opinion – an important early step in the progression of learning outdoor cooking skills. Regardless, they are not great for the environment.
  - Ideally, avoid building fires unless they are necessary for survival. This is the best way to minimize environmental impact.
  - Practically, if you are using a fire for cooking (and there are other better options, especially as your group gets older), make a small fire (using all the safety and minimizing environmental impact tips) and let it burn out as soon as you are done cooking. Some alternates to fire in the evening:
    • Have your kids go to bed early. They are likely to enjoy having time to hang out and chat in the tent or cabin as much as they would around the fire.
    • Play flashlight tag.
    • Enjoy the night. Get your group comfortable with night sounds, seeing in the “dark,” and looking at stars. Maybe even go for a night walk.
• In many areas fires aren’t allowed or their use is restricted. Your group needs to learn how to use other, more environmentally-friendly options.
  - Use alternate heat sources for cooking, such as camp stoves. (There are many options for stoves using various kinds of fuel. Some are big enough to easily cook for a large group. Others are small enough to take backpacking. Most are very easy to use.)
Wood Fires

- After your group has progressed beyond cooking things on the fire, limit the number of fires you make.
  - Bring proper clothing and equipment to keep you warm. Fires aren’t really an efficient way to keep a large group of kids warm over a longer period of time.

Fuel

- Build smaller fires, build fewer fires, and let your fires go out sooner.
- Know how to gather fuel in an environmentally-friendly way.
  - Imagine what would happen if every group gathered their fuel as close together as possible and as close to the fireplace as possible. The area would have no time to recover. Spread out.

Soil and Ashes

- Fire can harm the soil below it. Often soil sterilized by fire can’t grow new plants for a while. (NOTE: One confusing issue for children is that ashes can actually enrich soil that is low in certain nutrients, making it better for growing things. Focus on the idea that human-made fires are not natural to the environment.)
- Only build fires in designated fireplaces unless it is an emergency.
  - If you build a fire in a non-designated area in an emergency, make sure you dismantle and clean the area afterward.
    - If it looks like a fireplace, other people are likely to make fires there.
    - Your goal is always to change the environment as little as possible.
- If there isn’t a designated fireplace, there are a couple of environmentally-friendly options.
  - Fire blankets
    - A fire blanket is a piece material that is designed not to burn. It is placed in a flat, clear area as a protective layer over the soil.
    - When using a fire blanket, you spread a layer of soil on top of the blanket and make a fire as usual.
    - A fire blanket can keep the area clean and the fire contained (it shouldn’t be big enough to spread off the blanket).
    - When your fire is out, you can easily throw away your ashes. Then the blanket can be folded up and used again.
  - Fire pans
    - You can buy a special fire pan or use a metal oil pan. Much like a fire blanket, you simply put a layer of soil in the bottom, and build your fire on top of that soil.
    - Again, the fire pan keeps the area clean, the fire contained, and it allows you to easily dispose of your ashes.
  - Mound fires
    - Unlike fire blankets or fire pans, mound fires can’t be set anywhere.
      - Mound fires help prevent searing the ground below.
      - They are a good alternate to traditional fire rings, if A. It is an emergency and you absolutely have to build a fire to survive, or B. You are creating an area on your private property to have a fire once or twice.
Wood Fires

- To make a mound fire, build a circular mound that is six to eight inches high and twenty-four inches in diameter as the base for your fire. Build your fire on a flattened area on top.
  - This provides a big enough area for cooking. A small, light grate can be placed on top.
- Use the safety rules from the “safety” section: Don’t build on large rocks (rocks can explode, which is dangerous and can leave scars on the ground).
- Once your fire is out, it is easy to disperse the ashes and extra soil.

Packing-out Trash vs. Burning Trash

- The best rule to give kids is we don’t burn trash. We put it in the garbage can or take it with us in a garbage sack. If that is the rule you give, make sure you follow it when your group is present.
- The more complicated, adult version:
  - Never burn aluminum, steel, or plastic. They will not burn all the way leaving garbage (you’ve probably seen it in fire pits at campgrounds before).
  - Food waste should not be burned.
  - There are some things that are okay (but not necessarily good) to burn. Make sure anything that goes in the fire is fully consumed and turned to ash.

PREPARING TO BUILD A FIRE (FOR GROUP LEADERS)

Where to build your fire

- Is there some sort of fireplace available? What kind?
  - There are several types of established contained fireplaces: brick/stone fireplaces, raised/upright grills, and fire rings (often bound by cement, metal, or rocks; sometimes including a grate).
  - Do not build a fire in a place that does not have an established fireplace.
- Make sure that the fire is built in a safe area. Look for danger of your fire spreading under, over, and around the fire. Read safety information carefully.

Safety and Logistics

- When planning your fire, check the forest or park services for restrictions on open flames in your area. Fires may not be allowed, size may be limited, or other restrictions may apply.
  - If you are building your fire on private property that is not controlled by forest services or park services, there may still be restrictions. Burn bans or other restrictions are often posted. Contact your local fire station for information.
  - While you are getting this information, write down the phone number to call to report a fire. (In residential areas you usually call 911, but the number to report a forest fire is different.)
- Make sure you know what you are doing.
  - If possible, have someone who has training in fire building teach you and your group the first lesson. If your teacher has experience, but not recent training,
Wood Fires

make sure they are familiar with issues related to environmental impact (this stuff may have been updated since they learned to make a fire) and are using techniques you consider appropriate (not using lighter fluid, etc.)
- Read all material provided and make sure you are familiar with them, especially safety issues.
- Practice making a fire on your own.
- If fire building is new to you, it may help to develop a safety checklist to use. (Is the area safe – no hazards under, above, around, or in the area I’m going to build my fire? Is everyone’s hair tied back and loose clothing secured? Etc.)

Materials
- Fuel
  - Is their fuel available at the site? If not, you will need to bring some.
- Matches
  - If there is any possibility that your matches might get wet they should be waterproof or in a waterproof container.
    - There are several methods to waterproof matches. Additionally, waterproof matches can be purchased. Test them in advanced. Some are easier to light than others.
    - Old film canisters work well to store matches. Special containers can be purchased for this purpose. If you are going car camping or having a cook out, generally putting your match box in a sealed plastic baggie is sufficient, if you make sure you don’t leave your matches out.
  - Large wooden kitchen matches are the easiest to light, especially for new users. Strike them on a closed box. (Rocks also make a good striking surface.)
  - Gas lighters (like you use at home for a charcoal grill or for lighting candles) are easy to use. They last a long time and allow kids to hold the flame farther away.
    - Choose a lighter that is easy to light – some require coordination of several movements (that can be hard for smaller hands).
    - If you use a lighter at this time, I strongly suggest teaching your group to use matches at a later time. It is a very useful skill to have.
  - Matches and some type of fire starter (you can make these, buy them, or use tea light candles or tightly rolled newspaper) are some of the “ten essentials” that you should always bring with you on outdoor excursions.

GATHERING FUEL

Tips for Gathering Wood with Kids in an Environmentally-Friendly Manner
- Gathering wood away from the main campsite keeps the area more natural. Try not to gather everything from one place.
  - Have kids gather with a buddy within 100 yards of the campsite (or use natural barriers to keep them in an area that you can see/hear them). Alternatively, you can go on a short walk with the group to gather wood.
- Only pick up things that are dead and fallen on the ground.
  - Do not break wood off, even if the tree or plant is dead.
  - Green, recently fallen, or wet wood will not burn effectively. Avoid these.
Wood Fires

- Do not gather pieces that are thicker than your wrist. You should be able to break all wood that you gather by hand.
- Only gather enough for the group’s use.

**Chopping and Storing Wood**

- If you are staying at a camp or other privately-owned area, there may be wood that has been removed from an area available for use as firewood. Only use it if the owner/manager/caretaker says it’s okay.
- Avoid large pieces of wood. They are unlikely to burn all the way in one sitting and are harder to start burning.
- Anyone who is chopping wood into kindling should be properly trained.
- Store excess wood that has been cut in a safe, dry place.
  - Make sure that your wood pile is far enough from the fire so that it won’t catch on fire by a spark.
  - The wood should be stacked neatly, so that it is easy to get and so that it won’t fall on anyone when they are getting wood.
  - Think about what happens if it rains. In addition to protecting your wood pile from rain above, sides should be protected (as many sides as possible), and ideally your wood pile should be set off the ground, especially if it is on or at the bottom of a slope.

**Types and Sizes of Fuel for Wood Fires**

There are three sizes of fuel. Size is based on thickness of the fuel, which affects how easily it will catch on fire. Any fuel should be broken into pieces so that it is short enough to fit in the fireplace neatly.

- Tinder is the smallest size. These pieces are no bigger in diameter than a match stick.
  - They include: birch bark, wild grapevines, small sticks, dried spruce, dried tamarack, dried pine needles, lichen (such as “witch’s hair”), small pieces of wood, and dry plant stalks, among others. Newspaper would be considered tinder, although it is not recommended.
  - Tinder is the fuel that will catch on fire very easily. Unlike larger sizes of fuel, you should be able to light it using a match.
- Kindling is the middle size. These pieces should between the size of a pencil and the size of an adult’s thumb or index finger. (Kindling that you chop is often thicker.)
- Small fuel is the largest type of fuels. It should be bigger than kindling, but smaller than the size of an adult’s wrist if you are gathering your wood. (If you chopping wood that needs to be removed or bringing your own, you may have bigger small fuel. In this case aim for pieces smaller than six inches in diameter. It is easy to add more wood.)
Wood Fires

BUILDING A FIRE

Arranging the Fire

- Collect fuel.
- Remember fire needs sufficient amounts of three things to burn or it will go out. (This is an extremely important concept.)
  - Fuel (such as your wood)
  - Oxygen/air
  - Heat source (such as your match to start the fire)
- There are many ways to arrange your fuel. Especially at the beginning, it often makes more sense to use a simple arrangement, such as an A-frame or a teepee fire. Both work very well.
  - A-frame: This fire is easy to build and has a stable base.
    - Use three small fuel sticks to make a base, arranged like a letter A. (The crossbar goes on top of the other two pieces.)
    - Put tinder around the crossbar and stack kindling on top.
      - Start with 8-15 pieces of kindling. Heat from the tinder will light the kindling.
      - Leave small spaces for air to move in and out, and for you to light the fire.
  - Teepee: This fire is easy to build and effective because the flame burns upward, fueling the rest of the fire.
    - Put two handfuls of tinder in the center, so it resembles the shape of a small teepee.
    - Put kindling around the tinder, and small fuel around the kindling.
    - Be sure to leave holes for air and to light the tinder.
- Some things are important for building all fires.
  - Tinder should be in the inner part of the fire. You need to leave a space for you to light the tinder later.
  - Your fire should include a variety of sizes of fuel. You need more pieces of tinder than of kindling and more pieces of kindling than small fuel.
  - Don’t put all your fuel on at once. Plan on adding fuel as your fire burns.
  - Air pockets are very important. Remember that that is one of the three things a fire needs to burn.

Lighting the Fire

- Position yourself close to the fire, so you can easily light it. Kneeling works well. The first time you may want to do a practice run; run through the movements without actually lighting the match.
- Strike kitchen matches away from you (moving toward the fire) against the box. Kids may need to practice this a few times.
- Hold the match upright and carefully move it toward the fire.
- Light the fire in an air pocket toward the bottom. You should be lighting tinder.
- After you light the tinder, throw the match in to serve as additional fuel. (This is also the easiest and most practical way of disposing of a match – you don’t have to make sure it is completely cold before throwing it away.)
Wood Fires

Adding Wood

- As the kindling is burning, add more small fuel or kindling as needed. (Make sure you are leaving space for air and aren’t building your fire too big.)
  - If children add fuel to the burning fire, make sure they are well-trained, behaving calmly and responsibly, and supervised by an adult. If not, have the adult add fuel.
  - When adding fuel be especially careful of sleeves. Hold the end of the piece of fuel. Stay as far away as possible, without flinging the fuel. (Literally throwing a log on the fire from a good distance may knock your fire over and cause problems. If your fire is nice and small adding wood shouldn’t be a problem.)
- Let your fire burn down. There is no need for big flames – coals cook better. Only add fuel as needed.
- Your goal is to have a slow, study burning fire. Sudden flames (like a “twig” fire, which develop when you keep adding tinder and kindling and require constant feeding) or large flames are not useful for any practical purpose, and increase your risk of problems.

Problem Solving

- Your fire is too big. You put on too much fuel.
  - Let the fire burn down while monitoring closely. Then add fuel slowly.
  - If your fire is out of control (it is spreading out of the contained area)
    - Use shovels of soil (which does not include flammable rotting wood or such) to smother it. This is good for containing but not putting fire out.
    - Use your water to put the fire out.
    - If you can’t control the fire immediately, evacuate the area. Remember your primary responsibility is the children. Contact appropriate authorities immediately (fire department, forest service, etc.)
- The fire starts, but burns out quickly.
  - There may not be enough of air. Make sure you have air pockets in your fire.
    - If your fire has already burned some, your fuel may be hot. An adult may need to use a stick or shovel as much as possible to rearrange the fire.
  - You don’t have enough fuel of the correct sizes. You may have enough tinder, but tinder doesn’t burn long enough to light small fuel. Add more kindling.
  - Your wood may be wet. Gather dry wood or use a fire starter.
- If it is raining or has rained recently and everything is wet.
  - Look for fuel in dry spots, such as under trees.
  - If you have to use wet wood, use a fire starter to help get things going.
  - Remember it is possible to start and keep a fire going in light rain without difficulty. A real downpour may be a problem.
  - While starting the fire, it is okay to hold a tarp (at arms length above head) or aluminum foil above the fire until it is going. Use common sense.
  - Blowing or fanning the fire gently may help.
  - Feed the fire slowly and cautiously.
  - Make sure you keep additional wood dry, protecting it as needed from water above, below, and on sides. A tarp can be used.
Wood Fires

EXTINGUISHING YOUR FIRE

How to Put it Out

- Let your fire burn down as much as possible. Ideally, it will be almost out when it is time for you to leave the area.
- Gradually sprinkle water on the fire until the coals are cold.
  - If your kids are putting out the fire, make sure you are supervising and that they have been trained in what to do.
  - Sprinkling water – rather than dumping water – on the fire has many advantages. It is less messy, it cools the entire fire, and it makes it easier for someone to start a fire in that place after you. Most importantly, if you dump water on the fire all at once it creates a lot of steam, which can cause burns.
  - Stir the coals with a stick until they are all cooled. This may take some time, but it is important. Your kids will probably enjoy putting out the fire as well.
  - You can use a shovel/trowel and sand/dirt to put the fire out, but it leaves hot coals underneath. This technique is more useful for controlling a fire.
- Do a final check to make sure your fire is out.
  - Start with your hand a foot from the fireplace, and slowly move it closer until it is within an inch of the coals (you can touch them if you want). Make sure to move your hand around, above the entire area. One area may be cool, but another may still have coals burning. You should not feel a change in temperature at any point.
  - If at any time you feel warmth, stop. Your fire is not all the way out. Sprinkle more water on that area. Consider using a stick to “stir” the fire, to help you find hot spots.
- Dispose of the coals.
  - In many areas where there is an established fireplace, it is appropriate to leave the coals there. Someone comes and removes them all at once, when the fireplace is too full of ashes.
  - If this is not the case or if you didn’t build the fire in an established fireplace due to emergency, you need to get rid of your ashes.
    - Hopefully, most of your fire has burned down, but if there are any big chunks, you need to pack them out.
    - Scatter the remaining ashes on the ground. Spread them out as much as possible, out of the campsite. (Very similar to when you were gathering wood.)

After Your Fire is Out

- Check the area to make sure that you haven’t left anything there. Make it a game with the kids (you are so sneaky that no one can tell that you were there). Your goal is to make sure that you leave as little impact as possible.
Wood Fires

STICK COOKERY

Cooking Fires
- Although less environmentally sound, wood fires are excellent for cooking. The temperature is easily regulated, they are relatively safe, and they are fairly versatile. Additionally, you don’t have to bring materials to burn in most places.
- Allow most of the fuel to burn down to coals before you begin cooking. This provides more heat and lowers the risk of something catching on fire.
- Smaller fires are better for cooking. You can get closer to the fire to cook, and big fires often provide too much heat. If your fire is too big your food may burn or you have to wait for it to get smaller.

Cooking on Sticks
- Many things can be cooked using sticks over a fire. Be creative; anything meeting the following requirements should work:
  - It will stay on a stick even if it gets hot.
  - It is usually cooked over a heat source such as a grill.
- Some common items:
  - Biscuits: Use pre- or home-made thick batter (such as you find in cans in the refrigerated section) and wrap it around the stick. Cook these slowly or your outsides will be crisp and your insides doughy.
  - Marshmallows
  - Hot dogs
  - Kabobs
- Use a clean stick.
  - You may want to scrape the bark off the tip with a pocket knife. (Only people trained to use a pocket knife should do so. If your kids haven’t learned how yet, an adult should do this.)
  - Toasting forks also work well. (The sticks you buy at the store.)
- Select sticks that are long (but not excessively so) and stiff.
- Make sure your food is securely on the stick before cooking.
- Encourage kids to cook their food slowly and steadily over coals.

Tips for Cooking Marshmallows
- If you are observing the effects of heat as an energy source, marshmallows are an excellent tool. Kids can see something change right in front of them. They can see that coals give off more heat than big flames. The change from white and soft to brown (or black) and gooey is very visual.
- At the beginning of the activity set a limit on how many each child can have (I’d recommend two) and stick to it. Marshmallows – like other unhealthy food – are best as an occasional treat and in small quantities.
- Bring a few extra. You may have more kids than you expected or someone might drop one.
- Go over safety rules in advance. Enforce these very strictly.
- Sticks should never be waved around. Someone could get hit or poked in the eye. When you have your stick – with or without a marshmallow – move around as little as possible. When necessary WALK slowly and steadily, being careful not to hit anyone. Keep the stick as low to the ground as possible (farther away from eyes). If it doesn’t have a marshmallow on it, you can point it towards the ground.

- It is especially important to be careful once your marshmallow is hot. They can fly off the sticks easily. A toasty-brown marshmallow right off the fire is hotter than boiling water and a lot harder to get off of someone.

- What to do if your marshmallow catches on fire: Very slowly bring it up to your lips. Blow out the flame. If you wave it around to get it out it might go flying into someone’s face. If you are slow and careful, worse case is it burns up and falls in the fire. You can always get a new one.

- Tell children what to do when they are done cooking their marshmallows. A. Carefully bring it to a designated adult sitting in a designated area (or call the adult to come to the child) following the rules above, or B. Teach the children to let it cool a minute and to remove it carefully, so they will not be burned.
Wood Fires

I’ve included some background information on concepts used in this lesson. I believe it is sufficient for this stand-alone lesson, but many of the concepts (such as making observations and controlling variables) require additional information and activities to teach well. Additional information about some of these topics is available in other sections and through the list of resources in the appendix.

HEAT

Heat, Temperature, and Energy

• Energy
  - Energy is very hard to define and grasp, because it is not something tangible.
  - Often energy is defined as “the ability to do work.”
    - Energy is a “state of particle agitation.” Elementary students don’t discuss the movement of particles in matter, so more complete, complex explanations aren’t appropriate.
  - Heat is one of many forms of energy. Students may have discussed other forms of energy such as electricity, magnetism, sound, and motion

• Heat
  - Heat is the transfer of energy.
    - “Heat” talks about difference in temperature.
  - Misconceptions
    - Heat is often – incorrectly - described as opposite of cold. Although hot is opposite of cold, things that we would describe as very cold and things that we would describe as very hot both have heat.
    - Heat is often described as a substance; something that is transferred in the air. It is often considered a gas.
    - We talk about “turning on the heat” to warm up a room or cook food and about heat rising. Therefore it is easy to see where the confusion comes from.
    - Air does not convey heat. A room becomes warmer as a result of a series of interactions, transferring energy.
    - Remember, heat is actually a transfer of energy. That is an action not a substance.
    - Students’ misconceptions generally stay the same even after an explanation unless something challenges their understanding.

• Temperature
  - Temperature is a measure of heat.
    - A key misconception is that heat is the opposite of cold. Students may say that temperature is a measure of heat and of cold, which is not correct. “Cold” refers to a low temperature, which means that there is less heat.

Heat Transfer

• Hot objects transfer energy to colder objects. It never happens the other way around
Wood Fires

- If you have a spoon in ice cream the spoon feels colder because of lose of energy. The “cold” from the ice cream has not been transferred to the warmer spoon. The energy (in the form of heat) has been transferred from the spoon to the ice cream.
- Children – and adults – often think of heat as a synonym for “hot.” They describe “cold” as an opposite force of heat.

• Burning something produces heat energy. This energy is then transferred to the air.
• With children, it may be helpful to discuss heat transfer in terms of energy, because the word “heat” is often confused with “hot.”
  - For example: The energy from the spoon transferred to the ice cream, rather than the heat from the spoon transferred to the ice cream.
  - Your explanations will depend on the child’s age and experience.

• Types of heat transfer
  - Conduction
    ▪ Takes place when there is direct contact between two objects.
    ▪ When you put a room-temperature spoon into ice cream from the freezer, the spoon gets colder, because heat from the spoon is transferred to the ice cream through conduction. The spoon has lost the energy it had before contact with the ice cream and thus feels “cold” after contact with the ice cream.
    ▪ In terms of particles:
      • The two objects with different initial temperatures always tend toward an equilibrium temperature.
      • When the particle with less energy (moving slower, lower temperature) collides with the particle with more energy (faster moving, higher temperature), the faster one rebounds with less energy (so it has slowed down) and the slower one rebounds with more energy (speeding up).
      • A bunch of these collisions happen, until the particles are all moving at an intermediate speed. This means that the temperatures are now the same.
  - Convection
    ▪ Heat is transferred by a series of collisions.
    ▪ This is the process that makes a house warmer when you turn on the heater.
    ▪ Used by air and water. (Example: convection currents)
  - Radiation
    ▪ A method of heat transfer occurring between gases and in outer space. It does not require direct contact.

Heat Energy and Change

• A common area to study is the effect of heat energy on the state of matter. (For example, the freezing and evaporation of water.)
• There are many ways to produce heat. All forms of energy can transfer to another from of energy.
  - From mechanical energy: rubbing hands together, hammering nail
  - From chemical energy: hand warmers
  - From light energy: bulb, sun
Wood Fires

MAKING OBSERVATIONS

Using Different Senses
- Encourage students to describe the object with diverse descriptors. If they have little experience with making scientific observations, consider a chart or worksheet asking specific questions to consider.
  - Some examples:
    - What does it look like? What color is it? What is the texture? Is it shiny or dull? What about size, shape, lines, patterns?
    - What does it smell like? Does the odor remind you of anything?
    - How heavy is it? (This can be formatted as “Is it heavier than _____?” or as a measurement)
    - What does it do when...
    - It changed after I ______. Now it ______.
  - Make sure you explain all terms students might not be familiar with. This is especially important if English isn’t the first language for all of your students.
  - You may want to provide magnifying glasses or other tools.
- Be prepared for the child who wants to use ALL of his or her senses, by tasting it.
  - One strategy may be to discuss what a scientist would do. Taste might make a richer description, but it a safe way to make observations? What are situations where it is safe to taste? What are other ways to find out information? (The last question is used to steer the topic back to a broader discussion.
- Your students can use their observational skills to create a description of the properties of an object, to note what happens in an event or a certain situation, and to make comparisons.

VARIABLES

Identifying Variables
- Variables are any factor that can affect the outcome of the experiment.
- Controlling variables is an important part of setting-up an experiment. Before planning any experiment your students should be able to name variables that affect the outcome.
  - It is necessary that children “perceive more than one attribute of an object” and the occurrence of “interaction between the two.”
  - This understanding comes with time and experience.
- An example: If your experiment involved dropping things from a height to see what falls faster, students should brainstorm many of the following variables:
  - Height that is dropped from. (At first, standardizing height may be having anyone who drops the object stand on a chair. Because the people on the chairs are different heights, it may develop to dropping it a measured distance from the floor)
  - The weight of the object dropped.
  - The dimensions or surface area of the object dropped.
  - How time is recorded (stopwatch/counting/clock, how it is started and how it is stopped).
Wood Fires

Controlling Variables

- It is necessary to control variables, because you can't make conclusions when more than one variable is changed.
  - It is important that the only thing you are changing is the variable that you want to know about. For example, you could do an experiment about which type of seed grows faster. If a pot with one type of seed was put in the closet and a pot with another type of seed was put in sunlight, the results could be because of amount of light or because of type of seed.
- Once students can identify variables and understand the need to control them, they are ready to come up with methods for controlling variables.
  - In the above experiment, students should be able to invent ways to keep amount of light, amount of water, type of soil, amount of soil, and fertilizer consistent.
  - Students should be able to identify what variable were changed or manipulated, what variables were held constant, and what variable were measured to find the outcome (measured or responding variable).
  - Again this skill comes with time and experience. Younger children aren't expected to be able to do this at all. Students in 5th grade aren't expected to be perfect at this.

WORKING WITH SOIL

Soil vs. Dirt

- Soil is the upper layer of earth, generally composed of inorganic matter (sand, silt, and clay), organic matter (humus), water, and air. We can dig and plants can grow in this layer.
- Soil is a more precise term than dirt. Dirt also refers to dust and mud.

Collecting Samples

- Ideally, when discussing soil with your class you will have many diverse examples. These can include different types of soil (rich soil like from a garden, soil with a lot of clay in it, sand from the beach, and so on) and – in the case of this lesson – soil that has had different history with fires (no fires near it, a fire on it once, from a well-used fire pit, from a mound fire, and so on). This will make your discussion richer.
- I recommend gathering your soil samples well in advanced.
  - Plan how many samples you need for your class, and how large of samples you want. I gathered two shovels of dirt from each location.
  - If you have plastic tubs with lids, you can collect soil directly into these and use them in class. If not, medium-sized garbage bags work well.
  - Gather soil when it has been dry for a while if at all possible.
- There are two basic methods of collecting your samples.
  - Find a number of locations where you know there have been fires, and you can collect soil from where the fire is and from an area near by.
  - If you have a fire pan or fire blanket, collect soil samples from different area. Then put half of your sample in the fire pan or on the fire blanket, and light a fire on top of it. Make sure the fire burns for a while.
Wood Fires

4th grade
one hour long session, 1 hr. 30 min. session
Small Group
Melissa L. Boyer

Fire Building

Overview: During the first session, students learn how to build fires using food to represent different parts of the fire. During the second session, students build and light real fires. Concepts (especially safety) are reviewed. Students have a chance to observe a fire burning while cooking marshmallows or other snack.

Objectives:
• Academic
  - Students make observations about one form of energy (heat), including observing transfers of energy.
  - Students realize fire (heat) can have permanent impact on other things. There are safety rules to use when working with fire, such as always having an adult present.
• Outdoor Education
  - Students learn about and practice fire safety, and methods to minimize environmental impact.
  - Students are able to build and maintain a fire.

GLEs:
• Science
  - 1.1.4 (4th): “Understand that energy comes in many forms: Describe the forms of energy present in a system (i.e., energy of motion [kinetic], heat energy, sound energy, light energy, electrical energy, chemical energy, and food energy.)”
  - 1.2.2 (4th): “Understand that energy can be transferred from one object to another and can be transformed form one form of energy to another: Describe transfers of energy (e.g., heat energy is transferred from hot water to a cup); Identify sources of energy in systems (e.g., battery for a flashlight, spring for a toy); Describe transformations of energy (e.g., energy of motion of hands clapping changing into sound energy.”
• Health and Fitness
  - Benchmark 2.3.1.b.: “Identify abuse and risky situations and demonstrate safe behaviors to prevent injury to self and others at home, school, and in the community.”

Camp Fire Awards:
• Beads
  - TE124: “Find out what is meant by minimum impact camping. Tell ways that you, your family and your group can camp without leaving a trace.”
  - TE290: “Find out how to get a fire permit. Know the fire regulations and precautions in the area where you are hiking, cooking out or camping. Tell how to report a forest fire.”
Wood Fires

- TE292: "Lay, light, use and put out a wood fire outdoors. Follow safety practices while doing this. Be sure outdoor fires are allowed in the area."
- TE293: "Protect a woodpile from damp ground, rain or heavy dew."
- TE294: "Build a fire and let it burn down to a bed of coals. Cook at least one item over the bed of coals."

• Progression in Outdoor Action
  - Fire Tender 6: "Learn about the kinds of fuel for outdoor cooking. Know how to care for charcoal and/or make a wood pile."
  - Fire Tender 7: "Learn facts of fire building and fire safety. With a group, build and use a fire and cook a simple one pot dish or a foil dinner or something on a stick. Be sure to keep the fire as small as possible. Plan the menu, capers and cleanup."

Materials:

Session One:

• 8 carrot sticks (baby carrots in bag, or cut into slices) OR celery sticks (peanut butter and raisons optional; if use peanut butter, knives needed) PER PERSON
• 12 straight pretzel sticks (not the twisted kind) per person
• 3-4 Tablespoons shredded cheese OR shredded coconut PER PERSON
• 20-25 raisons OR nuts (not in the shell; should be round or oval) per person
• 1 spoon (plastic or be prepared to wash) per person PLUS at least two spoons to serve raisons and coconut for every five people
• 2 pairs of plastic gloves to serve carrot sticks and pretzels
• 1 plate (paper or wash) per person
• 1 cup per each person
• 1 napkin per person (plus a roll of paper towels for big messes)
• Pitcher of water (optional)
• Garbage bag
• OPTIONAL: charts/posters with information about fire building, safety, and minimizing environmental impact

Session Two:

• A large box of strike-anywhere kitchen matches (Kids often struggle with lighting matches. These are longer and stronger, so they are easier to light.) A lighter is another option. The long kind designed to light candles are easy to use. (Although in the future group members should learn to use matches.)
• Wood chopped to appropriate size for the fire
• Pre-cut kindling (chop in advance or plan on kids gathering large sticks)
• If you aren’t located where it is easy to gather tinder, provide materials
• Bucket filled with water (two buckets if your mini-fires and fire pit sites aren’t right by each other)
• Shovel (two if sites aren’t right by each other)
• 2 marshmallows per person + one extra for every six kids (exact amount is leader’s choice; s’mores are an option.) NOTE: This part of the activity is optional, but a good way for kids to make better observations about heat, coals, and fire. A healthier alternative can be used, such as biscuits wrapped around sticks.
Marshmallows have the advantage of having an obvious change in color when cooked. You can see the effects of heat.

- Sticks to cook marshmallows on. (I recommend you bring metal sticks or pre-made sticks if this is the first time most of them have cooked marshmallows. If not, make sure that there are long sticks available and have a knife so you can cut bark off the end.)
- Hand sanitizer, paper towels, and container of water OR access to a hand washing station
- Water bottles for each person or cups and access to a water faucet.
- Plastic bag for garbage
- An additional adult would be advantageous for this activity, particularly if you have a bigger or more rambunctious group
- OPTIONAL: any chart/posters/lists used in the last session

Set Up:

Session One:
- Check the rules for fire in the area where you will be burning. Make a list of rules from that location (National Forest, State Park, or local fire department for example) to share with students.
- A snack is made during this session, so plan the lesson to finish up around the time you usually have snack if possible.
- This activity can take place wherever you group usually meets if there is a sink and soap to wash hands/clean up near-by.
- Check for any food allergies and plan for substitutes for session one and session two.
- Gather and set-out all food materials.
- Have a plan to distribute food materials. (Separate out for each kid in advance; plan to take the time to hand out each thing as you’re talking; have kids distribute.)

Session Two:
- Location is extremely important for this activity. You need an established fire pit. Ideally the fire pit would be located in the woods, where kids could easily gather material. You also need a large, open space for kids to make “mini-fires,” such as a parking lot. (Depending on the size of your group and the size of your fire pit, you may be able to do this within the perimeter of the fire pit.) Closely review safety procedures before choosing a place for this activity. (NOTE: If you have a fire pit, but not a good place to do mini-fires, that part of the activity can be left out. Have members take turns lighting the fire each time your group makes a fire, and check them off on a list.)
- Scheduling is also important. Although fires can be done in the rain, I strongly recommend postponing the activity for a dry day. The ideal time for this activity would be about an hour before dusk, although any time is good. You want sufficient light for your group to make their fire, but if it is darker out, kids tend to be more focused on the fire and make better observations about burning. This is a good activity to do after dinner during an overnight. Also, this naturally leads to quiet talking time and singing around the fire before bed.
- Go over the information in “Preparing to Build a Fire.”
Wood Fires

Lesson:
Session One:
1. Tell group members today we are going to learn about safely building and
   maintaining fires. In the future we will make real fires for outdoor cooking and
   other activities, but today we are going to make snack fires out of food.
   a. Tell them that fires are very serious. Today and especially when they
      use real fires it is especially important to pay close attention and follow
      adult instructions.
   b. Have children wash their hands.
   c. Hand out plates. Tell children that this is where they will be building
      their personal fires.
      i. NOTE: If fiddling with materials while talking is a problem,
         have them move them towards the middle of the table or keep
         their hands in their laps.
2. The first thing you do when you want to make a fire is check to see what the rules
   are for fires in the area at that time? (Some places have rules year round and
   sometimes there are extra rules when it is really dry.)
   a. Are you allowed to build fires at all? Is there a high risk of forest fire at
      this time?
   b. Do they have to be built in a certain place, such as an established fire
      pit?
   c. How big can they be? (Commonly, no higher than two feet.)
   d. Anything else?
3. The next thing you do when making a fire is prepare to keep you and other people
   safe.
   a. Brainstorm some ways to do this. (You can record these ideas on a
      large piece of paper or white board.) They should include and focus on:
      i. Personal safety
         1. Always have an adult present.
         2. Staying at least two big steps (or set your own limits, by
            drawing a line in the dirt around the fire) unless you have
            permission from the leader or other adult to:
            a. Light the fire
            b. Add fuel, such as wood
            c. Cook on or in the fire
         3. When near the fire, think about what you are touching
            (could these rocks be hot?) and whether you could be
            burned. (If it feels too hot, move!)
         4. Keep long hair tied back, roll up or take off loose
            sleeves, and watch for anything that you are wearing that
            could accidentally light on fire.
      ii. Other people
         1. Tell other people, especially little kids, to stay back.
         2. If you are cooking on the fire using a stick or a pie iron
            make sure you don’t wave it around and that if you have
            to walk with it you 1. go slow, 2. hold it close to the
Wood Fires

ground, 3. watch where you are going and tell people you are coming.

a. It is easy to have accidents if you wave hot things around. Marshmallows that are on fire can fly off into someone’s face. You can run into someone with a hot pie iron.

iii. Keeping the fire from spreading

1. Build it in a safe area, such as an established fire pit

a. It should have a set perimeter (commonly rocks around the edges)
   i. Hand out the raisins/nuts and have students build a circle to contain their fire. They will probably adjust the size later, so if they have extra raisins/nuts have them set them on the side of their plate.

b. Look out for roots in the ground and branches over head that could catch on fire.

c. What would happen if the wind blew?

2. Make sure the area stays safe.

a. Any sticks that are burning should be all the way in the fire. If they are sticking out they could spread the fire accidentally.
   i. Have students use their finger to demonstrate a stick all the way in the fire, and one that is potential dangerous.

3. Be ready to control and put-out the fire. Brainstorm safe ways to put-out a wood fire.

a. Water – have a FILLED bucket handy
   i. Hand out cups and pour water

b. Smothering the fire – a shovel can be used to put dirt on the fire
   i. Pass out spoons to serve as shovels.

c. Never, ever leave a fire alone. You have to always have someone close enough to keep an eye on it.

d. When you are done make sure the fire is all the way out. That means you should be able to put your hand right above it and the fire should feel cool.
   i. If there is any heat in your fire pit, it is possible for something flammable to fall in the fire when you are gone. What happens then?

e. A fire needs three things to burn. What are they?
   i. Fuel, such as wood – It has to have something to burn.
ii. Air – Like people, fires need air to "breathe." That’s why they go out if you put too much stuff on them. When we put a fire out, we usually take away the air.

iii. Heat – It doesn’t even have to be a spark. That’s why you make sure your fire is out cold.

4. Once you are prepared to have a safe fire, you have to collect fuel (the material to burn in the fire. It is important that all your fuel is really dry. Otherwise it will have trouble burning. There are three sizes of fuel.
   a. First you need tinder. That is the very small stuff that catches on fire easily. It should be no thicker than your finger.
      i. Today we are using coconut to represent our tinder. Hand out.
      ii. When you are outside you can collect things such as lichen like "witch’s hair" (the stuff that you find on trees that is dry and crackly but otherwise similar to moss) and really, really small twigs. (Depending on your kids’ experience, you will probably want to show examples during the next part of the lesson.)
         1. Only collect materials that are already dead and on the ground. Why?
         2. Newspaper is really easy to light? What are some disadvantages of using newspaper?
            a. When you burn non-natural materials, often little bits are left in the fire or float off (sometimes still on fire!) to other places. Have you ever seen this kind of pollution, like foil in fire pits? Also when you burn some things, like plastic, it is particularly bad for the air.
         3. You want to spread out as much as possible (staying in the area the leader says is okay) to gather materials.
            a. What would be the impact if everyone got their tinder from the same place right next to the fire?
   b. The middle size is called kindling. It is bigger than tinder, but not as big as fuel, so it catches on fire easier.
      i. Today we will use pretzels. Hand out.
      ii. When we are outside, you can use kindling that is chopped from bigger logs or collect larger sticks. Look for things smaller than the size of your wrist.
   c. The last size is our small fuel. These are bigger logs.
      i. Today we will use carrots/celery.
         1. If you want to use celery, you have the option of having kids spread peanut butter their celery (and possibly put raisins on to make ants on a log) at this point.
         ii. If you collect small fuel, rather than using chopping wood, it should be the size of your wrist. Don’t use pieces that can’t be broken by hand.
Wood Fires

5. Building the fire.
   a. Now that we have our fuel, we can make a fire. There are many different ways to make a fire, and some of you probably already knew a few good ones. We are going to make an A-frame.
      i. Have children arrange two “logs” in a V-shape, and place “tinder” in the middle. A little bit of tinder should be left.
      ii. The third log is then propped on top of the other two to make an A-shape. Kindling is set over the top. No more than 8 pretzel sticks should be used.
      iii. Make sure, when building, enough space is left for the fire to have air.
      iv. Discuss lighting the fire. Fire burns upward, so is there a place or two where you could light the tinder on fire with a match safely, and the fire would burn up to catch the kindling?
         1. Children should pretend to light their fire.
   b. There are some extra materials that you haven’t used.
      i. What if you were going to add another log to the fire? How could you do that safely?
      ii. How could you store your fuel to use next time? Have kids stack there extra materials on the edge of their plate, while you give them some things to think about. (Given materials, their stacks aren’t going to be ideal. Have them think what they would really do.)
         1. Is it far enough away from the fire a spark couldn’t accidentally light the pile on fire?
         2. What if it rains? If you have a big stack of wood, you don’t want it to get wet. Ideally – something over it (tarp or roof) and on several sides to protect it, and something under it to keep it off the wet ground.
         3. Is it likely to fall over and hurt someone when they come to get wood? Stack it neatly.

6. It is important to minimize the impact your fire makes on the environment.
   a. What are some things we talked about to help take care of the environment?
      i. Prevent forest fires caused by people. Practice fire safety.
      ii. Avoid burning non-natural materials.
      iii. Collect material for fires that is dead and on the ground. Don’t get it all from the same place.
      iv. Follow fire regulations and keep fires small.
   b. What else could we do?
      i. Rocks and dirt are affected by fire too. If you have a fire pan or blanket show kids how to use.
      ii. Use a stove to cook instead of a fire.
Wood Fires

Session Two:

1. Have kids check for safety materials. *NOTE: Review this each time you make a fire.* Use information from the last session to make sure hair is tied back, sleeves aren’t loose, and all safety materials are available.

2. Start a big fire as a group. (If you are making mini-fires in the fire pit, do this first, and push the small fires together with the shovel. Then have an adult add tinder, followed by kindling, and a few logs, until the fire is going.)
   a. Have kids make piles of each of the three types of fuel. An adult will need to tell them when they have enough, and designate an area for each category. (Make sure you collect enough to keep the big fire going.)
   b. The leader should demonstrate building the fire, using the same method taught in the last session. The leader should light the fire.
   c. Monitor the fire (leave an adult if the mini-fire area is out of site, or designate an adult to keep an eye on it) and let the fire burn down to coals.

3. Tell group that each person will make a mini-fire within the designated area. The biggest pieces of fuel in these fires should be no thicker than their thumb and no longer than their hand.
   a. Give them three minutes to choose and set-up a safe site. Have sites checked off before they can move on to the next step.
      i. If this site is far away from your big fire, make sure you have materials to control and put-out fires.
   b. Monitor as they get fuel to make mini-fires, and build the fires.
   c. As each child finishes, an adult helps him strike a match safely and light the fire. Children are encouraged to try to keep fire going for several minutes. (Longer if they finish earlier, only a minute if they are the last one done.)
   d. Put out all fires. Check to make sure cold.

4. Return to big fire to cook marshmallows and watch fire burn.
   a. Review and discuss safety rules for cooking with sticks
      i. If it is on fire, SLOWLY bring to mouth and blow out
      ii. Do not wave around.
      iii. When you are done cooking your marshmallow, walk carefully to adult and have the adult remove the marshmallow. Walk slowly and don’t hold your stick high in the air. Alternatively discuss how to carefully remove marshmallows.
   b. Say each person gets two marshmallows (or whatever your limit is) and only two. (If they fall on the ground, you can replace them after dirty ones are thrown away.)
      i. Designate a person to hand out and remove marshmallows.
   c. If necessary, collect sticks and have an adult cut off bark.
   d. Everyone should wash hands or use hand sanitizer before touching food.
   e. Kids cook and eat marshmallows.
   f. Kids finish at very different rates. Encourage observation about fire. You may “absentmindedly” ask questions such as:
      i. Do you think coals or flames are hotter? Which do you like to use to cook your marshmallow and why?
Wood Fires

ii. There are so many colors in the fire. How many do you see?
iii. Why does the smoke go different ways?
iv. Did you know that heat is a form of energy, like electricity?
   Where did heat energy come from? How does it make your marshmallow cook?

5. Put out the fire.
   a. Ideally, the fire will burn down mostly by itself.
   b. Have an adult demonstrate how to put out the fire by sprinkling water over it and “stirring” or turning logs as necessary.
      i. If you have a big pile of water, it is hard to start a new fire the next day and is wasteful.
      ii. Water is better than shoveling dirt or sand onto the fire, because although that smothers the fire, coals may still be left underneath.
   c. Dispose of the half-burnt logs properly.
      i. In some places you pack these out or put them in a certain area.
      ii. Cold ashes and small pieces after completely out can be scattered away from the campsite. (No clumps!) Pieces larger than your wrist should be packed-out.
      iii. In established fire pits it is expected that you leave these in the fire place and when the fire pit will be shoveled out when it is full of ashes.
   d. Do a final check-over of the area, including where your mini-fires were.
      i. If you are leaving wood and chopped kindling at the site, is it in a protected wood pile?
      ii. Is the area completely free of trash?
      iii. Are you sure your fire is completely out?
      iv. Did you accidentally leave anything in the area, such as matches?

Assessment: Children’s success with the second activity will serve as an assessment of your first activity, and a time to work on common problems. Group members are unlikely to completely learn to build a fire and practice fire safety and techniques to minimize environmental impact in one session. A good follow-up, to assess learning and build on understanding is to add fire building to your kaper (chores) chart when you go camping. Assign one to two kids each time to be in charge of the fire, and monitor their success in lighting and maintaining the fire. Check to see if they use safe practices without prompting.
Overview: Students study the impact of fire on soil, by examining soil from below a fire pit and soil in a similar area that has not been burned. They discuss Leave No Trace principles and safety issues related to fire.

Objectives:
- Academic
  - Students practice observing, recording, and sharing observations about physical properties.
  - They gain some exposure to the idea that different types of soil have different properties. They may have an opportunity to sort soil based on physical properties.
  - Fire (heat) can have permanent impact on other things.
- Outdoor Education
  - Students learn about the environmental impact of fires. (This also ties into fire safety.) This is one of the three main areas students learn about when building fires. (The other two are safety and what a fire needs.)

GLEs:
- Science
  - 1.1.5 (3rd) “Understand physical properties of Earth materials including rocks, soil, water, and air: Describe and sort soils based on physical properties (e.g. color, particle size, ability to retain or drain water, texture, smell, support plant growth, source of mineral nutrients [not food] for plants).”
  - 3.2.4 (3rd, 5th) “Understand how humans depend on the natural environment and can cause changes in the environment that affect humans’ ability to survive: Describe the effects of humans on the health of an ecosystem; Describe how humans can cause changes in the environment that affect the livability of the environment for humans.”

Camp Fire Awards:
- Beads
  - TE124: “Find out what is meant by minimum impact camping. Tell ways that you, your family and your group can camp without leaving a trace.”
  - TE290: “Find out how to get a fire permit. Know the fire regulations and precautions in the area where you are hiking, cooking out or camping. Tell how to report a forest fire.”
Wood Fires

Background:

- Leave No Trace is an organization that provides training and materials that promote using the outdoors for recreation with minimal environmental impact. The following LNT principals relate to fire building:
  - Check to make sure that you are allowed to build fires in the area. (There may be specific restrictions as to where you build it or how big the fire is.)
  - Use fire wood that is no larger than your arm.
  - Use fire wood that is dead and down on the ground.
  - Gather fire wood from far away; spread out where you gather it from.
  - Use a pre-existing fire ring, a fire pan, or a fire blanket.
  - Use the mound method.
  - Build a small fire and keep it small.
  - Never leave the fire unattended. Always have an adult there.
  - Watch for fire problems: close plants, wind.
  - Put your fire completely out. It should be cold.
  - If you use a non-preexisting fire, scatter remains.
  - Remember fires leave permanent scars. Consider using a stove instead.

- Fires impact the soil even below the earth's surface. Impact can be lessened by building fewer fire pits, following LNT principles, and by using stoves more often.
- Fire can have a greater environmental impact if it is not controlled (forest fires). Fire safety is extremely important.
- See background information at beginning of section for more information, particularly on safety.

Materials:

- Two samples of soil for each group, one from under the ashes of a fire and one without fire damage in a similar area. Ideally groups would have different types of soil from one another.
- Chart and pencil to keep track of progress OR plan to make a chart with students.
- Newspaper/plastic to cover tables/desks
- Small magnifying glasses for each student or each pair of students
- White computer paper
- Wisconsin Fast Plants or other seeds
- Potting containers for each soil sample
- Fertilizer (optional)
- For each group: two beakers, two funnels (that will rest on the edge of the beaker and not touch the bottom), two paper towel squares, two small containers (that fit inside the beakers without touching the funnel), an eyedropper
- Measuring spoon
- Possibly chart/overhead or such on related LNT principals.
- Possibly related images/visuals (example: fire pan, mound fire)
Wood Fires

Set Up:
- Make copies of the chart for each student.
- Plant seeds into each soil sample. (See instructions on package.) Allow time to grow and replant if unsuccessful first time. OR Plan for students to plant.
- Two soil samples (fire and regular from the same area) for each group of students should be placed in plastic bins.
- Supplies set out for students to access
- If no sink in the classroom, provide beakers of water for each group
- Plan when you are doing each session. I'd recommend doing the sessions as close together as possible, even before and after P.E. or recess.

Lesson:
Session One
1. Opening: Ask students not to touch materials until directed to. Discuss when use a fire in the outdoors.
2. Brainstorm the effect fires can have (such as could start a forest fire) and ways that they can be avoided (fire safety).
   a. Some questions to ask to expand thinking:
      i. What if the fire got out of control? Could you prevent that?
      ii. Who makes a fire?
      iii. What happens after you are done you’re your fire?
      iv. Where is the fire built?
      v. What do you use to make the fire?
   b. Introduce impact on soil and rocks if someone doesn’t suggest.
   a. Tell students that they are going to compare soil from below a fire and soil nearby that wasn’t exposed to fire.
      i. Newspaper or plastic should be spread over the tables/desks.
      ii. Students are welcome to touch dirt in containers. They can scoop a small sample onto their white paper to examine closer.
   b. Pass out and explain chart.
      i. What are we investigating? (sample: The effect fire has on soil)
      ii. Review or practice making observations.
         1. Different senses
         2. Details
      iii. What does it look like?
         1. What color is it?
            a. What does it look like when smeared against paper?
         2. Is there anything in it? Rocks? Decaying living things?
         3. How big are the particles?
      iv. What does it feel like?
      v. How does it smell?
      vi. Does it retain or drain water?
         1. Demonstrate set up.
**Wood Fires**

a. Insert paper towel square into funnel, and fill with packed dirt.
b. Put measuring container into large container. Put funnel on top of container, so that water will drain into small container.
c. Slowly add water with eye dropper, counting drops.

c. Monitor and assist students to complete activity.
   i. Make sure students are filling in their chart.

**Session Two**

1. Closing: Compare results. Discuss ways to minimize impact (LNT), including preventing forest fires.
   a. Compare results as class or with representatives of each group.
      i. Students should use their chart (as well as the questions on the back) to discuss what they observed.
   b. As a class, discuss ways to minimize impact (LNT), including keeping a fire safe.
      i. Ask students if anyone had new ideas on ways to minimize impact.
      ii. Emphasize that a wildfire has the biggest negative effect on the environment, so keeping safe is the most important part of minimizing impact.
         1. One major item to highlight is always having an adult supervising the fire.
      iii. Go over the list of principals above, relating them to issues your class brainstormed earlier.

**Assessment:** Your assessment will vary depending on your class's experience up to this point. For example, if you have been focusing on making detailed observations using more than one sense, focus on that in your assessment.

- **Chart:** Requiring students to fill in both sides (or pages) of the handout is a good assessment tool along with providing structure for their observation. Some things you may want to look for: Do they know what the question they are trying to answer is? Where they able to use the chart to record their findings? Did they provide detailed observations?
- **Informal Assessment:** You will probably want to make some observations of students while they are working. Again, what you focus on, and if and how you record it will depend on your bigger objectives. You may want to use a checklist or take a few notes regarding specific areas students may be struggling with, how they work as a group, or the conclusions they come to.
NAME _________________________________  DATE __________

1. What did we want to know? ____________________________________________________________
   ___________________________________________________________________________________
   ___________________________________________________________________________________
   ___________________________________________________________________________________
   ___________________________________________________________________________________

*Please finish the chart on back before answering #2 and #3.*

2. What did we find out? ________________________________________________________________
   ___________________________________________________________________________________
   ___________________________________________________________________________________
   ___________________________________________________________________________________
   ___________________________________________________________________________________

3. What would we still like to investigate? ________________________________________________
   ___________________________________________________________________________________
   ___________________________________________________________________________________
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<td>Color, What is in the dirt, Size)</td>
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Cooking with Charcoal

TOPIC: Cooking With Charcoal

KEY CONCEPTS:

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LESSON SUMMARY:

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<td>• Box ovens</td>
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<td>• Hand washing</td>
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<td>• Heat</td>
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<td>• Fractions</td>
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(continued on next page)
Cooking with Charcoal

Extensions

- Students make their own box ovens: See directions in background information.
- Students plan and prepare a healthy meal. At least one item should be made in a box oven.
- To make option three in session one more challenging: Ask students to estimate the quantity of each item you should buy at the store in terms of container size (how many cartons of eggs rather than how many eggs, how many bags of flour rather than cups of flour, etc.). Include samples of ingredients (example: five pound bag of flour, measuring cups, scale, large bowl) to help them calculate.

ADDITIONAL RELATED ACADEMIC CONTENT:

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Content (EALRS)</th>
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<tbody>
<tr>
<td>4th, 6th, 7th</td>
<td>Transfer and Transformation of Energy – How food cooks, charcoal provides heat</td>
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<tr>
<td></td>
<td>Science 1.2.2</td>
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<td>Science 1.3.3</td>
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<tr>
<td>10th</td>
<td>Energy and Heat – Further understanding of the definitions of energy and heat, related to particles</td>
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<td>Science 1.2.3</td>
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<td>Science 1.1.4</td>
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<tr>
<td>2nd, 4th, 5th, 7th</td>
<td>Heat and Change of State – The role heat plays in the change of a substance’s state</td>
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<td>Science 1.3.3</td>
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<tr>
<td>6th, 7th</td>
<td>Proportional Reasoning and Fractions - Manipulating the quantity of the recipe (half as much, twice as much) or the quantity of one ingredient</td>
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<td>Math 1.1.3 (working draft)</td>
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<td>Math 1.1.6</td>
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Cooking with Charcoal

I've included information, tips, and instructions for cooking with charcoal outdoors. I strongly recommend having at least one adult in your group trained in outdoor cooking. Written instructions – although useful – are not a substitute for training and experience.

CHARCOAL

About Charcoal

- Charcoal is partially burned wood. It is a form of fuel.
- Charcoal comes in pieces (usually squares) called briquettes.
- Each briquette gives off approximately 40 degrees of heat.
  - The following formula is useful for calculating an acceptable number of briquettes to use: Number of briquettes \(\times\) 40 degrees = temperature
  - So, to find out how many briquettes you need, divide the desired temperature by 40. (For example, you would need 8 to 9 briquettes to cook at 350 degrees.)
  - There are a number of factors that affect how much heat each briquette gives off. Be prepared to make adjustments. On a cold day you will need a few more briquettes and on a hot day you need a few less.
    - Factors that affect charcoal briquettes:
      - Temperature where you are cooking
      - Wind
      - Irregularity in briquettes
  - People often use too much (or not enough) charcoal when cooking. Figure out what temperature your dish needs to be cooked at. Then count out the number of briquettes you need. Be prepared to make adjustments.
    - Adding extra briquettes is like turning up the temperature on your oven – it might cook faster, but too high of a temperature will burn the outside of the food before it can be heated thoroughly to the desired temperature.
    - It's not very environmentally friendly to use unnecessary briquettes.

Starting Charcoal

- Some charcoal is treated, so it does not require a starter. In this case, stack briquettes in a neat pile, and light them with a match. When all are lit use tongs to move the charcoal where you need it.
- When using non-treated charcoal you need some kind of starter.
  - Non-treated charcoal is preferable because it creates a better bed of coals.
  - It is possible – but more dangerous – to use a starter fluid. Because it is unnecessary and less safe, I would highly recommend using another option.
  - There are many diverse kinds of charcoal starters available. A few simple options:
    - You can by pre-made starters.
    - Make a charcoal starter out of an empty tin-can. (These work similarly to starters you would buy at the store.)
      - Select a large tin can. It should be able to hold your charcoal and an equal amount of newspaper. Clean the can and remove the label.
      - Punch five triangular holes around the top and bottom of the can. (More
Cooking with Charcoal

- holes for a larger can, fewer holes for a smaller can.
- Fill the bottom of the can with charcoal. Then fill the rest of the can with crumpled newspaper.
- Flip the can upside down and place it on a piece of tin foil on the ground. The newspaper should now be on the bottom.
- Light the newspaper through the holes.
- Use a potholder to remove the can when coals are lit and glowing. Then use tongs to place coals where needed.
- You can research other ways to start non-treated charcoal. (Such as coating charcoal with paraffin.)
- If you don’t make or buy a charcoal starter, you can start charcoal using a bed of coals from a wood fire. This is a lot harder. Because of the increased risk for burns when removing the charcoal from the fire, have adults do this step.

Extinguishing Charcoal
- Let charcoal burn down as much as possible.
- Sprinkle charcoal with water, and stir. Do not dump water onto the charcoal. (For more information see “extinguishing a fire” in the wood fire section.)
- When you are done, the charcoal should be cool to the touch.
- Often unused portions of charcoal can be saved and reused.

Cooking with Charcoal
- Charcoal can be used in a variety of methods for cooking. Some examples:
  - In a fire pit, like cooking with wood fires
  - Under and over a dutch oven
  - In a box oven
- Many outdoor cooking experts strongly prefer Kingsford brand charcoal, but any brand should work.
- Charcoal briquettes often need to be moved.
  - Have hot mitts, a long sturdy pair of tongs, and a shovel available
  - Until kids are older, have adults move briquettes. Your group can direct the adult where to put them.

BOX OVENS

Making a Box Oven
- Box ovens are made by covering the inside of a cardboard box with foil, and placing it upside down over a pan. They are easy enough for kids to make with little assistance, and can be used once or for years.
- To make a box oven:
  - Gather your materials and make sure they fit together.
  - You will need:
    - A large corrugated cardboard box without a top (if it has flaps, cut them off)
    - A roll of heavy-duty aluminum foil (wider rolls are easier for this project)
Cooking with Charcoal

- Duct tape
- Four sturdy aluminum cans of the same height (pop cans or soup cans work)
- A cooking pan or cookies sheet that fits easily in your box.
  - Check to make sure materials fit.
  - Put the four cans on a flat part of the ground, so that the pan can rest stably on them.
  - The cans should be towards the four corners of the pan.
  - Try putting the box over top of the pan and cans. The box will be upside down. You should be able to slide the box over the pan easily, leaving a little room on all sides and plenty of room above the pan.
  - Cover the inside of the box with aluminum foil. Use duct tape to secure it on the outside and as necessary.
    - Foil should be tightly packed, with no loose edges. There should be no cardboard showing on the inside of the box; if there is it could catch on fire.
    - The shiny side of the foil should be facing out.
    - It is not necessary to cover the outside of the box. The edges of the box touching the ground when you place it upside down should be covered with foil.
  - Your box oven is complete. You will need an additional piece of foil (big enough to cover the ground beneath your box) when you start cooking.

Using a Box Oven

- Anything that can be cooked in a regular oven can be cooked in a box oven. I would avoid recipes that require more than one hour to bake, because you have to add additional coals. Some easy things to make:
  - Cookies
  - Nachos
  - Pizza (consider healthier pizzas; mini-pizzas can be made on English muffins)
  - Lasagna (pre-cook noodles; possibly pre-cook meat)
  - French Toast
  - Mini-meatloaf (cook in tuna cans with labels removed)
- How to set-up a box oven:
  - Start your charcoal. It will probably take about twenty minutes to get started.
  - Find a flat spot on the ground. Remove any rocks, pine-cones, etc.
  - Place a large sheet of foil on the ground. The foil should extend at least an inch out from under all sides of the box.
  - Set four cans out on the foil like you did when you were testing to see if your box and pan fit. Double check to make sure that your pan will be stable on the cans.
  - Find a small, flat rock to prop up the edge of your box. Place it so that one edge of the box will sit on it, leaving a small crack for air.
  - If you haven’t done so already, prepare your recipe.
  - An adult, using tongs, should move charcoal from the starter to the foil. Spread it out under the cans, so that it will be evenly distributed beneath your pan.
  - Carefully place the pan (with your food in it) on top of the cans.
  - Slowly, carefully, put your box upside down over your pan. Rest one edge on the...
**Cooking with Charcoal**

- Remember from now on, everything there (box, foil, pan, etc.) is considered hot.
- Check your food
  - Check your food a minute or two before it should be done to avoid burning. Do NOT check food before this time. Every time you lift the box, you loose heat, and it will take significantly longer to cook.
  - Have the adult (or older, trained child) who is checking the food put on hot mitts.
  - Wearing the hot mitts, put the palms of your hands on the sides of the box, and lift straight upward.
  - Have an observer say whether the food looks done or not, as quickly as possible. If it is, set down the box, and use hot mitts to remove the pan. If not, put the box back on.

**Safety**
- Charcoal should NEVER be used indoors.
- Charcoal may not have a flame, but it is just like coals from a wood fire. Take appropriate precautions.
  - Use tongs or a shovel to move charcoal.
  - Use a hot mitt when removing the box or pan.
  - Be cautious of anything that could burn (like with fire safety):
    - Tie back long hair and check for extremely baggy clothing.
    - Be aware of your surroundings and what is around that might burn.
- Have an adult deal with briquettes, the box, and the pan. (An older child who has been trained can do these tasks.)
- If you have never used a box oven before, practice putting the box on and removing the box when there is no food in the pan and charcoal isn’t on the foil yet.

**COOKING IN THE OUTDOORS**

**Safety**
- Safety concerns vary from activity to activity. Make sure you and your children know how to use equipment properly.
- One common hazard is burns or fires. Be prepared for emergencies. This includes knowing what to do in case of a fire and taking a first aid class. Have emergency supplies (including first aid) on hand, and know how to contact help.
- Set up ground rules with your kids. Some common rules:
  - Certain areas where there are hot things (fires, stoves, outdoor ovens), sharp things (knives), or issues with germs (anywhere where food is prepared, cutting boards) are higher risk areas. Designate these as cooking areas.
    - Kids are only allowed in cooking areas to complete an assigned task.
    - You must be prepared when entering a cooking area. This may include clean hands (preparing food) or hair tied back (around a fire). Closed-toed shoes are preferable.
  - Kids must be trained and checked off before completing tasks on their own. At first they watch an experienced person demonstrate the task and learn what to do. Then they do the task with supervision. When they demonstrate that they are able
Cooking with Charcoal

to do the task successfully, following safety rules, every time, they are allowed to
do the activity without direct supervision. (An adult is still in the area monitoring,
but not watching over their shoulder.)

Hygiene
• You can’t expect to keep completely clean when you’re outside, but you still need to
maintain a basic standard of cleanliness (for germs more than for dirt), especially
when you are leading an event.
• Like anywhere else, wash or sanitize hands before cooking, before and after eating,
and after using the restroom.
• Before dishes are reused they need to be washed and sanitized. This is generally
easiest to do immediately after cooking or eating, so food doesn’t dry onto your
dishes.

Logistics
• If your kids have lots of experience cooking outdoors, things will run more smoothly.
You probably will have developed a kapers system, saying who cooks and who cleans
each meal. It will probably be a little hectic when you first start cooking outdoors: no
one will know what to do and everyone will want to participate in every activity.
That is okay. Just plan extra time for cooking and try to have extra adults to help.
• If you are on an overnight trip, have a plan for storing food safely.
  – Cold food should be kept in an ice chest.
  – Large and small animals are attracted to food smells.
    ▪ Before leaving the campsite or going to bed, wash all of your dishes.
    ▪ Store your food in a bear- and mouse-proof location. One option is to put it in
      large plastic containers with tight lids and keep it in your car. Another option
      is to use a bear bag.

HANDWASHING

Methods for Outdoor Activities
• If you are near a sink, you can have kids wash their hands as usual.
• When a sink is not available, you can use hand sanitizer instead. There are a number
  of brands available (usually located near the soap). Follow directions on the bottle.
• You can make a hand washing station. There are many creative ideas for this. Make
  sure your plan includes soap, water to rinse, and somewhere clean to dry hands. One
  example:
    – Obtain a clean plastic milk jug, a golf tee, string, an old pair of pantyhose, and a
      bar of soap.
      ▪ A clean wooden golf tee is preferred by some, because they swell a little and
        prevent water from dripping.
    – Poke a hole in the side of the milk jug, near the bottom. Insert the golf tee into
      this hole. (The tee should plug the hole completely.)
    – Tie one end of a length of string to the golf tee and the other to the handle of the
      milk jug. (This prevents the tee from being lost.) Place the milk jug on a
      platform or use another length of string to hang it.
Cooking with Charcoal

- Put the bar of soap into the foot of the pantyhose. Cut off the pantyhose around the knee, and tie the end to the milk jug’s handle. (This allows the soap to hang, so it doesn’t get dirt on it.)
- To use, fill the jug with clean water. Remove the tee to let a stream of water flow out, and wash your hands as usual.

DISHWASHING

Three-Sink Method
- Set up a station on a flat, elevated surface (such as a table). You need to have a garbage bag or can near by, and know where you are putting clean dishes. Select three containers (dishpans work best, but large pots or other plastic containers are fine) that are large enough to wash your bigger dishes in.
  - The first container should have hot soapy water. Water shouldn’t be hot enough to burn, but as warm as possible. If you are dumping your dishwater on the ground, use biodegradable soap in the smallest quantity necessary. If you are dumping it in a sink, regular dish soap is fine. You probably want something to scrub dishes at this station, such as a sponge.
  - The second container should have hot water for rinsing. Again, hotter water is better, but it should not burn children. Test it with your hand first.
  - The third container should have cold water and bleach. Use one teaspoon unscented bleach for every gallon of cool water. (Ratio from Whatcom County Health Department.) This step sanitizes the dishes.
- Assign one or two kids to each of five steps. All children should wash their hands before and after doing dishes.
  - The first child scrapes food off into garbage.
  - The second child washes dishes in the soapy water. After this station there should be no food, ashes, or other residue on the dishes.
  - The third child rinses dishes in hot water to remove soap.
  - The fourth child sanitizes dishes in the cool bleach water.
    ▪ If you are going to put dishes away, rather than drying them in dip-bags, they need to set for at least one minute before drying.
  - The last child hangs up dishes in the dip bag or dries them and puts them away.
- Drying your dishes.
  - Dishes can be dried with clean towels and immediately packed away.
  - A dip bag can be used to hang up dishes to dry. A dip bag can be made of any mesh bag with a draw string on top. It should be:
    ▪ Clean
    ▪ Have strong string at the top that is okay to get wet
    ▪ Be of an appropriate size for the dishes you are using (larger for pots and pans, but small enough to hang up)

Alternate Dip Bag Method
- After washing dishes in soapy water and rinsing them in clean water, put them into a dip bag.
- Dip the bag (with dishes) into a pot of boiling water, before hanging to dry.
Cooking with Charcoal

Dumping Dishwater

- If you do not have a drain to dump water down it, dispose of it on the ground away from water and your camp.
  - You need to be at least 200 feet away from natural water sources. This is to prevent contamination of rivers, lakes, etc.
  - Dishwater can attract animals, including bugs.
- If there are food particles in your soapy water, use a strainer to filter them out over a small hole in the ground (cat hole). (Coffee filter works well.) Dispose of the strainer and food particles in the garbage. Fill in the hole.
- Throw the rest of your water out of the containers, in large sweeping motion. You want to spread it over as much area as possible.
Cooking with Charcoal

I've included some background information on concepts used in this lesson. Information about heat is intended to help the teacher understand concepts better (not to be relayed to student) so they can better answer student questions and develop this lesson as part of their curriculum. Information about fractions provides some background about what students might be learning in school to small group leaders. Classroom teachers should connect math concepts to the curriculum that they are using. Some of this information is also included in other sections.

HEAT

Heat, Temperature, and Energy

- Energy
  - Energy is very hard to define and grasp, because it is not something tangible.
  - Often energy is defined as "the ability to do work."
    - Energy is a "state of particle agitation." Elementary students don't discuss the movement of particles in matter, so more complete, complex explanations aren't appropriate.
  - Heat is one of many forms of energy. Students may have discussed other forms of energy such as electricity, magnetism, sound, and motion

- Heat
  - Heat is the transfer of energy.
    - "Heat" talks about difference in temperature.
  - Misconceptions
    - Heat is often - incorrectly - described as opposite of cold. Although hot is opposite of cold, things that we would describe as very cold and things that we would describe as very hot both have heat.
    - Heat is often described as a substance; something that is transferred in the air. It is often considered a gas.
      - We talk about "turning on the heat" to warm up a room or cook food and about heat rising. Therefore it is easy to see where the confusion comes from.
      - Air does not convey heat. A room becomes warmer as a result of a series of interactions, transferring energy.
      - Remember, heat is actually a transfer of energy. That is an action not a substance.
    - Students' misconceptions generally stay the same even after an explanation unless something challenges their understanding.

- Temperature
  - Temperature is a measure of heat.
    - A key misconception is that heat is the opposite of cold. Students may say that temperature is a measure of heat and of cold, which is not correct. "Cold" refers to a low temperature, which means that there is less heat.
Cooking with Charcoal

Heat Transfer
- Hot objects transfer energy to colder objects. It never happens the other way around.
  - If you have a spoon in ice cream the spoon feels colder because of loss of energy. The "cold" from the ice cream has not been transferred to the warmer spoon. The energy (in the form of heat) has been transferred from the spoon to the ice cream.
  - Children – and adults – often think of heat as a synonym for "hot." They describe "cold" as an opposite force of heat.
- Burning something produces heat energy. This energy is then transferred to the air.
- With children, it may be helpful to discuss heat transfer in terms of energy, because the word "heat" is often confused with "hot."
  - For example: The energy from the spoon transferred to the ice cream, rather than the heat from the spoon transferred to the ice cream.
  - Your explanations will depend on the child's age and experience.
- Types of heat transfer
  - Conduction
    - Takes place when there is direct contact between two objects.
    - When you put a room-temperature spoon into ice cream from the freezer, the spoon gets colder, because heat from the spoon is transferred to the ice cream through conduction. The spoon has lost the energy it had before contact with the ice cream and thus feels "cold" after contact with the ice cream.
    - In terms of particles:
      1. The two objects with different initial temperatures always tend toward an equilibrium temperature.
      2. When the particle with less energy (moving slower, lower temperature) collides with the particle with more energy (faster moving, higher temperature), the faster one rebounds with less energy (so it has slowed down) and the slower one rebounds with more energy (speeding up).
      3. A bunch of these collisions happen, until the particles are all moving at an intermediate speed. This means that the temperatures are now the same.
  - Convection
    - Heat is transferred by a series of collisions.
    - This is the process that makes a house warmer when you turn on the heater.
    - Used by air and water. (Example: convection currents)
  - Radiation
    - A method of heat transfer occurring between gases and in outer space. It does not require direct contact.

Heat Energy and Change
- A common area to study is the effect of heat energy on the state of matter. (For example, the freezing and evaporation of water.)
- There are many ways to produce heat. All forms of energy can transfer to another from of energy.
  - From mechanical energy: rubbing hands together, hammering nail
  - From chemical energy: hand warmers
  - From light energy: bulb, sun
Cooking with Charcoal

FRACTIONS

Important Concepts in Fractions
- The part-whole relationships in fractions are an example of a ratio. Proportional reasoning is necessary to understand ratios. Proportional reasoning includes the following to some extent:
  - Sense of conservation: In proportional relationships, the two quantities change together (like doubling a recipe). If one changes, the other has to change in proportion (if you double the quantity of flour, you have to double the quantity of milk).
  - Proportional and non-proportional relationships are different.
  - Many strategies (informal and algorithms) to solve proportional reasoning problems and compare ratios.
  - Ratios represent a relationship. They are separate from the quantities in the ratio.
- Fractions are recorded in several ways
  - Words (how you say/read it)
  - Symbols (should be written vertically, with one number on top, rather than horizontally with a backslash)
- Fractional parts are equally-sized portions of a whole. For example, the term “third” mean there are three parts to make a whole.
  - The more parts there are the smaller the parts; fourths smaller than thirds.
- The denominator (the bottom number in a fraction) says what type (or size) the pieces are. The numerator (the top number in the fraction) counts how many pieces.
- Equivalent fractions:
  - The same amount can be written in different ways, using different-sized fractional parts. One-forth is the same as two-eights.
  - Generally written in lowest terms.
- You can use a variety of models to illustrate fractions
  - Area model (“pies” or rectangles divided into equal sections)
  - Length model (strips of paper or Cuisenaire rods)
  - Set model (six brown eggs out of one dozen eggs)
- Computations with fractions can be done using algorithms (a series of steps to solve the problem) or one of many invented strategies (informal strategies the student applies to a specific situation).

Teaching and Using Fractions with Kids
- Put off doing computations with fractions. A complete understanding of fractions should be developed first.
  - When you do start doing computations with fractions, remember that thinking not just following a process is important. Focus on concepts more than rules and procedures.
- Fractional number sense generally develops in 5th to 6th grade. 4th graders with a month of experience manipulating different models can have an understanding of fractions (what they mean, not computation with fractions).
Fractions and Cooking

• Usually in recipes fractions are written in symbols rather than words.
• Mixed fractions are often used. Children may not have experienced this yet in school, but if they cook they should understand that one and one-half cups is the same as one cup plus one-half cup. (Don’t worry about converting mixed numbers to fractions, unless it is something you discuss in class)
• Measuring provides a good visual that, for example, one half is not a set amount. One-half cup is different than one half tablespoon. It also is a chance to experiment with equivalent fractions. For example, if you need one-half cup but only have one-fourth cup measure, what can you do?
Cooking with Charcoal

5th grade
30-45 min. session, 1 hr. 30 min. session  Melissa L. Boyer

Box Oven Cooking

Overview: Students use a box oven to make cookies. Before making cookies, they do one of several activities involving fractions and cooking.

Objectives:
• Academic
  - Students apply fractions and other math skills to solve problems.
  - Students see a chemical reaction as a result of heat.
  - Students learn about cooking safely.
• Outdoor Education
  - Students learn to use charcoal and a box oven for outdoor cooking.
  - Students practice hygiene in an outdoor setting.

GLEs:
• Science
  - 1.3.3 (5th): “Understand that a substance remains the same substance when changing state. Understand that two or more substances can react to become new substances: Describe how two different substances can form a simple chemical reaction to produce new substances.”
• Math
  - 1.1.1 (5th): “Understand the concepts and symbolic representations of mixed numbers, proper and improper fractions, and decimals. Examples: Represent mixed numbers, proper and improper fractions, and decimals using words, pictures, models, and/or numbers; Explain how the value of a fraction changes in relationship to the size of the whole; Represent improper fractions as mixed numbers and mixed numbers as improper fractions.
  - 2.2.2 (5th): “Apply concepts and procedures from number sense, measurement, geometric sense, and/or statistics to construct solutions. Examples: Select and use appropriate concepts and procedures construct a solution; Determine whether a given solution shows use of concepts and procedures that are appropriate.

Camp Fire Awards:
• Beads
  - TE297: “Construct a reflector oven. Use it to bake biscuits or some other appetizing dish.” (A box oven is very similar to a reflector oven. Most councils/leaders would count this.)
  - TE361: “Make an outdoor hand washing station with soap, water and a washbasin.”
  - TE363: “Set up an outdoor dishwashing station. Include a place to wash, rinse and dry dishes and cooking utensils.”

• Progression in Outdoor Action
Cooking with Charcoal

- Fire Tender 6: “Learn about the kinds of fuel for outdoor cooking. Know how to care for charcoal and/or make a wood pile.”

Background/Main Ideas:

• Outdoor hygiene
  - When outdoors, it’s easy to set aside concerns about sanitation – dirt is everywhere! – but the same concerns apply outdoors as indoors. Having clean hands, being careful about raw meat, and making sure your food is properly cooked is just as important to prevent illness when camping as it is when in your kitchen. (It’s especially important if your outdoor cooking site is located far from medical assistance.)
  
• Generally each briquette gives off about 40 degrees of heat.
  - The following formula is useful for calculating an acceptable number of briquettes to use: Number of briquettes X 40 degrees = temperature
    - So, to find out how many briquettes you need divide the desired temperature (for example, 350 degrees) by 40. (You would need 8 to 9 briquettes to cook at 350 degrees.)
  - There are a number of factors that affect how much heat each briquette gives off. Be prepared to make adjustments. On a cold day you will need a few more briquettes and on a hot day you need a few less.
  - See background information for details.

Materials:

Session One:
- Copies of the recipe for each group
- Each student should have a pencil and a notebook/paper to make calculations
- Calculators if you feel appropriate for some students
- Materials for box-ovens or a pre-made box oven to show students

Session Two:
- Box-ovens
  - Ideally you will have one box for every group of six to eight students and one adult to work with each group in addition to you. If necessary groups can share boxes (one group can cook while another group prepares the food or does another activity).
  - Make the box ovens in advance following the instructions attached. You will need a large box, foil, duct tape, and four to six cans of equal height for each box.
  - Remember to have extra foil available to put on the ground
- Extra adults for supervision (see above)
- Enough ingredients for the class, plus a little extra in case of accidents.
- Charcoal briquettes (see instructions for ingredients) – one bag will probably be sufficient.
- Charcoal starter, newspaper, matches (ideally have at least one starter for every two groups)
- 1 pair of long tongs for each group
- Set of hot mitts for each group
Cooking with Charcoal

- Measuring cups and spoons (see set-up for appropriate quantity)
- Utensils and supplies needed for recipe (including metal spatula to remove food from pan, mixing bowl, mixing spoon, cooking spray, etc.)
- 1 cookie sheet or pan for each group. Make sure that this pan fits sturdily on top of cans and the box fits over top.
- Materials for a hand washing station and/or hand sanitizer. See background information.
- Materials for dishwashing station (although you will probably wash everything again later) – this means you need a way to get hot water
- 1 pair of plastic gloves per student for food prep (optional)
- Plastic wrap to cover food
- Plates (paper okay) or something to put cooked food on
- Garbage bag or can
- Watch or timer for each group
- Students copies of the recipe and calculations (if applicable) from the last session
- Container with water in it (to put out charcoal, safety precaution)

Set Up:
Session One:

- Make sure you have permission to do this activity and an outdoor location to do it. This could take some time. If you are in a school, this is a possibility if you have an outdoor camp of some sort.
- Decide what you are going to make and have copies of the recipe (amounts of each ingredients and cooking temperature) ready for each group. I’ve set up the lesson to make cookies, because they:
  - Although the recipe has a greater number of ingredients, it is fairly simple and forgiving to slight errors. Students are required to use fractions in cups and teaspoons.
  - They have a short cooking time.
  - After students have one or two themselves, it is easy to give away the rest of them.
They are many other – healthier – options. Decide what is best for your group.
- Decide what criteria you want to use to divide groups up. You may have them choose – which means you don’t need to do anything now – or you may want to assign groups in advance.
- Check to see if there are any food allergies in your classroom. Make appropriate accommodations.
- For session one, decide which option your group is going to do. Read through the lesson to decide. NOTE: If you are a small group leader, you may need to talk to students (or their teachers or parents) to see what they know about fractions and to get an idea of their proportional reasoning skills.
  - Option One: Complete the above steps to be prepared for session two.
  - Option Two:
    - On the board or an overhead write: How many briquettes will your group need? (One briquette = 40 degrees)
Cooking with Charcoal

- Get the measuring cups and spoons. (Ideally, bring one cup, one-half cup, one tablespoon, one-half tablespoon, and one teaspoon measure for each group.) Bring flour (to be thrown out after this use), sand (you will need to wash the measuring utensils thoroughly), or another type of powder for students to practice measuring. Have one container of powder for each group to use.

- **Option Three:**

- Write questions and information on the board or overhead that everyone can see. Alternatively, a handout can be made. Include the following:
  - How many briquettes will your group need? (One briquette = 40 degrees)
  - IF YOU ARE A LARGE GROUP: If each group in the class makes one batch, and there are x groups in the class, how much of each ingredient will we need to buy? (This is too hard of a question for more than three groups unless your group is older or very advanced. To simplify, use the question below.)
  - FOR SMALLER GROUPS: If we are going to make two times the quantity of the recipe, how much of each ingredient do we need?

**Session Two:**

- Find an area that is acceptable to do this activity. You need a medium to large, flat, open space. This space must be outside.
- Make box ovens. (Alternatively you can have the students make them during the first session. It will probably take them an additional ten to fifteen minutes.)
- Make sure any adults assisting with the activity know what is expected of them. Ideally, they will have information about the procedure and content of the lesson in advance.
- Set up a place to mix the ingredients. Your plan for this will depend on where you are. Ideally, provide one or more tables located close to the hand washing and dish washing stations.
  - Set out ingredients, preferably in large bowls (you may want to put smaller quantities of each out; you can put out more as necessary) with measuring cups and spoons.
  - Provide several copies of the recipe.
- Set up hand washing and dishwashing stations. **NOTE:** You can leave out dishwashing for convenience, but it is an extremely important skill for outdoor cooking.
  - Plan where hot water is coming from (tap water may be hot enough; otherwise you will need to heat it), what happens with dishes when they are clean, how you are going to get more water if it gets dirty from washing a lot of dishes, etc.
- Consider planning an activity or task for down-time while food is cooking. Alternatively, this can serve as free time for students or a chance to visit.
Cooking with Charcoal

Lesson:
Session One:
OPTION ONE:
• If you plan to skip the math component of this lesson. Your group is comfortable making measurements in cooking. You can do the entire activity in one session. Add the following steps to the beginning of session two.

1. Introduce the activity. Tell students that you will be using a box and charcoal to bake cookies or whatever is on your menu. Show them the materials you will be using.
   a. Demonstrate and talk through the set-up (without charcoal). Clear an area and put foil on the floor/ground. Spread out the cans and make sure that the pan can rest securely on them. Check to make sure the box fits over top. Get a small, preferably flat, rock to hold up the edge of the box. Explain that charcoal will be spread out under the pan to provide heat.
   b. Take time for questions. Many of your students will be skeptical.

2. If you are working with a class or a group larger than ten students, divide the kids into groups. I recommend groups of six to eight students.
   a. Hand out a copy of the recipe to each group.

OPTION TWO:
• If your group has experience with fractions, but isn’t ready for option three. You want to enrich their understanding of fractions.

1. Introduce the activity. Tell students that you will be using a box and charcoal to bake cookies or whatever is on your menu. Show them the materials you will be using.
   a. Demonstrate and talk through the set-up (without charcoal). Clear an area and put foil on the floor/ground. Spread out the cans and make sure that the pan can rest securely on them. Check to make sure the box fits over top. Get a small, preferably flat, rock to hold up the edge of the box. Explain that charcoal will be spread out under the pan to provide heat.
   a. Take time for questions. Many of your students will be skeptical.

2. If you are working with a class or a group larger than ten students, divide the kids into groups. I recommend groups of six to eight students. To encourage participation in the first session you can divide each group in half (three to four students) to make calculations. Then have the group come back together to see if they all got the same answers.
   a. Hand out a copy of the recipe to each group.
   b. Tell students that you need to know how much charcoal to buy. Use the question and information you put up on the board.

3. Let groups work. Depending on the background of your students, they may need some additional help/prompting.
Cooking with Charcoal

a. Walk around and see how groups are doing. If they speed through it, offer additional challenges.
b. Have groups write their conclusions on the recipe or another sheet of paper.

4. Discuss prior knowledge. Ask if students have used fractions in cooking before.
a. IN A CLASSROOM SETTING: Review what you have learned about fractions in the past.
b. IN A SMALL GROUP SETTING: Ask what students know about fractions. (Use background information to direct the discussion.

5. Tell students that they have an opportunity to practice measuring now.
a. Demonstrate how to measure.
   i. Discuss making the top level
   ii. Point out that one-half cup and one-half tablespoon are both halves, but the size of the whole is different.
b. Tell them they have five minutes (exact amount of time up to you, based on kids’ previous experience and interest) to experiment with different measuring devices. Some questions you might ask the whole class or groups as you walk around:
   i. Is there another way you could get exactly one cup?
   ii. If you needed one-half cup, but you didn’t have that measuring cup what could you do? What if you wanted one-third or two-thirds?
   iii. How does this relate to what we learned? (Ideally, cite a specific activity.)

6. Have students return supplies to a designated area. You may choose to collect their recipes if you want to view it or to make sure it doesn’t get lost before the next lesson.

OPTION THREE:
• If you group has a firm understanding of fractions. They have started to experiment with computations of fractions.

1. Introduce the activity. Tell students that you will be using a box and charcoal to bake cookies or whatever is on your menu. Show them the materials you will be using.
   a. Demonstrate and talk through the set-up (without charcoal). Clear an area and put foil on the floor/ground. Spread out the cans and make sure that the pan can rest securely on them. Check to make sure the box fits over top. Get a small, preferably flat, rock to hold up the edge of the box. Explain that charcoal will be spread out under the pan to provide heat.
   a. Take time for questions. Many of your students will be skeptical.

2. If you are working with a class or a group larger than ten students, divide the kids into groups. I recommend groups of six to eight students. To encourage participation in the first session you can divide each group in half (three to four
Cooking with Charcoal

students) to make calculations. Then have the group come back together to see if they all got the same answers.

a. Hand out a copy of the recipe to each group.
b. Tell students that you need to know how much of each ingredient and how much charcoal to buy. Use the questions above.

3. Let groups work. Depending on the background of your students, they may need some additional help/prompting. Use the sample for ideas.

a. Walk around and see how groups are doing. If they speed through it, offer additional challenges.
b. Have groups write their conclusions on the back of the recipe or another sheet of paper. You may choose to collect their recipes if you want to view it or to make sure it doesn’t get lost before the next lesson.

Session Two:

1. Remind the students that it is very important to pay attention to what they are doing and what adults tell them to do.

a. Review safety rules. These may include:
   i. Don’t touch anything that is hot. Your adult will do that for you. OR ask permission from the adult before touching anything that is hot. This includes your cooking pan and box after you add charcoal.
   ii. Stay a certain distance away from the box oven unless you have permission to do something. (i.e. two big steps or outside a circle drawn in the ground.)
   iii. No running.

b. Separate students into their groups and assign an adult to stay with the group.

c. Return groups' papers from the day before.

2. If you have a large group it would be easiest to do steps three, four, and five in rotations, but it is a good idea to get the charcoal going before you have everything set up. It may take about twenty minutes. (On the other hand, you don’t want to have your charcoal burning for forty minutes before you start cooking.) I’ve used the ideal order, but you can make adjustments.

a. Walk everyone briefly through each step so they will know what to do. Provide additional help as they are working.
b. Have groups choose their locations. They should be level and flat, not too close to another group, and not have any fire hazards. They need to okay the location with an adult.

3. Start charcoal next to location

a. Have an adult (following instructions) pour charcoal into charcoal starter, and light it underneath. Students can watch and work on another activity while it gets going, although the charcoal needs to be monitored. (This step may vary with type of charcoal and type of starter.)
b. Remind students that an adult should do this OR that the job requires special practice and an adult to be present.

4. Get your food ready to cook.
Cooking with Charcoal

a. Wash your hands and put on plastic gloves (gloves optional)
b. Use the appropriate measuring tools to follow the recipe. Point out labels on each item, identifying quantity (1/2) and unit (cups, teaspoons, tablespoons). Make sure you are careful to follow the recipe closely.
c. Show or remind students how to measure a level cup. Demonstrate or explain other more complicated parts. (Rolling and flattening balls of dough, etc.)
d. Once your food is prepared cover it or bring it over to you cooking area.

5. Set up the space for your box oven.
a. Clear away any debris on the ground and set out several large sheets of foil.
b. Position cans, pan, and rock. Practice putting box on.
c. Make sure you have hot mitts and tongs ready.

6. Cook your food.
a. Have an adult use the tongs to spread out the number of coals students say to use under the pan (from earlier calculations). Students should watch from one or two steps back.
b. Have the adult place the box on top. Remind them that as soon as the box is in place it is considered hot.
c. Start timing. Check a couple of minutes before the recipe says it should be done. When checking to see if it is done:
   i. An adult should lift the box.
   ii. No one should touch anything, just look first. If necessary have a designated person carefully check with a utensil.
   iii. Put the box back on as quickly as possible, and try not to check more than once. You loose heat.
d. When finished cooking, take the box off. Have an adult use the hot mitts to remove the pan to a stable area. Then the food can be removed onto a plate.

7. Clean up.
a. Put out coals completely or have someone monitor them until they burn out (this takes a long time).
b. Wash dishes. (See instruction.) Every student should do at least one job (they can take turns): scraping, soapy water, rinse water, bleach water, drying, putting away.
c. Return supplies to designated areas.

8. If students haven’t already, test your food. Make sure to wash hands first.

9. Gather the group back together.
a. Discuss what you observed.
b. Ask about the role heat energy played in baking. (Your discussion of this will depend largely on your groups’ experiences.)
Cooking with Charcoal

Assessment: Assessment will vary, because exact objectives depend on students past experience.

- Session One: Depending on the option you choose, session one provides a chance to see how students apply and think about fractions in a real-life situation. You may want to take notes or use a check-off sheet to look for specific behaviors.
- Session Two: The main thing to look for in this activity is participation. Also, you can note what students contribute to the discussion and what observations they make during the activity.
PEANUT BUTTER COOKIES

Ingredients:

\[
\begin{align*}
\frac{1}{2} \text{ cup shortening} & \quad \frac{1}{2} \text{ cup brown sugar} & \quad \frac{1}{2} \text{ teaspoon baking powder} \\
\frac{1}{2} \text{ cup peanut butter} & \quad \frac{1}{2} \text{ egg} & \quad \frac{1}{4} \text{ teaspoon salt} \\
\frac{1}{2} \text{ cup sugar} & \quad \frac{1}{4} \text{ cups flour} & \\
& \quad \frac{3}{4} \text{ teaspoon baking soda}
\end{align*}
\]

Consider substituting healthier options for ingredients.

Directions:

1. Thoroughly mix shortening, peanut butter, sugar, brown sugar, and egg.
2. Blend in flour, baking soda, and baking powder.
3. Cover and chill. (When dough feels cold it will be easier to roll into balls. This step can be omitted if necessary.)
4. Shape dough into 1 inch balls. Place 3 inches apart on baking sheet.
5. With a fork dipped into flour, flatten to two inches in criss-cross pattern.
6. Bake ten to twelve minutes at 375 degrees Fahrenheit.
7. Place on rack to cool.

Recipe from the Tillikums Kumtux Ekkoli Hehe Camp Fire Club Cookbook
**Clothing and Hypothermia**

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# Clothing and Hypothermia

## TOPIC: Clothing and Hypothermia

### KEY CONCEPTS:

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<th>Outdoors</th>
<th>Academic</th>
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<tr>
<td>Hypothermia – g, c</td>
<td>Heat lose – g, c</td>
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<tr>
<td>Appropriate gear – g, c</td>
<td>Setting up an experiment (focus: controlling variables) – c</td>
</tr>
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<td>Making a pack list – g</td>
<td></td>
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*Concept included in small group lesson – g*
*Concept included in classroom lesson – c*

### LESSON SUMMARIES:

<table>
<thead>
<tr>
<th>Title</th>
<th>Small Group Lesson</th>
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<tbody>
<tr>
<td><strong>Overview</strong></td>
<td>In the first session students experiment with different gear. Hypothermia, keeping heat in, water, and wind are discussed. In the second session, students make a specific list of what they are going to bring on their overnight.</td>
</tr>
</tbody>
</table>

**Prerequisites/Age**
- 5<sup>th</sup> grade and up
- Working on High Adventure or Trail Maker
- Planning on going on an overnight in the next month
- Experience in school controlling variables

**Academic Standards**
Science GLEs
- 2.2.4 (3<sup>rd</sup>-5<sup>th</sup> grade)
- 3.1.2 (3<sup>rd</sup>-5<sup>th</sup> grade)

**Camp Fire Awards**
- Beads
  - TE341
  - TE350
- POA
  - High Adventure 7 OR
  - Trail Maker 7

**Background Information**
- Hypothermia
- Outdoor clothing
- Sample pack list
- Heat
- Experiments
- Controlling variables
# Classroom Lesson

## Cold Hands

### Title

Students experiment with different types of materials for keeping warm and dry in the outdoors using different types of gloves (silk, cotton, plastic, etc.).

### Overview

- **Cold Hands**

### Prerequisites

- 4th grade and up
- Past experience with variable control
- At least one experience designing part of an experiment
- Experience recording data
- Experience with heat as an energy source
- Familiarity with tools used in lesson

### Academic Standards

**Science GLEs**

- 1.1.4 (4th grade)
- 3.1.2 (3rd-5th grade)

**Communication GLEs**

- 3.3.1 (4th grade)

### Camp Fire Awards

- **Beads**
  - TE341

### Background Information

- Hypothermia
- Outdoor clothing
- Heat
- Experiments
- Controlling variables

### Extensions

- Write a letter to a younger child, a hiker, or the owner of a company that makes gloves giving them advice.
- Research hypothermia. Use information to make skits involving a person showing signs of hypothermia and what the group did to help.

## ADDITIONAL RELATED ACADEMIC CONTENT:

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<thead>
<tr>
<th>Grade Level</th>
<th>Content (EALRS)</th>
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<tbody>
<tr>
<td>6th, 7th</td>
<td>Surface area – How does surface area affect heat loss?</td>
</tr>
<tr>
<td></td>
<td>• Math 1.2.1 (working draft)</td>
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<tr>
<td></td>
<td>• Math 1.2.6</td>
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<tr>
<td>10th</td>
<td>Energy and Heat – Further understanding of the definitions of energy and heat, related to particles</td>
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<td>• Science 1.2.3</td>
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<td>• Science 1.1.4</td>
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<tr>
<td>4th, 6th, 7th</td>
<td>Transfer of Energy – How heat is lost</td>
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<td>• Science 1.2.2</td>
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<td>• Science 1.3.3</td>
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<tr>
<td>2nd, 4th, 5th, 7th</td>
<td>Heat and Change of State – Evaporation and heat lose</td>
</tr>
<tr>
<td></td>
<td>• Science 1.3.3</td>
</tr>
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</table>
Clothing and Hypothermia

This section is about clothing and outdoor recreation. The focus is on avoiding hypothermia, a major killer of participants in outdoor activities. Heat related illnesses are a problem too. They are less of an issue in this region, so this information focuses on hypothermia.

HYPOTHERMIA

Basics
- One major concern with outdoor recreation activities, regardless of weather, is hypothermia.
  - A person can get hypothermia indoors or outdoors, during the day or at night, and in warm and cold temperatures.
- When you have hypothermia your internal temperature drops.
  - Your temperature drops because your body can't produce heat as quickly as it is lost. Your internal body temperature drops below 95 degrees Fahrenheit.
  - In effort to keep warm, as your temperature starts to drop, you move and exercise or your body automatically makes adjustments (such as shivering) to keep the normal temperature in your vital organs. These make you tired.
  - When your temperature has dropped, the cold affects your judgment and reasoning. You don't realize what is happening. You loose control of your hands.
  - Hypothermia is life-threatening.
- Your risk for hypothermia is increased when it is windy, when your body is wet, and when you are tired.

Symptoms and First Aid
- Some symptoms
  - Shivering
  - Disorientation or change in mental status
  - Loss of consciousness
  - Potential death
- First Aid
  - If you think anyone may be getting hypothermia, take immediate steps to get them warm.
  - Immediately seek shelter (building, tent, fire and blankets)
    - Insulate the person from cold on all sides. Keep them off the cold ground (for example, use sleeping pads on the tent floor as well as sleeping bags on top of the person).
  - Remove any wet clothing (replace with dry, warm clothing as possible).
  - If the person is coherent or has an unaltered mental status, give them hot liquids and energy bars.
  - Get medical help as quickly as possible.
  - Watch other members of the group. Take care of yourself.
Clothing and Hypothermia

How Body Heat is Lost
- Evaporation: When you sweat. When you are exercising during outdoor activities you get warmer. When you stop, the sweat on your body makes you cold. Wear breathable clothes, so you don’t trap the sweat next to your body.
- Respiration: When you exhale. This can be avoided by covering mouth and nose (with a bandana, scarf, or balaclava).
- Conduction: When you sit on something cold, such as a rock. Consider using a sit-upon of some sort. (A folded piece of clothing will work.)
- Convection: Protect your self from the wind. Wear clothes that trap warm air next to your skin.
- See information about “heat” for more details.

Avoiding Hypothermia
- Stay dry (this includes avoiding getting sweaty).
- Be aware of wind, particularly if you are wet.
- Wear layers and appropriate clothes. Don’t let your body get too cold – it is extremely hard to warm up outdoors.
- If you don’t have the appropriate gear and people are getting cold, get shelter and take prevention measures. (This can mean returning to a heated building or setting up a tent and making warm drinks.)
- Understand the risk even on sunny days.
- Keep other prevention issues in mind even when the risk of hypothermia is higher. When it’s cold and pouring down rain, it is easy to focus on keeping everyone dry and forget to make sure the group is drinking water.

OUTDOOR CLOTHING

Basics
- When choosing and packing clothing for outdoor excursions, consider:
  - Where are you going?
  - When are you going? What might the weather be like?
  - How long will you be gone?
  - What are you doing?
- Be sensible, rather than fashionable. You are likely to be doing a lot of things and your clothes will probably get dirty. Bring older clothes that you know are comfortable. Avoid clothes that are tight or that you want to keep nice.
- Choose weather appropriate clothes. Sometimes you will need shorts and sometimes you won’t. In cold weather you will probably want several sweatshirts/sweaters/fleeces, but in warm weather one will probably be sufficient.
- Rainwear: If there is possibility of rain, you need to be prepared to protect your entire body with water proof (not just water repellent) gear. Ideally, this would probably be a Gortex raincoat, rain pants, boots, and gloves. Realistically, you can use a cheap poncho (or a large plastic garbage bag with a hole in the top for the head and holes for arms if necessary) with a good hat.
Clothing and Hypothermia

- **Feet**
  - Like the rest of your body, feet should be kept dry (waterproof shoes when appropriate) and warm. Wear two pairs of socks when hiking. The inner (like other inner layers of clothing) should wick sweat away. The outer layer should provide protection and insulation.
  - If you are hiking it is extremely important to have appropriate footwear (socks and shoes) to avoid blisters and to keep your feet warm.

**Material**

- **Vocabulary**
  - Breathable: Perspiration and body heat is let out, so moisture doesn’t accumulate inside the clothing. This is useful when you are exercising and become hot and sweaty.
  - Wicking: Wicking pulls sweat away from skin, into outer layers of clothing. This is advantageous, because it keeps your bottom layer of clothing from getting wet (which will keep you warmer and more comfortable).
  - Water-repellent: Water-repellent clothes “repel” water. They will keep you dry in a sprinkle, but water will soak through in a downpour.
  - Water-proof: Water-proof clothing keeps you dry; regardless of how wet it gets on the outside. Some material needs to be treated every so often to retain its water-proofing.

- **Cotton**: Cotton holds moisture. This is good in the summer (it keeps you cool), but bad in the winter. Avoid wearing cotton when there is a possibility of you getting wet. Common types of cotton:
  - Tee shirt material
  - Denim: Jeans get very heavy and cold when wet.
  - Flannel: Great for chilly, but dry, days.

- **Synthetics**: A variety of synthetic materials have been created for certain benefits. One common disadvantage of synthetics is they tend to melt, rather than burn. Melting can cause more serious burns if the material is next to your skin.
  - Polypropylene (or “polypro”): Polypropylene wicks moisture away and remains warm when it is wet. It’s often use for long underwear and hiking socks.
  - Fleece: Fleece is warm when wet, dries quickly, and is lighter than wool. Some people prefer wool because it is thicker and can be found for very low prices at used clothing stores.
  - Nylon: Nylon is windproof and water repellent. It’s good for blocking weather, but provides little warmth.
  - Gortex: Gortex is a breathable, waterproof material. It is often used to make coats and boots. A major downside to Gortex is that it is very expensive.

- **Wool**: Wool is an excellent insulator for cold. Unlike many materials, it provides insulation even when wet. On the down side, wool takes a very long time to dry. Also it is fairly bulky (takes up a lot of pack space, heavier) and some people find it itchy.

- **Down**: Down provides the warmest insulation for the weight, so is often used in sleeping bags and vests. Down isn’t a good material to use in this region, because it provides no insulation when wet and is very slow to dry.
Clothing and Hypothermia

- Silk: Silk is good for insulating and wicking. It is very light, and most people find it comfortable. A major disadvantage is that it tends to be delicate. Sometimes it requires special washing, and is not as durable as other fabrics.
- Plastic/rubber: These materials, used for raingear, provide water-proof protection from rain. The downside is that they do not absorb body moisture and aren't breathable. You are more likely to become sweaty and overheated when exercising (such as hiking) in these materials. When you stop moving this will cause you to become chilly.

Layers

- Layers of clothing create an excellent insulator (see information about “insulators and conductors”). Insulation is improved because your clothing is thicker and often air is trapped between layers.
- Basic three layers:
  - Bottom layer (next to the skin): Moisture control. Clothes should wick moisture away from skin. This layer is usually the thinnest. Long underwear would be included in this layer.
  - Middle layer: Insulation. This layer is to keep you warm. An example would be fleece or wool sweater and pants.
  - Top layer (outmost layer): Water and wind proofing. This layer should protect you from wind and rain. This usually includes a raincoat with a hood and rain pants.
- Layers are practical for changing weather and activity.
  - If there is no wind and rain, you can remove the outer layer. If you keep them easily accessible, you can add them as soon as you needed.
  - You can adjust the quantity of insulation (middle layer) to keep you warm but not overheated. For example, when hiking, as you start to walk you warm up and remove layers. When you stop, you cool down, and can add the layers back on.

SAMPLE PACK LIST

Clothing

- Underwear (a couple extra pairs)
- Long underwear – tops and bottoms
- Socks – regular (bring a couple extra pairs); light and heavy for hiking
- Shoes – tennis shoes/regular shoes, hiking shoes, slip-on/beach/shower shoes; bring at least two pairs in case one gets wet
- Gloves
- Headgear – bandanna, wool/fleece/stocking cap
- Rain gear – coat (with hood) and pants or poncho
- Fleece coat/sweater/sweatshirt
- Tee shirts, long sleeve shirts
- Pants (if really hot bring at least one for nights, unexpected cold days; if expect to wear daily, bring at least one for every two days) – regular/jeans, fleece/wool pants for cold
- Shorts (if needed)
- Warm pajamas
Clothing and Hypothermia

Sleeping
• Sleeping pad
• Sleeping bag
• Extra Blanket if needed

Personal Items
• Toothbrush
• Toothpaste
• Floss
• Hairbrush, comb
• Hair ties
• Deodorant (if needed)
• Other necessary toiletries (not make-up, odors attract bugs)
• Washcloth
• Towel
• Shampoo, conditioner, soap (if showering)
• Bug repellent
• Sunscreen

Activities
• Permission slip (as applicable)
• Material for any special activities
• Hiking
  - Ten+ essentials (only have kids bring what they know how to use; adults in the group should have all essentials)
    • Water bottle
    • Map of area
    • Compass
    • First aid kit
    • Waterproof matches
    • Candle/fire starter
    • Whistle
    • Water treatment (iodine)
    • Extra food
    • Extra clothing
    • Flashlight and batteries
    • Mirror (or other tools to attract attention)
    • Large plastic garbage bag/space blanket
  • Pillow (optional)
  • One stuffed animal (optional)
  • Flash light with extra batteries

• Sun glasses
• Watch (optional)
• Water bottle
• Camera (optional)
• Notebook/paper and pen/pencil
• One fun thing (toy, book, etc.)
• Any medication needed (give with instructions to leader)
• Tissue (Kleenex)
• Two Ziploc sandwich bags, two plastic bags (bread or grocery), one plastic garbage bags

• Backpack
• Chap stick
• Sunscreen
• Sun glasses
• Bug repellent
• Outdoor cooking
  • Plate
  • Bowl
  • Mug
  • Silverware
  • Pocket knife (if trained to use)
  • Dip bag
• Water sports
  • Swim suit
  • Cap, goggles if needed
  • Life jacket if needed
  • Extra towel
  • Beach/water shoes
  • Sunscreen
  • Sun glasses
Clothing and Hypothermia

I've included some background information on concepts used in this lesson. I believe it is sufficient for this stand-alone lesson, but many of the concepts (such as experiments) require additional information and activities to teach. Some of this information is also included in other topic areas. Additional information is available through the list of resources in the appendix.

HEAT

Heat, Temperature, and Energy

- Energy
  - Energy is very hard to define and grasp, because it is not something tangible.
  - Often energy is defined as “the ability to do work.”
    - Energy is a “state of particle agitation.” Elementary students don’t discuss the movement of particles in matter, so more complete, complex explanations aren’t appropriate.
  - Heat is one of many forms of energy. Students may have discussed other forms of energy such as electricity, magnetism, sound, and motion

- Heat
  - Heat is the transfer of energy.
    - “Heat” talks about difference in temperature.
  - Misconceptions
    - Heat is often – incorrectly - described as opposite of cold. Although hot is opposite of cold, things that we would describe as very cold and things that we would describe as very hot both have heat.
    - Heat is often described as a substance; something that is transferred in the air. It is often considered a gas.
      - We talk about “turning on the heat” to warm up a room or cook food and about heat rising. Therefore it is easy to see where the confusion comes from.
      - Air does not convey heat. A room becomes warmer as a result of a series of interactions, transferring energy.
      - Remember, heat is actually a transfer of energy. That is an action not a substance.
    - Students’ misconceptions generally stay the same even after an explanation unless something challenges their understanding.

- Temperature
  - Temperature is a measure of heat.
    - A key misconception is that heat is the opposite of cold. Students may say that temperature is a measure of heat and of cold, which is not correct. “Cold” refers to a low temperature, which means that there is less heat.
Clothing and Hypothermia

Heat Transfer

- Hot objects transfer energy to colder objects. It never happens the other way around.
  - If you have a spoon in ice cream the spoon feels colder because of *lose* of energy. The “cold” from the ice cream has *not* been transferred to the warmer spoon. The energy (in the form of heat) has been transferred from the spoon to the ice cream.
  - Children – and adults – often think of heat as a synonym for “hot.” They describe “cold” as an opposite force of heat.
- Burning something produces heat energy. This energy is then transferred to the air.
- With children, it may be helpful to discuss heat transfer in terms of energy, because the word “heat” is often confused with “hot.”
  - For example: The energy from the spoon transferred to the ice cream, rather than the heat from the spoon transferred to the ice cream.
  - Your explanations will depend on the child’s age and experience.
- Types of heat transfer
  - Conduction
    - Takes place when there is direct contact between two objects.
    - When you put a room-temperature spoon into ice cream from the freezer, the spoon gets colder, because heat from the spoon is transferred to the ice cream through conduction. The spoon has lost the energy it had before contact with the ice cream and thus feels “cold” after contact with the ice cream.
    - In terms of particles:
      - The two objects with different initial temperatures always tend toward an equilibrium temperature.
      - When the particle with less energy (moving slower, lower temperature) collides with the particle with more energy (faster moving, higher temperature), the faster one rebounds with less energy (so it has slowed down) and the slower one rebounds with more energy (speeding up).
      - A bunch of these collisions happen, until the particles are all moving at an intermediate speed. This means that the temperatures are now the same.
  - Convection
    - Heat is transferred by a series of collisions.
    - This is the process that makes a house warmer when you turn on the heater.
    - Used by air and water. (Example: convection currents)
  - Radiation
    - A method of heat transfer occurring between gases and in outer space. It does not require direct contact.

Heat Energy and Change

- A common area to study is the effect of heat energy on the state of matter. (For example, the freezing and evaporation of water.)
- There are many ways to produce heat. All forms of energy can transfer to another from of energy.
  - From mechanical energy: rubbing hands together, hammering nail
  - From chemical energy: hand warmers
  - From light energy: bulb, sun
Clothing and Hypothermia

Wind and Lose of Heat
- Wind (the movement of air)
  - Wind blows away the moist air that generally surrounds the body. This causes faster evaporation from the surface of the skin, which cools the body.
  - Wind also blows away warm air that surrounds the body, replacing it with colder air.
    - Your body generally warms up a layer of air surrounding it. When the wind blows this air away, your body loses energy by warming a new layer of air.

Water and Lose of Heat
- Water takes more heat energy to warm up than an equal volume of most other substances. In fact, it takes five times as much heat energy to warm water up one degree as it does to warm a solid rock of the same volume up one degree.
  - This is why risk for hypothermia is higher when you are in the water or wet.
- Sweating is useful for cooling down when you are over-heated, because evaporation cools the skin. Unfortunately, the same process can occur when you don’t want it to, such as on a cold, rainy day.

Insulators and Conductors
- If your students have experience with insulators and conductors in electricity (another form of energy) these concepts will probably come more naturally.
- A conductor is something that changes temperature very quickly (such as metal). It gains and loses energy (in the form of heat) easily, meaning that it can get hotter or colder quickly.
- An insulator is something that changes temperature slowly. It does not gain or lose energy (in the form of heat) very easily, meaning that it is slow to get hotter and slow to get colder.
  - Insulation is used to “hold onto” heat. Ex: heat doesn’t travel efficiently through air. So two panes of glass with air in between them serves as an insulator. Layers of insulating materials also work. Water also is harder to heat.
- A common misconception (related to confusion of heat and hot discussed in “heat, temperature, and energy”) is that a conductor is something that heats or cools quickly. This is not correct.
  - Heat is not opposite of cold. “Cold” is just a low temperature. Heat is a form of energy. Something we consider “very cold” does have heat energy; it just has very little of it.
  - It is correct to say a conductor is something that heats quickly. That means it can get hotter (by gaining energy) or colder (by losing energy) easily.

EXPERIMENTS

The Scientific Method
- There is a series of steps commonly used in school (and by researchers) to do experiments. This is a valuable tool to help kids learn what to do. Key components:
  - Question
  - Prediction
Clothing and Hypothermia

- Materials
- Procedure (including variables)
- Data Collection
- Conclusions

- This method isn’t completely developed in elementary school.

Question
- Any time you have an experiment, your goal is to answer a question about something. These can include:
  - “I wonder what would happen if…”
  - “I wonder why…”
- When your students are doing experiments it is important that they know what question they are trying to answer. Otherwise they are going through motions without a goal.
  - If written work is required for the activity, you may ask them to write the question in their own words at the top. (Developing good ways of wording a question takes practice. Provide plenty of examples. You may want to have them write it in their own words – a good assessment tool for you – and then put up a couple of versions that you thought of.)

Recording Data
- There are different methods students can use to keep track of what they find out.
  Make sure you use several over time. Some possibilities:
  - Answers to a list of questions (possibly on a worksheet).
  - In a format the student chooses on blank paper.
  - Copies of a chart that you make.
  - A chart that students make.
  - A combination of several of the methods above.
- Students can record their observations individually, have one scribe for the group, or even write their results on a chart for the class.
- Writing (both full sentences and lists) and drawing can both be used.

Planning an Experiment
- After you have a question, you can come up with a method to answer that question.
- Identify and control variables. Include these measures in your method.
  - It is okay if your students don’t do this perfectly. What is important is that they get better at controlling variables over time.
- Make sure everyone knows what the plan is. Often providing written steps helps.

Conclusions
- It is important that students have time to discuss or record what they learned from the experiment. This includes:
  - Outcomes of the experiment and answers to their question.
  - Evaluations of their method and their control of variables. What worked well? What would they do differently? What aren’t they sure about?
Clothing and Hypothermia

Further questions. After doing this experiment, I’m curious about...? If we did this experiment again, but changed ________, what would happen?

VARIABLES

Identifying Variables
- Variables are any factor that can affect the outcome of the experiment.
- Controlling variables is an important part of setting-up an experiment. Before planning any experiment your students should be able to name variables that affect the outcome.
  - It is necessary that children “perceive more than one attribute of an object” and the occurrence of “interaction between the two.”
  - This understanding comes with time and experience.
- An example: If your experiment involved dropping things from a height to see what falls faster, students should brainstorm many of the following variables:
  - Height that is dropped from. (At first, standardizing height may be having anyone who drops the object stand on a chair. Because the people on the chairs are different heights, it may develop to dropping it a measured distance from the floor)
  - The weight of the object dropped.
  - The dimensions or surface area of the object dropped.
  - How time is recorded (stopwatch/counting/clock, how it is started and how it is stopped).

Controlling Variables
- It is necessary to control variables, because you can’t make conclusions when more than one variable is changed.
  - It is important that the only thing you are changing is the variable that you want to know about. For example, you could do an experiment about which type of seed grows faster. If a pot with one type of seed was put in the closet and a pot with another type of seed was put in sunlight, the results could be because of amount of light or because of type of seed.
- Once students can identify variables and understand the need to control them, they are ready to come up with methods for controlling variables.
  - In the above experiment, students should be able to invent ways to keep amount of light, amount of water, type of soil, amount of soil, and fertilizer consistent.
  - Students should be able to identify what variable were changed or manipulated, what variables were held constant, and what variable were measured to find the outcome (measured or responding variable).
  - Again this skill comes with time and experience. Younger children aren’t expected to be able to do this at all. Students in 5th grade aren’t expected to be perfect at this.
Clothing and Hypothermia

5th grade
one hour long session, one 30 min. session
(before a camping trip)

Packing

Overview: In the first session students experiment with different gear. Hypothermia, keeping heat in, water, and wind are discussed. In the second session, students make a specific list of what they are going to bring on their overnight.

Objectives:
• Academic
  - Students make observations about heat loss.
  - Students use the experimental process.
• Outdoor Education
  - Students are able to make a list of appropriate gear to pack for an overnight.
  - Students learn about keeping warm and dry outdoors in order to avoid hypothermia.

GLEs:
• Science
  - 2.2.4 (3rd-5th) “Understand how to make the results of scientific investigation reliable: Describe how the method of investigation insures reliable results (i.e., reliability means that repeating an investigation gives similar results); Identify and describe ways to increase the reliability of the results of an investigation (e.g., multiple trials of an investigation increases the reliability of the results).
  - 3.1.2 (3rd-5th) “Understand how the scientific design process is used to develop and implement solutions to human problems: Propose, implement and document the scientific design process used to solve a problem or challenge. Define a problem, scientifically gather information and collect measurable data, explore idea, make a plan, list steps to do the plan, scientifically test solutions, document the scientific design process; Describe possible solutions to a problem (e.g., preventing an injury on the playground by creating a softer landing at the bottom of a slide); Describe the reason(s) for the effectiveness of a solution to a problem or challenge.”

Camp Fire Awards:
• Beads
  - TE341: “Demonstrate the proper clothing and equipment to wear on a hike. Do this with your group or camp unit.”
  - TE350: “Make a personal equipment list before you start on a camping trip. Follow it as you pack for your trip. Check it again as you pack to return home.”

• Progression in Outdoor Action
  - High Adventure 7: “Using all knowledge gained so far, plan and carry out an overnight camping trip. Cook at least two meals outdoors. Do a waste disposal plan, caper chart, equipment list, permission form, transportation plan, etc.” OR
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Trail Maker 7: “Plan and carry out a one-night or two-night camping trip using all skills so far obtained. Cook at least three meals using at least two kinds of outdoor cookery. Have a waste disposal plan, capers, equipment, permission, transportation, etc.” *(This only meets part of the requirements. You still need to go on an overnight.)*

**Materials:**

**Session One:**
- Different types of outdoor clothing. Assortment should include as many of the following as possible:
  - Different types of raingear: thin poncho, water resistant jacket, plastic rain coat, Gortex coat
  - Clothing (such as shirts) in different materials: wool, cotton, polyester, fleece, silk, flannel, synthetic fabric
- Pencil/Pen and paper/clipboard/notebook for each member to take notes on.
  (Alternatively you can make a large chart at the beginning of the lesson for everyone to use.)
- Electric fan
- Container of water
- 1 set of measuring spoons and cups for every five kids
- 2 thermometers for every five kids
- 1 paper fan for every five kids (can be homemade)
- OPTIONAL: copies of *Backpacker* or other magazine that reviews outdoor gear

**Session Two:**
- Results from last week
- A copy of a sample packing list for you
- Paper and pencils for each student
- If appropriate, copies of the weather forecast for your upcoming trip or an internet print-out of what the weather is supposed to be like during that time of the year.

**Set Up:**

**Session One:**
- An ideal location to do this activity would be indoors, with an outdoor area where students could be easily monitored.
- Have the materials set out somewhere in the room. Students aren’t expected to use everything (and wouldn’t get effective results if they did).

**Session Two:**
- Review the packing list and outdoor clothing background information until you are familiar with it. It will make it easier to prompt students to think about things that they are forgetting.
- In a newsletter or in conversation, tell parents that students have a list and are prepared to pack for the overnight trip by themselves. If parents want to help or monitor packing that’s fine, but kids are working on learning the skill of packing for a trip.
Clothing and Hypothermia

Lesson:
Session One:
1. Tell students that some people have jobs (often part-time) testing outdoor gear to see which works best. They consider all sorts of things from really important ones like “Is this going to keep me warm and dry?” to convenience issues like “Is this zipper sturdy or is it going to break after I’ve used it for a while?” Often they do “field tests” of the gear (which means that they take it on a trip and try it out). The field tests can be supplemented by experiments at home
   a. Show some samples of gear comparisons.

2. Tell the group that they are going to test some different types of clothes to see which materials or combinations of materials seem to be best for their upcoming camping trip. They are going to focus on preventing hypothermia.
   a. Provide some information about hypothermia. Answer questions.
      i. Hypothermia occurs when your body produces heat slower than it is losing heat. Your body gets too cold.
      ii. You can get hypothermia even when it is sunny out or you are inside.
      iii. You stop thinking right. You don’t even know that there is a problem. Your body doesn’t work right. If you don’t get taken care of you can die.
      iv. To avoid hypothermia, it is important to stay warm and dry. Think of a time you were wet outside. Would of you been warmer if you were dry? You also need to watch out for wind, because wind makes you colder. Wear clothes that will keep you warm and dry.
      v. If you think someone has hypothermia, you need to warm them up. Take off their wet clothes and wrap them in warm clothes. Get them shelter, and get medical help.
   b. Discuss how people lose body heat (see background information). Focus on issues related to wind and rain. (Your level of discussion will depend on your kids’ scientific background in heat as an energy source.)

3. Point out the available equipment. Tell them that they aren’t expected to use it all.
   a. Remind the group that the fan moves air around. Unlike an air conditioner, it doesn’t push out only cool air. This is similar to wind.
   b. If you have a large group (more than 8 kids) consider dividing them into two smaller groups for the experiment.

4. Have students discuss ways to do their gear testing. Give them five minutes to brainstorm. (Don’t worry if they come up with an idea that isn’t practical. Unless it is not safe or is going to damage something, let them try it. They could learn a lot from an ineffective idea, and probably will change what they are doing when they discover it doesn’t work well.) Once they have some ideas, give them a few more things to think about to help them develop their plan. They will probably discuss many of these things without prompting.
   a. You think clothes that dry quickly would be good, because you are colder when you are wet. Let’s say you are going to put water on the shirts and see if it dries in a certain amount of time. How much water
**Clothing and Hypothermia**

are you going to put on each shirt or does it matter? (Yes it matters. They should standardize the amount of water.)
b. People often wear more than one top. Are you going to test for that?
c. Who is going to do what? Sounds good, but if you split up the work – say Alex tests two shirts and Jennie tests another two shirts – how are you going to make sure they are doing the test in the same way? (Probably by writing down their plan for everyone to follow.)
d. What question are you trying to answer with each part of the experiment? (Ideally they would write out the initial problem as well.)
e. In the given time how much can you do? Can you do different tests or just one?
f. How are you going to keep track of your findings? (Make a chart together or take notes)
g. What are you going to call each shirt in your notes? (One suggestion is looking at the tag to find out what it is made of.)
h. Are your results going to be scientific or less scientific descriptions or both? (Some of each is acceptable in this case.)

5. Let students do their experiment. Give them a ten minute warning before time is up.

6. Have students discuss results for each material and combination of materials. Provide any additional information about materials. (See background information.)
   a. Define wicking, breathable, water-repellent and water-proof
   b. Discuss advantageous and disadvantages of different types of materials.
   c. Explain the importance of layering. Describe the three layers.

7. Tell students to think about what kinds of things they usually bring on a trip at home, because next week they are going to make a personal gear list.

**Session Two:**

1. Today students are going to use what they learned last week to make a specific packing list for their upcoming trip. This will be a personal gear list, so – at this time – they don’t need to worry about supplies for cooking (unless everyone brings their own mess kit) or tents. Instruct students to make a descriptive check list for each person to follow.
   a. If you have computer access, they could type it up now. Alternatively you or one of the group members could type it up later and give out copies to each person. This will make it easier for everyone to read.
   b. There list should be specific. Example: 3 short-sleeve shirts (cotton okay), 1 warm sweatshirt/sweater/fleece, etc.
   c. Students may have some differences in what they want. It is okay to make an item optional (Optional: extra blanket (bring if your sleeping bag isn’t warm enough)) or to include a couple of choice (a book OR a journal and pen).

2. Here are some prompts you can give students as necessary.
   a. How long are you going to be on the trip? How much clothing do you need?
   b. What if your clothes get wet or really dirty?
Clothing and Hypothermia

c. Let's say you expect it to be sunny. Can you be sure? What if it isn't?
d. What if it rains and is really wet and muddy? What if it is really cold?
What if it is warm out?
e. What are we doing on the trip? (Are we hiking? – you probably need
shoes and a backpack. Are we going to practice using something like
pocketknives? – if you have one, you want to bring it.)
f. Where are you going to sleep?
g. What toiletries do you need? (If their list is excessive and not practical
for outdoors) do you really need that? (Remember products that have
an odor often attract bugs.) What special things do you need for
outdoors? (bug spray, sunscreen)
h. Anything else you need during the day or night? Think about what
happens when you get up, when you go to bed, when you eat...
i. Do you want to bring something for fun? We have limited packing
space. How much is it okay to bring?

3. When they think they’ve finish their list, compare it with a packing list someone
else came up with. It doesn’t need to be identical, but if theirs is different, ask
why? (Example: they don’t include hiking boots and that is something on the
list…Nobody in the group owns hiking boots. Instead they have good shoes for
hiking and an extra pair of shoes in case the other ones get wet.)

4. Make a plan to get type the list and print out copies for everyone. (Or make sure
that everyone’s list is easy to read.)
   a. Tell students that packing it is their responsibility, and no one else’s,
even if someone helps. They have to make sure they have everything
on the list.
   b. Everyone should bring their copy of the list to the overnight (maybe add
this to your packing list) or something to take notes with. During the
overnight they should make notes about what worked well and what
they want to change next time they pack. (Example: Red fleece got wet,
but I was still pretty warm. Don’t bring purple shirt next time, because
it will get dirty and I want to keep it nice.) It can also be useful to make
sure no items are forgotten when packing to go home.

5. On your overnight provide at least one five to ten minute time a day for students to
write notes on their gear. Instruct them to keep their list and modifications
somewhere safe at home – where they can find them easily – so that they are ready
to pack for the next trip.

Assessment: When your group goes on outings and overnights in the future, notice what
they bring and choose to wear. Ask why they made certain choices. Have your students
modify their pack list for an overnight the following year, and see what they remember.
Observation and ongoing discussion will help you know if you need to review any areas.
For example, if your group always is prepared with raingear, they probably learned that
well. If your group often brings light nylon jackets (and you know they have a better coat
at home or they don’t ask for/bring a plastic garbage bag or poncho) when it is likely to
rain, you probably want to discuss water-repellent and water-proof clothing again.
Clothing and Hypothermia

4th grade Classroom Lesson
1 hour session, 45 min. session Melissa L. Boyer

Cold Hands

Overview: Students experiment with different types of materials for keeping warm and dry in the outdoors, using different materials of gloves (silk, cotton, plastic, etc.).

Objectives:
• Academic
  - Students practice designing an experiment. The focus is on controlling variables.
  - Students practice presenting their findings to classmates.
  - Students can make some observations about heat loss.
• Outdoor Education
  - Students observe the effectiveness of different types of materials one could wear when doing outdoor recreation.
  - Students learn about hypothermia.

GLEs:
• Science
  - 1.1.4 (4th): “Understand that energy comes in many forms: Describe the forms of energy present in a system (i.e., energy of motion [kinetic], heat energy, sound energy, light energy, electrical energy, chemical energy, and food energy.)
  - 3.1.2 (3rd-5th) “Understand how the scientific design process is used to develop and implement solutions to human problems: Propose, implement and document the scientific design process used to solve a problem or challenge. Define a problem, scientifically gather information and collect measurable data, explore idea, make a plan, list steps to do the plan, scientifically test solutions, document the scientific design process; Describe possible solutions to a problem (e.g., preventing an injury on the playground by creating a softer landing at the bottom of a slide); Describe the reason(s) for the effectiveness of a solution to a problem or challenge.”
• Communication
  - 3.3.1 (4th): “Applies skills for delivery of effective oral communication and presentations: Adjusts body language to increase engagement with audience (e.g., depending on proximity to audience, includes purposeful gestures); Adjusts volume to engage the audience, with teacher guidance (e.g., lowers and raises voice for interest); Uses adult grammar and syntax appropriate to grade level.; Uses appropriate language registers with teacher guidance (e.g., casual versus formal: peer-to-peer, small group versus large group).

Camp Fire Awards:
• Beads
  - TE341: “Demonstrate the proper clothing and equipment to wear on a hike. Do this with your group or camp unit.”
Clothing and Hypothermia

Materials:
- Different types of gloves: plastic, silk, glove liners made of some blend of synthetic materials, fleece gloves, cotton gloves, gloves with a water-repellent coating, etc. You need at least one pair of gloves for every group of students.
- Electric fans – ideally one per group, but you can make do with one for the classroom.
- Container of water for each group of students
- If possible, container of crushed ice for each group
- Measuring devices: graduated cylinders, syringes, measuring cups/spoons, etc. - Ideally one of each per group
- Thermometers (suitable for taking temperature of potato) – Two per group, plus one extra
- Balance or scale, and one or two other materials commonly used in science experiments
- Overhead or copies of a list of criteria for presentations
- Students should have notebooks/paper and pencils
- Pieces of butcher paper and markers if you require a visual
- Potatoes – two per group plus one extra. They should all be approximately the same size. They need to be small enough to fit in gloves, but long enough for you to insert a thermometer in them.
- Rubber bands – two per group
- Timers/stop watches – one per group

Set-up:
- Evaluate student readiness for the activity. This is a fairly complex lesson. If it is near the end of the year, and your fourth graders have had a lot of science, especially activities that involve variable control, or if you have older students, they are probably ready. If not, put it off.
- Heat up potatoes in the oven or microwave (poke holes first). Wrap them in foil, plastic, and towels (perhaps with a heat pack if they need to stay warm for a long time) to keep them warm. When students get them, they should feel hot, but be cool enough to touch without being burned.
- Plug fans into outlets. Place in an area where students can access.
- Create a list of things you want included in students’ presentation. Use whatever vocabulary you’ve been using in the past and consider what students have been practicing. Your list may include: Discuss question/problem, materials used, method, results, conclusions, what worked well and what you would change; Everyone needs to talk; Presentations should be two to five minutes long; Include one visual; Make sure that you are speaking loud enough that everyone can hear you.
Clothing and Hypothermia

Lesson:
Part One
1. Introduce the activity. Ask students who has been camping, hiking, etc.
   a. Tell students that some people have jobs testing different type of gear to be used when doing outdoor recreational activities. That is what we are going to be doing today. The results will be good for other times when you are outside too, not just for camping and such.
   b. Today each group is going to compare two different types of gloves. They will come up with their own experiment to determine how gloves will perform in weather that is wet, cold, or weather both windy and wet.
   c. Tell students than, when outdoors, one part of your body that gets cold easily is your hands. Like other clothes, gloves come in lots of different types of materials.
      i. Discuss how people lose heat. (See background information.)
   d. Discuss hypothermia. (See background information.) Focus on losing heat when it is cold, when it is wet, and when it is windy. Answer questions.
      i. Hypothermia occurs when your body produces heat slower than it is losing heat. Your body gets too cold.
      ii. You can get hypothermia even when it is sunny out or you are inside.
      iii. You stop thinking right. You don’t even know there is a problem. Your body doesn’t work right. If you don’t get taken care of you can die.
      iv. To avoid hypothermia, it is important to stay warm and dry. Think about a time you were wet outside? Would you have been warmer if you were dry? You also need to watch out for wind, because wind makes you colder. Wear clothes that will keep you warm and dry.
      v. If you think someone has hypothermia, you need to warm them up. Take off their wet clothes and wrap them in warm clothes. Get them shelter, and get medical help.
      vi. You are more likely to get hypothermia when you are wet, when it is windy out, or when you are tired.
2. Divide your class into groups of three to six students. Give each group two different types of gloves to test. (Note: They only need one glove from the pair.)
   a. Tell students that each group will be presenting their experiment and findings to the group. Review your criteria. Suggest that these are things that they should take notes on.
      i. If they haven’t done many science experiments, you may want to write a sample outline on the board. (Question we are answering, what materials we need, what we are going to do, etc.)
      ii. Recommend that they make a chart of some sort to keep track of their results. Making a large chart is one option for a visual.
Clothing and Hypothermia

iii. It is okay if only one person writes down the information at the table. Just make sure that everyone in the group knows what is being written and agrees with it.
b. Show students where the material table is. Let them know that they will not be using everything on the table. Explain materials as necessary.
   i. Every group gets two potatoes. They can use thermometers to take the potatoes temperature, by inserting the thermometer. If the thermometer pokes all the way through the potato it will mess up the results. One thing you could do for your experiment is find out which glove keeps the potato warmer in a particular weather condition.
   ii. The fan moves air around. Unlike an air conditioner, it doesn’t push out only cool air.

3. Let groups get to work. Suggest that they write up their question, materials, and plan first. Walk around and check out what each group is doing. You may need to provide some of the following:
   a. If the group’s experiment is very complex and long: Think, could you finish this experiment in half an hour. If you aren’t sure, consider doing one part first and then coming back and adding other steps later.
   b. If the group rushes over to the materials table and starts trying things out: Slow down! How do you know you are all working together to do the same thing? What is your plan? Who is going to do what? How do you think this will help you answer your question?
   c. Ask groups why they choose to do what they are doing. What do they expect to happen?

4. When you have fifteen minutes left in the class, warn students that they need to start finishing up. They need time to plan their presentation and draw conclusions from their research.
   a. If you require a visual, warn students at twenty minutes or allow later class time to work on presentations.

Part Two
1. During this session, each group will give their presentation. Presentations should meet all criteria you set.
   a. Give students five minutes to get their groups ready.
   b. During presentations everyone needs to listen respectfully.
   c. Provide a time at the end of each presentation for questions.

2. At the end of presentations ask for some common conclusions. Write these on the board. Share additional information and suggestions about each material. (Layering, wicking, etc. See background information. The detail of information you provide will depend on the detail of their observation.)
   a. Ask students to vote on and explain which gloves they would wear in the following situations (make layers including a glove liner an option):
      i. To school on a chilly but dry day.
      ii. On a camping or hiking trip when it might rain.
      iii. In the snow.
Clothing and Hypothermia

Assessment: You have a number of opportunities to assess students. Informal observation during part one and during the concluding discussion can provide useful data. Any materials groups write up for their experiment and their presentation are also valuable tools. Your past science lessons will dictate your main areas of evaluation. Some things you might look for:

- Variable control
- Work together in groups (especially during planning)
- Meeting presentation requirements
- Conclusions at the end of the lesson (what have they learned about fabrics, wind, rain, etc.)
Appendix A: Possible Areas of Integration

Appendix A: POSSIBLE AREAS OF INTEGRATION OF ACADEMICS AND OUTDOOR SKILLS

Outdoor Concepts Related to Heat

- Pie irons
- Coals
- Grill
- Box oven
- Dutch oven
- Stick cookery
- Planks
- Briquettes
- Building fires
- Stoves
- Safety
- Hygiene
- Environmental impact
- Shelter
- Heat and the outdoors
- Outside/Weather
- Equipment
- Hypothermia
- Clothing
- Sleeping
- Survival

A Few Other Suggested Topics

- Nature, Leave No Trace – Science (environmental education)
- Pacing/Compasses – Math (averages, measurement, angles), Science (magnets)
- Maps – Science (landforms), Social Studies (geography)
- Survival and Emergency skills – Health (safety)
- Hiking skills – P.E. (fitness activity)
- Any outdoor topic or experience – Literacy, Writing
Appendix A: Possible Areas of Integration

Key Outdoor Skills

- Geology
- Animals
- Nature
- Plants
- Weather
- Trail marking
- Compasses
- Maps
- Hiking/Boating skills

Outdoor Skills

- Conservation
- Leave No Trace
- Manners
- Climate
- Planning
- Learning Skills

Skills

- Knots/looping whipping rope
- Setting up camp
- Tents
- Emergency
- 10 essentials
- Survival
- Shelters

Safety

- Equipment repair
- Hug a tree
- First aid

What to bring

- Proper clothing
- Packing

Bear bag

Food

- Pocket knives
- Outdoor cooking
- Fires

Cleanliness

Ax/Hatchet

Life-saving

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Appendix B: Resources

I used the following resources to provide information for my project. I would recommend them, as applicable, for your further information.

Outdoor Skills
  - “OLS teaches participants environmental awareness, forges environmental ethics and promotes environmental responsibility while learning skills to live comfortably in an outdoor environment.” – Field Guide, p. 3
  - Includes content information, as well as lesson and trip suggestions for instructors. The Field Guide is designed for use with children.
    - Uses “SIP” method: “Show” the skill, “Instruct” (explain), and participants “Practice” until proficient.
  - Activities divided by content area and levels. Levels form a progression similar to Camp Fire’s.
- Camp Fire USA
  - Outdoor Progression (POA)
    - Earn emblems for doing various activities at each level. A variety of content; levels usually correspond with ages, but progression through levels is necessary.
    - Leaders should receive some sort of outdoor training from the council before teaching to youth. Training varies from council to council, but usually focuses on safety, environmental issues, methods for teaching to kids, and preparation and equipment necessary.
    - Sometimes councils put on events (such as camping weekends or trainings) to help youth meet these requirements.
    - Although older, information still relevant/current.
    - Designed to correspond with Camp Fire program.
    - Provide information for adults to use with children.
- Council Trainings
  - Much of my information has come from youth and leader in trainings in Central Puget Sound Council and Orca Council.
  - Most of my training came from my mother and Camp Fire leader, Debra Langley-Boyer. She has set-up and written outdoor education programs for day camps and teaches outdoor education to leaders in Central Puget Sound Council.
- Leave No Trace (LNT): Center for Outdoor Ethics
  - Runs trainings, often in partnerships with other organizations. Trainings teach LNT principles or give instruction to future LNT trainers.
  - Provides programs and tools for education.
Appendix B: Resources

Science
- Course content from “Science Methods and Curriculum for the Elementary School” and “Lab/Field Experience: Elementary Science” taught at Western Washington University by Don Burgess. Fall quarter 2006 and winter quarter 2007.
  - Cartoons related to lesson topics.
    - pg. 186, 193: 15.3: Ice cream
    - pg. 186, 197: 15.7: Windy Day
- FOSS Solar Energy kit – 5th-6th grade
- STC Soils kit – 2nd-3rd grade

Math
- Class content from “Teaching K-8 Mathematics I” and “Teaching K-8 Mathematics II” taught at Western Washington University by Janet Mock. Winter quarter 2006 and spring quarter 2006.