All Ages

Going Knotty

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Main idea: Knots are everywhere in our life. Something as simple as tying your shoe demonstrates a practical use and understanding of knots. Understanding knots in the mathematical sense is complex. Many scientists study knots to better understand how the natural world works. **Note**: beyond just science activities, these are good group-building activities or ice-breakers.

Objectives: Youth will explore a variety of knots and how they work by creating and manipulating them.

Materials: 3 or 4 hula-hoops or bicycle tires (without the tubes).

Motivator: Ask youth if they think they could untie a huge knot of people. Tell them that this is exactly what they are going to try to do.

Questions: Before the activity, ask the youth:

- How many of you know how to tie your shoe?
- Have you ever thought about how knots work?
- Did you know that knots are studied by scientists and mathematicians?

Activity 1, Human Knots:

1. Groups of 8 - 10 work best. Youth stand shoulder-to-shoulder in a circle, all facing inward.

2. Each person takes their right hand and reaches across the circle and holds hands with another person who is at least two persons away.

3. Next, each person reaches across the circle with their left hand and hold hands with a different person from the one they are holding with their right hand. Challenge the group to untangle the knot they have formed without letting go of hands.

Note: You may need one "imaginary" can of "unknotting spray" which has "magic properties" and allows youth to unlink and re-link one connection when they are stuck in a particularly knotty situation. (Sometimes the body just doesn't bend a certain way.) The whole group must agree on when to use the "unknotting spray," and it is up to the leader to help identify when it may be appropriate to do so.

Learning checks: Discuss what happened. How did they end up in a circle (or circles) of people holding hands? Have them describe what happened.

Extensions:

- The group may want to do the Human Knot a second time and pay attention to how the knot was unknotted. Perhaps even count how many maneuvers it takes to get unknotted.

- The group may also want to try to go from a circle of people holding hands back into a knot (people standing shoulder-to-shoulder).

- Discuss knots that occur in nature (such as chemical compounds).

Activity 2, Hoop Pass:

1. Have youth stand in a large circle holding hands.
2. Separate a few of the hands and add a hula-hoop and reconnect the hand so the hoops are hanging between two people.
3. Challenge the group to pass the hoops all the way around the circle. Have some hoops go clockwise and others counter-clockwise.

Learning checks:

- After the hoops have successfully passed around the circle, ask how did this work? Why did it work?

- Could you ever get the hoops off the circle without disconnecting hands? Why or why not?

- What objects do youth know of that have closed interlocked loops? (Ex. Links of chain, heat exchanger, etc.).

Background:

Knots have been studied extensively by mathematicians for the last hundred years. Recently the study of knots has proved to be of great interest to physicists, chemists, and molecular biologists. One of the most interesting things that emerges as you study knots is how a category of objects as simple as a knot could

be so rich in mathematical and science connections.

Knot Theory is the mathematical study of knots. A mathematical knot has no loose or dangling ends; the ends are joined to form a single twisted loop. The central problem of knot theory is distinguishing between various knots and classifying them. The best way to learn about knots is to make some knots and play with them.

Through a variety of activities, youth will explore some knots and how they work. In the first activity, the Human Knot, youth will create a closed loop and untangle themselves into one continuous knot (or sometimes two knots). In the Hoop Pass activity, youth will realize that a seeming impossible task of passing hoops around a circle of people holding hands is easy if they understand knots.