Archery

Adventure: Archery

Archery Range, located to beyond athletic field, north of the dining hall

Duration: 45 minutes

Purpose: The purpose of this lesson is to explore the history and skills related to archery and use of the bow and arrow.

Science TEKS:

Materials:

Camp will provide: Bows, arrows, targets, safety equipment as needed.

Archery background information

American Indians did not always have the bow and arrow. It was not until about A.D. 500 that the bow and arrow was adopted in Iowa some 11,500 years after the first people came to the region. Primary benefits of the bow and arrow over the spear are more rapid missile velocity, higher degree of accuracy, and greater mobility. Arrowheads also required substantially less raw materials than spear heads. A flint knapper could produce a large number of small projectile points from a single piece of chert. Even with the gun's many advantages in the historic era, bows and arrows are much quieter than guns, allowing the hunter more chances to strike at the prey.

Indians used arrows to kill animals as large as bison and elk. Hunters approached their prey on foot or on horse back, accurately targeting vulnerable areas.

The choice of materials and the design of arrows and the bow were not random. Some materials were generally more readily available than others. Environmental conditions also affected the choice of materials. Humidity affects wooden bows, and temperature affects horn and antler. The intended use of the system, on foot or horse back, for instance, affects the final design. Bows used while mounted on horseback tend to be shorter than the bows used when on foot. Since the length of the bow determines the stress placed on the bow when drawn, shorter bows tend to be made of composite materials while bows used when on foot can be made of wood.

Indians used a variety of materials to make the *bow stave*, relying on materials that met certain requirements, most important of which is flexibility without breaking. Several species of plants and some animal materials met these requirements. Ash, hickory, locust, Osage orange, cedar, juniper, oak, walnut, birch, choke cherry, serviceberry, and mulberry woods were used. Elk antler, mountain sheep horn, bison horn, and ribs, and caribou antler also were used where available.

Bow construction techniques included a single stave of wood (*self bow*), wood with sinew reinforcement (*backed bow*), and a combination of horn or antler with sinew backing (*composite bow*). Hide glue was used to attach the backing. Bow strings most frequently were made of sinew (animal back or leg tendon), rawhide, or gut.

The Dakota Indians also used cord made from the neck of snapping turtles. Occasionally, plant fibers, such as inner bark of basswood, slippery elm or cherry trees, and yucca were used. Nettles, milkweed, and dogbane are also suitable fibers. Well-made plant fiber string is superior to string made of animal fibers because it holds the most weight while resisting stretching and remaining strong in damp conditions. However, plant fiber strings are generally much more labor intensive to make than animal fiber strings, and the preference in the recent past was for sinew, gut, or rawhide.

Arrow shafts were made out of shoots, such as dogwood, wild rose, ash, birch, chokecherry, and black locust. Reeds from common reed grass were also used with some frequency throughout North America with the exception of the Plains where reeds did not grow. Shoots were shaved, sanded, or heat and pressure straightened. Tools made of bone or sandstone were used to straighten the shaft wood. Because they are hollow and light, reed-shaft arrows typically have a wooden *foreshaft* and sometimes a wooden plug for the nock end of the arrow. If a foreshaft was used, it could be glued to the main shaft, tied with sinew, or fit closely enough to not need glue or sinew.

Prehistoric points or heads were made of stone, antler, or bone. Thin metal, bottle glass, and flint ballast stones also were used to make points in the historic period.

Points were attached to the arrow shaft with a variety of methods. Most frequently, the arrow shaft would have a slit cut into the end to accept the point. Sinew would then be wrapped around the shaft to pinch the slit closed. Points could also be hafted directly by wrapping sinew around the point and the arrow shaft. Metal points generally were attached using the same techniques and only infrequently attached by means of a socket.

Indians made many types of arrowheads. In addition to the traditional triangular stone arrowhead, carved wood or leather points have large, broad surfaces. Different types of arrow tips were used for different purposes, such as for large game versus small game. Small triangular stone points are not bird points: large, blunt-tipped wooden points were used for birds. Harpoon-like points also exist and were used in fishing.

Fletching of bird feathers was sewn to or inserted in the shaft. Feathers of wild turkey were preferred but many other birds, including eagle, crow, goose, hawk, and turkey, were often used. Sinew was generally used to attach the fletching by first stripping some of the feathers from the front and back of the vane and then tying the vane to the shaft in front of and behind the remaining feathers. Sometimes plant twine was used to sew through the quill. Hide glue was used with or instead of sinew ties. Animal products like sinew have the advantage of tightening as they dry.

The fletching balances the weight of the arrowhead to prevent the arrow from tumbling end-over-end in flight. When fletched properly, an arrow may spin in flight producing an ideal trajectory. A similar effectiveness is gained by placing grooves in the barrel of a rifle to cause the bullet to spin. In fact, until the invention of rifled guns, bows generally proved to be more accurate and could shoot arrows further than powder-thrown missiles.

The bow and arrow is a complex technology. Each element must be balanced in proportion to the others and to the user to make an effective tool. The bow acts as a pair of springs connected by the grip or handle. As the string is pulled the material on the inside or *belly* of the bow limbs compresses, while the outside or *back* is stretched and is placed under tension. This action stores the energy used to draw the string back. When the string is released, the limbs quickly return to their state of

rest and release the energy stored by drawing the string. Therefore, the power of a bow is measured in terms of *draw weight*.

The height and strength of the archer determines the ideal draw weight of the bow. A combination of the length of draw and the draw weight of the bow determines the *cast* (propelling force) of the bow. Adjusting either or both of these features allows the arrowhead to be made larger or smaller as needed.

The draw weight of the bow also determines the ideal weight and diameter of the arrow shaft. Even a bow with a high draw weight can only throw an arrow so far. If the arrow is too heavy, it will not fly far or fast enough to be very useful. A shaft that is too thick or too thin will also lead to problems. It must compress enough to bend around the bow stave as it is launched by the string. If it does not bend, the arrow flies to the side of the target. If it bends too much, it will wobble (reducing the striking force) or even shatter.

The length of the draw, also determined by the body of the archer, determines the length of the arrow. The maximum cast of the bow determines the maximum weight of the point. This is how we know that certain "arrowheads" can not really have been used on an arrow, at least not to any good effect. A general rule of thumb is that a stone arrowhead will be less than 1 1/2-x-3/4-inch in dimensions and will generally weigh less than one ounce. Larger "arrowheads" probably would have been spear, dart, or knife tips.

For further reading...

Ackerman, Laura B. 1985 The Bow Machine, *Science* 85, July/August, pp. 92-93.

Allely, Steve, and Jim Hamm 1999 *Encyclopedia of Native American Bows, Arrows & Quivers: Volume I: Northeast, Southeast, And Midwest*. Lyons Press, New York.

Allely, Steve et al. 1992, *The Traditional Bowyer's Bible*, Volumes 1-3. Lyons & Burford, New York.

Hamilton, T. M. 1982 *Native American Bows*. Special Publications No. 5, Missouri Archaeological Society, Columbia, Missouri.

Hamm, Jim 1991 *Bows & Arrows of the Native Americans*. Lyons and Burford, New York.

Hardy, Robert, 1992 *Longbow: A Social and Military History*. Lyons and Burford, New York. [Appendix has detailed description of bow and arrow physics.]

McEwen, Edward, Robert L. Miller, and Christopher A. Bergman 1991Early Bow Design and Construction, *Scientific American*, June 1991, pp. 77-82.

Pope, Saxton T. 1962 *Bows and Arrows*. University of California Press, Los Angeles.

Stockel, Henrietta H. 1995 *The Lightening Stick: Arrows, Wounds, and Indian Legends*. University of Nevada Press, Reno.

Hurley, Vic, 1975 *Arrows Against Steel: The History of the Bow*. Mason Charter, New York. [Discussion of effectiveness of the bow compared to firearms.]

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Procedures

On the first day of activities the leader will be responsible for setting safety standards for the students, teaching them safety rules, basic nomenclature, shooting procedures, shooting commands, how to retrieve their arrows, and how to score.

Scoring is determined as follows:

* Arrows hitting gold = 9, red = 7, blue = 5, black = 3, and white = 1
* Bounce-offs and pass-through score 7, and a hit on the target skirt receives no score.

Safety:

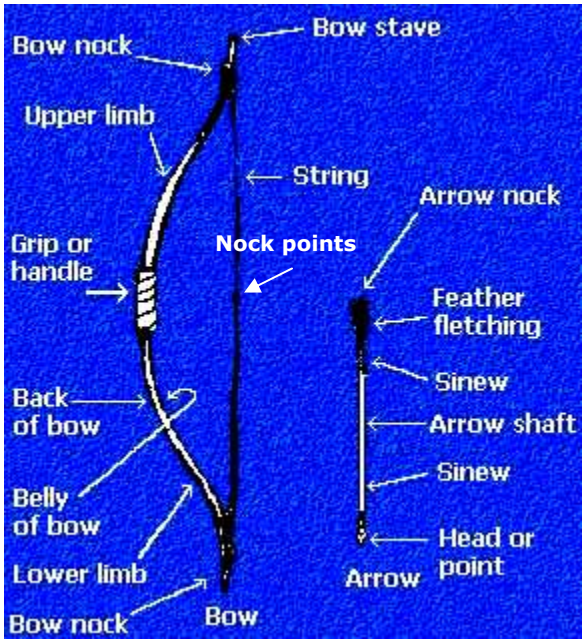
- Students will enter the archery range only when a leader invites them to do so, and will listen to and obey the commands of the instructor.
- No leader or student should EVER leave the shooting mark to approach the target until everyone has finished shooting.
- Arrows should not be used unless they are feathered.
- Bows should not be drawn without an arrow in the string as damage to the bow and string may result.
- Damaged bows or arrows that are too short should not be used.

Nomenclature:

If the leader is to help the student discuss archery, his difficulties in scoring, or to report repairs, he must know some basic nomenclature and terminology.

Main names to learn:

- String
- Bow
- Grip
- Nock points
- Arrow nock
- Fletching
- Shaft



Leaders Procedures

One student will step up to each shooting position. The leader will give the commands (see shooting commands) and assist any student who needs help. After all students are through shooting, help them retrieve their arrows and take scores. Make sure all arrows have been returned before proceeding to the next "end" (6 arrows = one end).

At the end of the period all students will return their bows and arrows to the shed. The leader will then dispose of any arrows that have lost their fletching and report any repairs that need to be made to the program director or camp director.

Leaders will learn shooting procedures at pre-camp, and although staff need not be able to shoot well, they should still be able to demonstrate proper stance and shooting position. If after pre-camp there are any questions or doubts concerning

procedures, ask help from the camp or program director.

The shooting commands are as follows:

"Take your position ..... (Step to shooting line)
"Knock your arrows"..... (Pick up-bow, and knock arrow)
"Aim and shoot when ready"..... (Draw the string back & release)
"Cease shooting"…….. (All bows should be put down)
"Retrieve arrows"..... (Find arrows & return to shooting position)

When removing arrows from the target, place one hand on the target face near the arrow's point of entry and twist the arrow out with the other hand. This helps keep the target face from being torn. If an arrow passes through the target so that the fletching has entered the target mat, pull the arrow through the target from the backside so that the fletching will not be pulled against the grain. If an arrow is lodged in the grass, pull it forward and through for the same reason.

Optional Games

Some students may not desire to shoot for an award, or the leader may wish to vary the program with the following suggestions:

- **Survival Game** (attached)
- **Shoot at balloons**: Staple balloons on target.
- **"Box shoot":** Put boxes (Clorox bottles or cereal boxes) out at various distances on the range.
- **"Pop Shoot":** Staple pull-tab rings from drink cans to target face. Each time an arrow passes through the ring, allow a drink discount or some other prize at the store – clear with camp director prior to offering the activity.
- **"Tic Tac Toe":** Put tic-tac-toe target up (either on card board or drawn on sheet and covering target face), and alternate shots between 2 people for a game.
- **"Field shoot":** Draw designs (geometrical or animal) on the solid cardboard sides of boxes are good, and tape in such a way that they sit up on a wire.
- **"Archer Golf':** Place a rubber ball on a wire, stand at varying distances and shoot.
- **"Clout":** Layout target (a much larger one -- at 48 feet across) on ground 75 to 100 yards away and shoot up into the air letting arrows fall on target to score. (This is a lot of fun but even with a light-weight bow, the arrows travel very far so be prepared to chase them over 125 yard away). PLAN SAFETY -- make sure the additional area needed is clear.