

Making Archery Equipment

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Objectives

Participating youth and adults will:

1. Understand the basics of constructing personal archery equipment like strings and arrows.
2. Construct selected pieces of archery equipment.
3. Develop skills related to making archery tackle.
4. Determine other types of archery equipment they may wish to make with the aid of instructors or alone.
5. Have fun while learning.

Roles for Teen and Junior Leaders

- Provide extra hands and tutor participants who need help.
- Demonstrate procedures for making specific items.
- Demonstrate use of personally made items.
- Encourage and assist members with tasks that give them trouble.
- Conduct workshops to make a particular item of interest.

Parental Involvement

- See Roles for Teen and Junior Leaders above.
- Provide shop space and equipment for workshops.
- Arrange for or provide transportation.
- Assist with other types of equipment they make.
- Arrange for additional leadership on this topic.
- Arrange for or provide refreshments.

Best Time to Teach

Any time after personal equipment has been selected and basic shooting form is mastered

Best Location

Well-lighted and well ventilated shop area

Time Required

1 hour (workshop sessions will add to the teaching time)

Materials/Equipment

- material requirements vary with the item being made. Refer to teaching outline or individual fact sheets for detailed lists.

References

- Bowhunting with Easton Aluminum Arrow Shafts.*
Easton Aluminum, Inc., Van Nuys, CA.
- Target Archery with Easton Aluminum Arrow Shafts.* Easton Aluminum, Inc., Van Nuys, CA.
- National Archery Association Instructor's Manual*, third edition. P. Baler, J. Bowers, C.R. Fowkes and S. Schoch. National Archery Association. Colorado Springs, CO. 1982.
- Bowhunting Deer.* W.H. Wadsworth, ed. National Bowhunter Education Foundation. Murray, KY.
- A Sand County Almanac.* A. Leopold. Oxford University Press, New York, NY. 1966. (Paperback: Sierra Club – Ballantine Books.)

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Teaching Outline

Presentation

Application

I. Value of making equipment

- A. Increases enjoyment
 - 1. Greater investment
 - time
 - energy
 - fun
 - 2. Doing it yourself
 - independence
 - more understanding
 - personal satisfaction
 - increasing involvement

ASK participants if they prefer homemade things like jelly, bread, berry pies or soups better than the ones they can buy in bags or cans at the grocery store.

ASK – why do we have preferences? SEEK answers like just the way I like it, better quality, did it myself, etc. USE the mood set to start discussion of making archery equipment.

- B. Leopold on archery
 - 1. Risk of failure
 - 2. Avoiding gadgets

READ Leopold's *A Sand County Almanac: "A Man's Leisure Time"* (about middle of essay) to show the role of uncertainty in recreation.

II. Types of equipment to make

- A. Simple equipment
 - 1. Climbing blocks
 - 2. Hauling lines
 - 3. Safety lines
 - 4. Ground quivers
 - 5. Strings
 - 6. Arrows
 - 7. Wall bow stringers
 - 8. Dip tubes
- B. Moderately complex equipment
 - 1. String jigs
 - 2. Bow or arrow stands
 - 3. Bow stringers
 - 4. Wooden bow boxes
 - 5. Bow or arrow racks
 - 6. Target stands
- C. Complicated equipment
 - 1. Tree stands
 - 2. Cresting lathes
 - 3. Cut-off tools

USE either personally constructed or purchased equipment as examples.

POINT OUT that some archery equipment projects may be major.

III. Making arrows

- A. Materials needed

If a workshop is going to be held, be sure to prepare participants for it by handing out a list of needed materials after this DEMONSTRATION is completed. See *Fact Sheet 6: Making Arrows*.

1. Shafts
 2. Nocks
 3. Adapter inserts or points
 4. Fletching material
 5. Adhesives
 6. Lacquer
- B. Equipment needed
1. Fletching jig
 2. Dip tube
 3. Cresting lathe
- C. Procedure
1. Shaft selection
 - materials
 - spine
 - length
 2. Shaft preparation
 - cleaning
 - cleanser and hot water
 - lacquer thinner
 - alcohol
 - base lacquer dip
 - optional but wise
 - bonding base
 - ventilation needed
 3. Clean base of fletching
 - remove mold release agents
 - lacquer thinner or alcohol
 4. Nock application
 - clean, true base
 - sandpaper pinched against nock taper
 - rotate shaft
 - one drop of cement
 - straight alignment
 - press and twist
 - check alignment
 5. Adapter or point installation
 - adhesives
 - meltable adhesives
 - epoxy
 - alignment with shaft
 - precautions
 - avoid getting adhesive inside threads
 - test for alignment
 6. Fletching
 - select fletching pattern
 - adjust for proper vane placement
- Have a teen leader or parent DEMONSTRATE making one or more arrows while you DISCUSS the process.
- USE arrows in different stages of completion as examples.
- POINT OUT dangers of using these materials without adequate ventilation. DEMONSTRATE this step and DISCUSS its importance.
- EXPLAIN the importance of the steps in this process.
- EMPHASIZE the need to have the insert in line with the shaft.
- DISCUSS the uses of different fletching patterns and materials.

- apply fletching of choice
 - feathers more forgiving
 - vanes faster and tougher
 - clamp according to directions on adhesive

7. Cresting

- personal signature
- arrow identification

IV. Making a bowstring

A. Materials needed

1. String material
 - Dacron
 - Fastflight
2. Nylon serving thread
3. Monofilament serving material
4. String wax
5. Chalk or grease pencil

B. Equipment needed

1. String jig
2. Serving jig

C. Procedure

1. Adjust string jig to length
 - use old string
 - set on previous mark
2. Attach string material to lower loop post
3. Wind string material tightly around posts
 - follow manufacturer's instructions
 - use for fine tuning
 - finish on same end as begun
4. Rotate end block
5. Serve center of lower loop
6. Rotate end block
7. Wrap loose ends of string material around loop base
8. Finish serving end loop
9. Whip finish
10. Mark location of upper loop
11. Repeat above process with upper loop taking care to keep the upper loop centered
12. Twist string to adjust length
13. Wax string and work with small leather pad

EXPLAIN some factors in selecting vanes or feathers.

ILLUSTRATE the impact of poor quality bonding, using a junk shaft and poorly applied fletching.

Have a teen leader or other volunteer construct a bowstring as a demonstration.

DISCUSS the uses of each material and piece of equipment.

DEMONSTRATE using an old bowstring.

ILLUSTRATE the proper way to attach string material. DISCUSS why a single broken strand in a string is significant.

Be SURE the lower loop is properly sized to fit the bow fairly snugly.

DEMONSTRATE the whip finish and have kids try to do one on scraps of material.

DISCUSS need for keeping the loop centered.

14. Switch to monofilament serving material
15. Mark center serving location
16. Push monofilament end through center of string
17. Serve center of string
18. Whip finish monofilament
19. Place on bow and set nocking point(s).

V. Making climbing blocks

- A. Materials needed
 1. 2 x 4 (inch) stock
 2. Rope (400 pound test)
 3. Camouflage paint as desired
- B. Equipment needed
 1. Saw
 2. Drill with ½ inch bit
 3. Sander or rasp
- C. Procedure
 1. Cut 5-inch section of 2 X 4
 2. Locate center of 2 inch side about 1 ¾ to 2 inches from top
 3. Drill ½ – inch hole at mark
 4. Rasp or sand all eight corners to a slight bevel
 5. Sand bevels smooth
 6. Spray paint to camouflage
 7. Pass one end of rope through hole, around block and through one again.
 8. Tie bowline on end of rope
 9. Melt ends of rope to seal

VI. Making a hauling line

- A. Materials needed
 1. Parachute cord or similar line
 2. Small snap(s)
- B. Equipment needed
 1. Knife
 2. Small lighter or match
- C. Procedure
 1. Cut line to desired length
 2. Seal ends with lighter
 3. Secure snap(s) at end(s)

VIII. Making a safety line

DISCUSS the purpose of the center serving and the value of monofilament for this purpose.

PASS AROUND some climbing blocks and DEMONSTRATE or DISCUSS their use. POINT OUT that many of the items needed are available as scraps.

A drill press is helpful but not necessary.

Measurements are not critical.

DISCUSS the significance of the beveled corners.

DEMONSTRATE and have kids PRACTICE tying a bowline.

If archers are interested in bowhunting, have each one make a hauling line.

DEMONSTRATE the use of a hauling line for the participants and let them PRACTICE using their own.

DEMONSTRATE the use of a safety line or belt. STRESS that every tree hunter should use a safety line.

- A. Materials
 - 1. Heavy braided Dacron line
- B. Equipment needed
 - 1. Knife
 - 2. Lighter or match
- C. Procedure
 - 1. Cut line to desired length
 - depends on size of archer and tree diameter
 - 15 to 25 feet usually enough
 - 2. Seal ends of rope with flame
 - use caution
- D. Using the safety line
 - 1. Tie a bowline around the upper body.
 - 2. Rotate the knot to the center of the back.
 - 3. Attach the rope to the tree
 - Chest high or higher
 - Enough line to shoot
 - Keep line short enough to prevent stepping off stand
- E. Automotive or airline seatbelts may be used too

Have each participant **MAKE** a shooting safety line and **PRACTICE** using it from a tree stand. **DISCUSS** the reason for keeping the line high and boy and relatively short.

VIII. Other items you can make

- A. Tree stands
- B. Skinning gambrel
- C. Bows
- D. Leather accessories
- E. Flint arrowheads
- F. Others you determine
- G. Care, caution and effort

DEMONSTRATE how the safety line can help in shooting.

BRAINSTORM other items that could be made to enhance archery or bowhunting enjoyment.

Lesson Narrative

In *A Sand County Almanac*, Aldo Leopold stated that the best leisure activities involved some element of uncertainty or risk. He went on to say that archery was one of those activities. He hunted with bows he had constructed, arrows he had made and points that had been handcrafted from sheets of steel like Leopold, or other famous archers such as the Comptons, Saxon Pope, Art Young or Ishi, today's archer can increase shooting enjoyment by making some of his or her own equipment. Making personal equipment also can promote safety, understanding and shooting skill.

An archer can make simple equipment or more complex items that require a great deal of time and skill. Many accomplished archers have tried their hand at making bows. The increased popularity of the longbow has resulted largely from a sense of history and interest in making bows. The bowyer's art is complex and will not be covered in this lesson.

We will concentrate on making bowstrings, arrows, a string jig and a couple of types of bow stringers. Along the way we will learn some of the skills needed to maintain archery equipment.

Many archers enjoy making their own arrows. It is easier to match the arrows to your size, shooting style and other equipment when you make your own. The arrows maybe customized to fit personal desires as well. Those custom touches may be as simple as nock or fletching color. They may include customized fletching, a personal crest and individual identification of shafts. The starting point is selecting shafts with the proper spine and length in the desired material.

Making Arrows

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Shaft selection is discussed in the bow tuning lesson. Use a table of potential shaft sizes from a manufacturer as a guide, but also use your personal experience. Shafts for target or field use maybe cut to the actual draw length as determined by using a draw-check arrow. Those for hunting purposes should be cut a few centimeters (3/4 to 1 inch) longer than the distance from the string to the back of the bow. This provides adequate clearance for the broadhead and a margin of safety for the archer. Dealers will cut the shafts to length for a small fee, or they maybe cut with an abrasive cut-off wheel. Pipe cutters, hack saws and similar cutting tools should not be used. The slight burring at the cut area should be removed to provide a uniform tube diameter for inserting points or screw-in adapters.

After the shafts have been cut to length and de-burred, the points or adapters can be inserted. On fiberglass arrows, the nock inserts can be installed at the same time. Most archers prefer to use an epoxy for fiberglass and similar types of arrows. Heat set or meltable adhesives are used for installing inserts on aluminum shafts. Wooden shafts need not be cut to length or tapered until they

have been completed. If screw-in adapters are used, a few precautions can increase your satisfaction with the installation. Place a small amount of petroleum jelly on the threads of a field point. Screw the point fully into the insert before it is installed. That keeps excess glue from getting into the threads and fouling the insert. Melt a small amount of glue on the insert. Twirl the insert to spread the glue evenly over its surface while pre-heating the end of the shaft. Insert the adapter with a twisting motion to spread the glue evenly. Hold it tightly in place for a few seconds to let the glue set. (Some people twirl the tip of the shaft under cool water to hurry the process.) Once the glue has set, the arrow can be spun on its tip to check for proper insert alignment. If necessary, reheat and adjust the insert so the arrow spins without wobbling. Once the insert is aligned and the glue has set, the field point can be removed. The arrow is ready for the next step.

Before the shafts are used to construct arrows, they must be cleaned. Manufacturers make special solvents for preparing arrow shafts, but other solvents or home cleansing techniques can be used effectively. The shafts can be scrubbed with a cleanser, wiped clean with alcohol or cleaned with lacquer thinner or remover. Once they are clean and dry, they should not be touched with oily fingers. The bases of the fletching should also be cleaned with a thinner or alcohol to remove any remnants of the release agent from the molding process.

Once the shafts are cleaned, most arrow makers apply a thin coat of lacquer to the area where the crestring and fletching will be applied. Some adhesive manufacturers recommend their lacquers for providing a good base for the adhesive. The lacquer base tends to promote excellent bonding. Lacquer color is a matter of choice. Drawing a very light line around the shaft where the lacquer should stop is a good practice for consistent results. Lacquer is most easily and consistently applied by using dip tubes. Merely insert the shaft to the line, allow it to drain briefly, and hang it up to dry. The lacquers used for archery applications are tough and difficult to remove, so protect your work area. Adequate ventilation is also essential.

After the shafts dry completely, remove the lacquer from the nock area or remove any irregularities in the lacquer from that area. Place a drop of glue on the tapered portion of the shaft, and insert a nock with a slight downward twisting motion. The nock should fit tightly and evenly on the nock taper. Refer to the shaft maker's materials or another chart of nock sizes to select the proper nock for the shafts used. Care in applying the nocks will ensure the nock is properly aligned with the shaft.

The next step is to apply the fletching. Set up your fletching jig according to the manufacturer's instructions. Select the fletching style you prefer. Set a shaft in the jig, being sure the nock engages properly in the nock receiver. Position a feather or vane as you want it on the shaft and mark the clamp where the end of the fletching crosses it. Apply an even bead of glue along the base of the fletching material

and slip the clamp into the jig. Follow the manufacturer's advice on the length of time each vane or feather must remain in the clamp. Usually 3 to 4 minutes is adequate. Remove the clamp. Rotate the nock receiver to bring a new area of the shaft into position. Repeat the process until all the fletching has been applied. Finally, place a small drop of fletching cement on the leading and trailing edges of the base of each feather or vane.

If no crestring is desired, the arrow is complete. All you need to do is screw in a point of your choice and head for the range. If the arrow is to be crested, a few more minutes' work are required. The crest is your signature. Design one that is pleasing to you. Remember that light colors should be applied first. They are easily covered by darker ones. Use an assortment of brush sizes to get the effect you want. Having a junked shaft to use as a practice area is often very helpful, as is keeping your lacquer rather thin.

Congratulations! You have just finished your first set of arrows.

Making a Bowstring

There are many advantages to making your own bowstrings. You can easily adjust length, string weight and the thickness of the servings, making it easier to fine tune your equipment.. Making a bowstring requires a few tools and materials: a string jig, a serving bobbin, nylon serving thread and monofilament for the center serving. The techniques are easily mastered and the process is relatively quick. Let's go through them one step at a time.

The first step is to establish the proper length for the string. If you have a string that has been working well on your bow, use it for a pattern. With Dacron strings, you may want to shorten the string stretching when the string is put on the bow. Mark the base of the string jig to indicate the ideal string length for your bow. That will make duplicate strings easy to produce later. Remove the old string from the jig and, following the directions on the string material, wrap the required number of strands around the ends of the jig. Leave a little extra material on both ends of the thread for knotting and finishing. Both of these should be on the same end of the string.

Pivot the end of the string jig on the end having the two tied-off strands. Following the directions with your serving bobbin, serve the middle portion of the end loop with nylon thread. Once that middle portion is served (the part that will become the end loop), rotate the end of the jig back into line. Adjust the string position slightly so that the serving thread will conceal the end of the other side of the serving and begin to form the loop. Either wind the loose ends of each strand around their side of the serving or wind the strands in a crisscross pattern over the area to be served. Serve the remainder of the end loop area (about 4 to 60 inches) and whip finish the serving thread.

While the string is in this position, mark the loop area on the other end of the string with wax pencil or chalk. (*Note:* some inks damage some types of string materials.) Once the loop area is marked, rotate that end of the string jig, serve the loop and finish off the other end of the string as before.

At this point, many archers like to “set” the string. Place the string on the bow, wax it completely and rub it vigorously with a small patch of leather. This process conditions the string and settles the strands into place. Many manufacturers recommend that the string be twisted slightly in the same direction that the individual strands are twisted to increase its strength. Note that all servings should be made in that same direction.

Once you have established the proper length for the string, mark the top and bottom of the center serving with chalk. Generally the top of the center serving should be about 2 to 3 inches above the arrow rest. The bottom should be about 5 to 6 inches below it. The main functions of the center serving are to protect the string from abrasion, to provide a smooth area aiding release and to provide a snug fit for the nock. Feel free to build yours to fit your shooting style.

On recurve bows the center serving can be applied while the string is on the bow. The cables of compounds complicate the matter a bit. In either case, the string could be removed from the bow and replaced on the jig for serving the center. Although nylon can be used in the center of the string, most archers prefer to use a monofilament center serving. Mono comes in several diameters and colors. Select a combination that is pleasing to the eye and one that fits your nocks snugly. Starting at the top mark on the string, insert the monofilament through the string and leave several inches of the free end protruding through the string. Hold that free end along the string and wind start of the serving over it. Continue winding in the same direction as the twist in the string (and the same direction in which the string will roll on release) until most of the area to be served is covered. As you near the end of serving, insert a loop of monofilament (loop side toward the unfinished end of the serving) and continue to wind at least 12 to 15 additional turns of serving material. Keeping the serving tight, snip off the monofilament and insert the loose end through the loop. Pull the loop through, drawing the free end under the wrapped monofilament; and pull it up tight. Trim the end and apply a drop of fletching cement.

In order to have the string function properly, it must have a nocking point indicator of some type. Some archers wrap one of dental floss or a similar material. Others use metal/plastic nock sets. Place the string on the bow and position the nocking point as desired. If you have found the best location for your bow's tuning, simply repeat the placement (you should have that noted or marked on your bow square). If not, try various locations until the bow is tuned properly. Hunters and target archers alike should have extra, pre-stretched, conditioned and tested strings with nock sets available in their field gear.



Making Tree Climbing Blocks

While the target archer may not appreciate climbing blocks, the tree stand hunter will find them very helpful. Ethical hunters avoid damaging trees by using non-invasive ways of climbing trees. The climbing block is an excellent way to do that, and can be made from scraps of 2 x 4 construction lumber. Each block should be about 5 to 5 1/2 inches long and cut square on both ends. Approximately 1 3/4 inches from one end of the block, drill a centered 1/2-inch hole through the 2-inch side of the block. Rasp or sand off all eight corners of each block slightly. At this point, you may want to paint the blocks with a dark paint or camouflage paint to preserve and conceal them. Using 400 to 600 pound test nylon or Dacron rope that has been dyed a dark color, pass one end through the hole, around the wide side of the block and back through the hole again. Make a small loop close to the edge of the block using a bowline knot. Cut the opposite end of the rope to a length suitable for the trees you are likely to be climbing. I usually make mine about 15 to 20 feet long. About 6 to 10 of these blocks will get the hunting archer into most tree stands.

The climbing blocks are used by wrapping the rope around the tree at the desired location, passing the end of the rope through the bowline loop and cinching it down as tightly as possible. The line is then passed back around the tree and cinched under the block (called **frapping**) with a couple of turns of rope before passing back around in the opposite direction and repeating the process. Once the block has been frapped in place, the remainder of the rope can be tucked under the block to keep it from blowing in the wind. The block will shift when weight is first applied to it, but after that it should remain stable.

Making a Hauling Line

Any archer that hunts from a tree stand should wear a safety belt or safety line every time they enter a tree stand. Safety belts can be purchased at modest cost, but you can also make one from a heavy piece of braided Dacron rope. A length of rope about 4.5 to 7.5 meters (15 to 25 feet) in length is adequate for most areas. The ends should be sealed with a flame. Take care not to start a fire or get burned on the molten polymer.

The safety line attaches the archer to the tree to prevent dangerous falls. Start by tying a bowline snugly around your upper body. Keep the rope fairly high on the chest. Turn to face the tree while standing at about the distance you want as your limit. Attach the line chest height or higher on the tree. Another bowline is adequate, but any strong and easily untied knot (a clove hitch for example) will do. Rotate the knot to the center of your back. Test the arrangement to see if you have enough room to shoot before hauling your equipment into the tree stand. A secure safety line can improve your shooting if it is used as a support when shooting from a tree stand.

Other Things You Can Make

Archers can find plenty of things to make for themselves, and all of them can add to your enjoyment of the sport. Some of them, like the climbing blocks or hauling line can be made quickly and simply. Some, like arrows or bowstrings, take a little more time and planning. Lots of others are complicated projects that may take many hours of work to complete. Examples include items like tree stands, bow presses, string jigs, cresting lathes or bow cases. Let your skills and your imagination be your guide, and try your hand at making your own archery equipment.

Summary Activities

1. Have each participant complete a selected project from the lesson. Select one that will be useful to nearly all the archers, like a hauling line or a shooting safety line for bow hunters.
2. Have each participant make at least one arrow simultaneously with the entire group.
3. Have each person participate in making one or more bowstrings. Demonstrate the proper technique first, then let the participants try their hand at applying the servings.

Exhibit and Sharing Ideas

Nearly any item that is personally constructed by the archer could be displayed as an exhibit in shows or fairs. In addition, some of the items would make excellent demonstration topics or be potential activities for a workshop conducted by young people. Some of the more complex items could be used as projects for science fairs. A few of these functional items may even become fund-raising projects. Opportunities for active and continuing demonstrations at sportsmen's field days, shoots, bowhunter education programs or National Hunting and Fishing Day exhibitions are also abundant. Let your imagination be your guide

Links to Other 4-H Programs

The relationship to woodworking, wood science or other mechanical sciences and engineering projects is obvious. Wildlife links are also clear and abundant. Heritage projects, outdoor skills, forestry and photography also have direct connections to some of the items being constructed or their use. Many of these items present an opportunity to explore science and technology as well. Let your imagination be your guide and stay alert for areas of interest shown by the young people in your group.