Knot-testing Experiment

Teacher Preparation for *Knot: A Test*

Materials

- 1 old fashioned flat-headed wooden clothespin (the kind that do not "pinch") for each student
- 1 metal screw eye bolt for each student
- Drill
- 1/16" drill bit
- Cardboard box
- 1 copy of Student Handout: **Knot: A Test** (next page) for each pair of students

Preparation

Use the cardboard box to hold the pins in place while you drill a hole in the top of each pin. Students will screw eye bolts into the tops of the clothespins.

WISCONSIN ACADEMIC STANDARDS:
Math:

E.8.1 Work with data in the context of real-world situations by formulating questions that lead to data collection and analysis; designing and conducting a statistical investigation; and using technology to generate displays, summary statistics, and presentations.

E.8.2 Organize and display data from statistical investigations using tables, graphs, and/or charts.

E.8.4 Use the results of data analysis to make predictions, develop convincing arguments, and draw conclusions.

E.8.7 Determine the likelihood of occurrence of simple events by using a variety of strategies to identify possible outcomes, conduction and experiment, designing and conducting simulations.

E.12.1 Work with data in the context of real-world situations by…designing a data collection plan that considers random sampling, control groups…and conducting an investigation based on that plan.

F.8.2 Work with linear and nonlinear patterns and relationships in a variety of ways.

Knot-testing Experiment

Instructions for *Knot: A Test*

Fishing line breaks at its weakest point, usually just above the knot. With a partner, conduct an experiment to find the ideal number of wraps to make a strong knot. This experiment works best with the Improved Clinch knot, but you can try it with others.

1. Each person will need a knot tester. You can make a knot tester by twisting a small screw eye bolt into a wooden clothespin.
2. Draw a number off of the Random Number Chart by closing your eyes and pointing to a number. The number you choose is the number of times you will wrap your line on your first test knot. Your partner will draw a different number.
3. Each partner will tie one end of the same piece of fishing line to his or her knot tester using the number of wraps drawn.
4. Once the knots are tied, the partners pull away from each other, each holding onto his or her knot tester. When one knot breaks, the other becomes the winning knot. Record the number of wraps each partner used below. Mark a "w" next to the number that won. If the line breaks (not at the knot), record that round as a draw, "d."
5. Look back at the Random Number Chart and do the number of wraps listed *below* the number you used for your first trial. If you reach the end of a number column, go to the top of the next column to the right. If you are at the number in the very lowest right hand column, go to the uppermost left-hand corner. Repeat this process for five trials.

NAME	TRIAL 1 # OF WRAPS	TRIAL 2 # OF WRAPS	TRIAL 3 # OF WRAPS	TRIAL 4 # OF WRAPS	TRIAL 5 # OF WRAPS

Reflection

1. Do more wraps mean a stronger knot? Why or why not?
2. Why would one knot break before another with the same number of knots?
3. Why are experimental results more accurate when more trials are conducted?
4. Compare and graph the data from your entire class. What is the winning number of wraps in the class?

Random Number Chart

4	4	3	1	1	4	5	7	4	3	9	4	5	8	9	6	8	8
4	2	8	8	5	5	9	1	6	1	1	7	7	6	6	10	4	1
6	9	1	9	5	4	9	9	9	5	7	5	8	8	5	6	2	7
7	3	2	4	5	8	7	6	3	8	7	5	9	9	8	5	7	5
8	8	7	3	7	9	4	1	8	7	4	8	1	10	4	6	1	4
9	4	7	2	4	3	8	10	4	2	6	3	3	4	9	4	7	1
4	6	5	5	6	10	7	6	7	9	4	8	10	2	6	1	6	9
5	5	8	8	4	2	2	3	6	7	4	3	2	7	7	2	6	9
6	2	9	7	9	2	4	10	8	4	6	6	10	6	3	6	4	6
7	9	3	6	7	7	1	4	2	7	8	3	5	6	8	1	3	2
9	6	4	9	4	2	6	3	3	3	1	2	5	2	6	2	5	3
8	5	3	9	9	9	6	4	6	2	3	7	3	9	3	3	9	7
4	6	9	4	4	4	7	3	2	4	5	2	10	6	5	10	4	10

Get Rigged

Bluegill

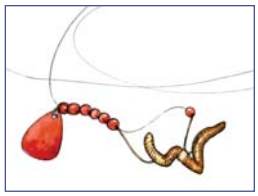
Bluegills are one of Wisconsin's most abundant and popular game fish. Bluegills are lovers of shallow, fertile, warm waters and are found across Wisconsin. They will remain in water that becomes warm even through midsummer, although larger fish often seek water as deep as 20 feet as summer temperatures rise. Like all sunfishes, the bluegill's diet is varied. Insects represent a major portion.

Bluegills' fearlessness and voracious appetite make them ready biters and, once hooked, they are amazingly scrappy and stubborn for their size. Bluegills readily take bait, small artificial lures, and flies. Most are caught on small hooks (#8 is a good choice) baited with worms. These are most often fished underneath a bobber, often with split shot just above the hook so it hangs a foot or two above the bottom. However, bluegills can make excellent targets for ultra-light tackle when casting tiny artificial lures. Flycasting for bluegills on quiet mornings or evenings is great sport. Their habit of sucking in insects from the water's surface creates surprisingly loud smacks.

Bluegills are excellent eating, but you should allow two or three per serving. A bluegill may reach up to 10 inches in length, but they average much less. Occasionally you may find a waterbody packed with very small bluegill. This may be evidence that the lake is not healthy. If there are thick patches of aquatic plants in the lake, bluegill predators may not be able to catch the fish, resulting in a bluegill population explosion and a disrupted food chain.

The world record bluegill, taken in Alabama in 1950, weighed a whopping four pounds, 12 ounces.

Walleye



Walleye are found in a variety of lakes and rivers in Wisconsin, from Lake Superior and clear northern lakes to the more murky rivers, such as the Mississippi. They live on or near the bottom, often in fairly deep water during the summer months. During the spring and fall they can be found in shallower water. They are active all year. Walleye may feed at any time. However, they feed most heavily at night or on cloudy days, when they group into schools and seek minnows and any other fish they can find, including smaller walleye.

Walleye are one of the most prized game fish because of their superb taste and their good size. They average two pounds but anglers commonly pull in walleye weighing over five pounds. Best fishing for walleye is typically early and late in the day and after dark. Good walleye fishing requires a boat much of the time, but in spring boatless anglers can cast jigs in gravelly areas near shore when the fish are still swimming in the shallows. Anglers with boats often troll for walleye. Many walleye take slow-trolled minnows, nightcrawlers, or plugs. If you find a school of walleye, cast bucktail jigs with plastic tails or tipped with a piece of nightcrawler. Some anglers also cast minnows or nightcrawlers with split shot, sometimes beneath a bobber. The world record walleye weighed 25 pounds. It was caught in Tennessee in 1960.

Bullheads

While not considered trophy game fish by most anglers, bullheads are fun and easy to catch and fine to eat. Bullheads feed actively along shallow, fertile bays and shorelines, and will eat almost any animal or vegetable they come upon. Their populations thrive in most water conditions, including low oxygen, so it is not unusual for bullheads to overpopulate an area and become stunted. They feed most actively in late spring and summer after the water has warmed to at least 60 degrees.

Bullheads can provide an angler with fast action and, except when taken from very warm, very murky water, are a tasty treat. They are among the easiest of Wisconsin's fish to catch. All an angler needs to catch a bullhead is a simple cane pole and any natural bait (nightcrawlers are most common). Fish the bait along the bottom of a warm, shallow waterbody and bullheads will often respond quite quickly. Keep in mind that bullheads, like all catfish, should be handled with care. They each have a long, sharp spine in front of their dorsal and pectoral fins that is mildly venomous. Anglers who get stuck by these spines say that it feels like a bee sting.

The world record bullhead, a black bullhead, was eight pounds and was caught in New York in 1951. Most bullheads caught in Wisconsin average about one pound.

Joining Physics and Physical Education through Fly Casting

University of Alaska Fairbanks Sport Fishing Bulletin #12

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Introduction

What is sport casting? It's a series of events that test or help anglers improve their casting proficiency in plug casting, spinning and fly casting. There are both accuracy and distance games to help sharpen casting skills. Casting practice or competition is to the angler what trap or skeet shooting is to the hunter. Many people enjoy shooting and never go into the field hunting. The same enjoyment and challenges apply to casting. Whether the casting consists of individual practice or informal competition, it originated as a way of getting bait to the fish. It was a skill that had to be practiced and, when two or more fishermen were practicing together, it eventually led to friendly competition that eventually led to formal events.

A Little History

Casting is actually one of America's oldest organized sports. The New York Sportsmen's Club began holding an annual fly casting tournament in 1861, thirty years before basketball was invented. English and Irish fishermen had introduced fly casting to the United States. Competitive casting may have begun in England, on a small, local scale, as early as the mid-18th Century. The *Fishing Gazette* conducted the first British national tournament in 1881. From England, casting as a competitive sport moved into several Northern European countries early in the 20th Century.

The Chicago Fly Casting Club staged the first truly national tournament as part of the 1893 Chicago World's Fair. The American Casting Association (ACA), who sanctions competitive, casting events in the United States, was formed in 1960. However, casting didn't become an international sport until after World War II. In 1953, the *National Rod and Reel Association* (the predecessor to the ACA) invited several other national casting organizations to form a worldwide federation. As a result, the International Casting Federation (ICF) was founded in January 1954. Original members included Australia, Belgium, England, Finland, the Netherlands, New Zealand, Norway, Scotland, Sweden, and the United States. The ICF became known as the International Casting Sport Federation (ICSF) in 2003. There are two basic types of casting competition, distance and accuracy, and four basic kinds of tackle: fly, bait, spin casting, and spinning. More information on the ACA can be found by logging on to americancastingassoc.org.

Casting Proficiency = Angling Success

Does this physical activity help anglers catch more fish? Absolutely! Except for trolling or still fishing, casting proficiency is the most important skill in fishing success. For example, imagine a fish that is surface feeding. Can you place that fly in its immediate feeding zone? How often have you wished you could cast another dozen feet to reach that slurping trout or marauding pike? Casting can be an end in itself as an intriguing, wholesome, recreational activity, but it also furnishes a powerful means to improve fishing techniques and skills which translate into more fishing enjoyment.

Casting Instruction Advice

Fly casting can be quite challenging to teach with larger groups. An optimum class size is eight to twelve students. For larger groups, recruit additional volunteer instructors to achieve a student-teacher ratio to 4:1 is advised. There are three key kinesthetic principles to good fly casting form: the grip, the stance, and the launch. The grip is covered below in the section "How It Is Done." The stance becomes critical if the caster is trying to launch the fly line a great distance, say 30 to 35 feet to reach a fish under a far bank. Downed trees, brush, and aquatic vegetation along the bank require long, accurate, delicate casts. A good stance in this situation for a right handed caster includes having the left foot pointed at the target, and the rear foot in a

comfortable position behind the caster. This yields a stable stance that allows the caster to rotate the body during the launch of the cast, thus providing greater distance and accuracy.

Fly Casting as a Physical Education Activity

Students can use their own gear for most informal and competitive events, however, equipment may have to be borrowed to accommodate everyone. Local Fish & Game (DNR) Offices and fly-fishing clubs may be able to provide fly casting equipment and lend their expertise. This means that this activity could cost nearly nothing! At minimum, besides the fly rods, reels and lines, all that's needed are a few casting targets and some open ground (or a gymnasium in the winter).

Game Rules and Strategies

The American Casting Association (ACA) sets formal rules for the accuracy and distance games; an example appears in the appendix. While the ACA rules are probably excessive for beginners, they can be adapted using a little creative license.

Whenever practice casting, students should have a piece of wool or a fly with the point removed tied on to the leader. The leader is that section of monofilament line between the fly line and the fly. Many anglers practice without a fly or piece of wool. This is a mistake; a fly is to a line and leader what a tail is to a kite. It stabilizes the cast. Without it, the leader swishes back and forth and the student must change his or her casting stroke to compensate. A piece of wool yarn, about the size of a No. 10 fly (bright orange or yellow so that you can see it) is ideal. Another point: in practice, or actual fishing, always wear eyeglasses (sun glasses or plain) or safety glasses. Please make this a hard rule whenever students are casting. More than one angler has lost the use of an eye fly-fishing without glasses.

When kids first learn how to throw a ball, rock, stick or snowball, they want to hit targets. After they acquire the throwing motion, they want to throw at objects: a garbage can, a tree, whatever. The same applies with casting. After students develop a casting stroke, and are comfortable with it, they need targets. Brightly colored hoops, foam craft circles, or rubber hose secured with duct tape make wonderful targets on the ground. Place three to six targets, each about 30 inches in diameter, at various distances, depending on the age and skill level of the students. The closest target should be about 20 to 25 feet away and the longest target for the oldest kids should be no more than 45 feet out.

How Is It Done

Fly Casting Myths & Facts

Fly casting is not difficult. It requires no more coordination than swinging a golf club, baseball bat, or tennis racquet. Watching some anglers struggle with casting only makes it appear difficult. Unfortunately, this perception seems to be the main reason why people are reluctant to give it a try. With the appropriate equipment and proper instructions, novices should be able to cast the line reasonably well within a few hours.

When spin fishing, a lure is attached to very thin line and cast with a spinning rod. The lure has weight and this loads the rod to propel it towards the target. The fishing line is just along for the ride. When fly-fishing, you cast a fly line attached to a leader and fly with a fly rod. The fly is almost weightless. The leader it is attached to, which is usually around 9 feet long, is very similar to standard spinning line. This is attached to a fly line, which is usually about 90 feet long. The fly line is made of a flexible plastic and is much larger in diameter than spinning line and much heavier. When fly casting, the fly line provides the weight to load the rod and propel itself towards the target, with the leader and fly just along for the ride. It is very important to understand that you are casting the line, not the fly. The line and the rod have to be matched to each other in order to work properly.

The whole purpose of all of this, besides the grace and beauty of it, is to cast almost weightless flies and present them in the most delicate manner. Because it is not the same as casting a more heavily weighted lure with a spinning rod, it often takes several 'false' casts to load the rod with the desired length of line which will allow the angler to drop the fly where desired. Sometimes it is necessary to cast the line a few times in the air, back and forth with the fly remaining in the air. This is called "false casting." Basically, the rod is loading

up with the weight of the fly line, and more line can then be fed out to increase the length of line that is in the air, until the desired length has been reached.

Fly casting follows facts of nature, laws of physics, and natural forces such as gravity. Style is a different thing, each student may move differently, their bodies are different, and their senses and timing skills are different. There are a handful of generally accepted principles to good fly casting technique:

A good grip should be one where the fly rod is grasped like a screwdriver with most of the force being imparted by the pinky and ring finger. The thumb should be on top of the cork handle. This grip should be firm, but not tight. If the forearm starts to tire, the student is gripping much too tight.

Start with the line straight. Just as it is impossible to pull a car with a slack rope, it is impossible to move a fly with a slack line. If the line is not straight, not only are movement and effort wasted to straighten it, the student will have the rod in a bad starting place. If the fly line is all piled up in front of the student, have him or her place the rod on the ground (or floor), pick up the fly line, and walk it away from the fly rod until straight. While this method doesn't work on water, it does apply in a gymnasium or field.

Every casting stroke is a smooth acceleration followed by a stop. As shown later in the Physics section of this bulletin, rod speed has nothing to do with making a good cast; it is the acceleration and deceleration that matters. The acceleration bends the rod and loads it like a catapult. While it is accelerating the bend increases, when it stops the rod recovers and straightens. It is the stop that transfers the stored energy in the catapult (rod) to the line and makes the cast. That is why descriptions like "flicking the tip" or "flicking paint off a brush" are applicable to casting. Most people understand that action and can replicate it. The harder the "stop," the further and straighter the fly line goes.

The caster loads energy into the rod during the casting stroke. The rod releases the energy into the line in the cast. The caster loads a little energy (a short, low-energy stroke) into the top of the rod for short casts; he loads a lot of energy (a short, powerful stroke) into the middle and bottom of the rod for a long cast.

The line always follows the rod tip and when the rod stops the line travels in the direction that the rod tip was going in when the stop was made. This is perhaps the least understood rule but it is absolutely fundamental to the construction of every casting technique. Movement the of rod tip produces every direction that the line takes. For the line to go in a straight line, the rod tip must move in a straight line. The direction of the line is the same as the direction of the rod tip. The same thing goes for circles or parts of circles, ellipses, or any other shape.

Good fly casting is not strength-related; it is timing-related. Thus students must practice the timing of the cast to become good casters. How much practice? No more than 20 to 30 minutes at a stretch is recommended. During a class students can cast for 20 to 30 minutes, do another activity for 10 to 20 minutes, and then cast again for 20 to 30 minutes. Most anglers require considerable practice to develop proficiency in fly casting. The shear amount of practice required to develop highly skilled casting techniques underscores the subtle mechanics involved. Only a limited number of technical papers have addressed the underlying physics of the fly line during casting and are provided as references in this bulletin.

Lessons in Mathematics & Physics Derived from Fly Casting

Fly-fishing differs significantly from other forms of sport fishing largely due to the equipment. In fly-fishing, an angler casts a lightweight artificial fly by using the distributed weight of the fly line. The motion of the fly line is controlled in part by the motion of the fly rod (i.e., by the angler) as well as by other forces including air drag, gravity, and line tension. The casting action is achieved by establishing a nonlinear wave, simply referred to as a loop, which propagates along the line. Ultimately, this loop reaches the end of the fly line where it unrolls on or near the surface of the water. By contrast, in spin or bait fishing, an angler casts a lure, bait, or weight that has significant weight compared to the line to which it is attached. In this instance, the lightweight line remains largely straight and is simply pulled from a reel under tension.

Lesson 1: Dimensional Analysis

WISCONSIN ACADEMIC STANDARDS:

Math: D 8.2, 8.3, 12.1; F 8.1, 8.2, 8.4, 12.1, 12.2, 12.4.

Dimensional analysis, sometimes referred to as unit analysis, is a mathematical technique often

employed by scientists to convert units from metric to English (and vice versa), and to change the units of their measurements. The following example deals with fly line weights. As stated before, in fly casting the line has the mass and is the object being cast. The fly and leader are both just along for the ride. In the 1960's, the American Fly Tackle Manufactures Association (AFTMA) established a uniform system for sizing fly lines. An abbreviated chart appears below:

FLY LINE SIZE	WEIGHT IN GRAINS (FOR THE FIRST 30 FEET)
4	120
5	140
6	160
7	185
8	210
9	240
10	280

Not many people use grains in daily measurement. The underlying principle of dimensional analysis holds that all numbers can be multiplied by 1 or any fraction that equals 1. Therefore, the first 30 feet of a 5-weight line fly line weighs:

$$140 \text{ grains} \times \frac{0.064799 \text{ grams}}{1 \text{ grain}} = 9.07 \text{ grams}$$

Lesson 2: Gravity

WISCONSIN ACADEMIC STANDARDS:

Math: F 8.1, 8.2, 8.4, 12.1, 12.2, 12.4.

Science: D 8.5, 8.6, 8.8, 12.7.

To restate a previous point, good casting requires quick movements or acceleration. To make a good cast, the student must overcome the force of gravity, which is defined as:

$\mathbf{F_g = M \times A_g}$; where,

$\mathbf{F_g}$ is the force of gravity measured in Newtons (N)

M is the mass of the object measured in kilograms

$\mathbf{A_g}$ is the acceleration due to gravity which is defined as 9.81 meters per squared second (m/s2)

Using the example of a 5-weight fly line, students can determine the force of gravity imparted by the earth on that line. First, they must convert the mass of the fly line to kilograms using dimensional analysis:

$$\frac{9.01 \text{ grams}}{1} \times \frac{1 \text{ kilogram}}{1000 \text{ grams}} = 0.00907 \text{ kg}$$

Then:

$\mathbf{F_g = M \times A_g}$

$\mathbf{F_g = 0.00907 \text{ kg} \times 9.81 \text{ m/s2}}$

$\mathbf{F_g = 0.0889 \text{ N}}$ of force imparted on the fly line

Since the mass of the fly line doesn't change the students *must accelerate* the fly line. Note that *speed* does not equal *acceleration*. Speed is a velocity vector that describes distance traveled per unit time such as miles per hour or meters per second (m/s). On the other hand, acceleration is different. It describes distance traveled per time *squared* (m/s2).

Lesson 3: Torque

WISCONSIN ACADEMIC STANDARDS:
Math: Math: F 8.1, 8.2, 8.4, 12.1, 12.2, 12.4.
Science: D 8.5, 8.6, 8.8, 12.7.
*Physical Education: B 8.3, C.8.1, F 8.2

Fly casting students often ask, "How much wrist should I put into it?" This really becomes a physics problem regarding torque. If the fly rod is treated as a third-class lever, then one part of the "wrist" question can be logically answered. Torque is defined as:

$T_r = L_r \times F_c$; where,

T_r is the torque created by the fly rod measured in Newton-meters (N•m)

L_r is the length of the lever (rod) from the fulcrum to the tip in meters

F_c is force the caster is exerting on the lever (rod) measured in Newtons

First have the students find out the length of the fly rod. This is usually printed on the rod just forward of the cork handle, along with other information such as the proper weight line to cast with the rod. Then have the students convert the rod length to meters by dimensional analysis:

$$8.5 \text{ feet} \times \frac{0.3048 \text{ meters}}{1 \text{ feet}} = 2.59 \text{ meters}$$

For this example, F_c is assumed to be 1 Newton. For the first torque calculation have the students use the full length of the rod (in this example, the rod is 2.59 meters long):

$T_r = L_r \times F_c$ or,

$T_r = 2.59 \text{ m} \times 1 \text{ N} = 2.59$ **N•m** of torque *theoretically* produced by the rod alone

However, the full length of the rod is not used in casting because it is gripped some distance above the butt. To find the effective length of the rod, have the students work in pairs with one student gripping the rod as he or she would cast it, and the other student measuring from the butt of the rod to the student's (the "gripper's") wrist. This time, have students bend their wrists while casting, effectively shortening the lever and reducing torque. Thus in the "wrist bending" example:

$T_r = 2.45 \text{ m} \times 1 \text{ N} = 2.45$ **N•m** of torque produced when the wrist bends

Finally, instruct the students to keep their wrists stiff while casting and rotate their casting elbows, effectively lengthening their levers (rods):

$T_r = 2.74 \text{ m} \times 1 \text{ N} = 2.74$ **N•m** of torque produced when the elbow is bent instead of the wrist during the cast

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University of Alaska Fairbanks, Sport Fishing Bulletin 12, Fairbanks, Alaska.

Edited by, Theresa Stabo, Wisconsin Department of Natural Resources, Aquatic Resources Education Director, January 2010.

Casting Equipment

Check with the Wisconsin Department of Natural Resources Tackle Loaner Program, **dnr.wi.gov/fish/kidsparents/loanerequipment.html** or your local Trout Unlimited chapter for assistance.

About the Author

Shann Paul Jones is Instructor of Leisure and Sporting Activities at the University of Alaska Fairbanks where he specializes in adult outdoor education/recreation program development and delivery. Since 2001, he's offered over 70 postsecondary level outdoor education/recreation clinics, workshops, classes and community outreach events. His current research interests include adult recreation education assessment and outdoor activities for people with developmental disabilities.

His activity was recognized in the July 2005 issue of *Fly Rod and Reel* in which University of Alaska Fairbanks garnered honorable mention as "American's Top Ten Fly-Fishing Colleges." Jones taught his first Alaskan fly-tying and fly-fishing courses in 1987. Since then, he has also delivered aquatic education and recreation programs for the Hunter Heritage Foundation of Alaska, Fairbanks North-Star Borough Community Schools, the Alaska Department of Fish & Game, Alaska AHPERD and independently for small groups and individuals.

After graduating from United High School of Armagh, Pennsylvania in 1984, Jones joined the U.S. Army as a photojournalist and started writing outdoor recreation articles for several publications. In 1986, he was transferred to Fort Greely, Alaska and promoted to editor of the Fort Greely Buffalo. He relocated to Fairbanks in 1990, and graduated from UAF in 1999 with a degree in engineering. He finished his master's degree work in the fall 2009. His thesis focus consists of understanding the transfer of scientific knowledge to lay adults through the use of outdoor education and marrying such presentations to users' needs and desires.

WISCONSIN ACADEMIC STANDARDS:

Math:

D.8.2 Demonstrate understanding of basic measurement facts, principles, and techniques.

D.8.3 Determine measurement directly using standard units (metric and US Customary).

D.12.1 Identify, describe, and use derived attributes to represent and solve problem situations.

F.8.1 Work with algebraic expression in a variety of ways.

F.8.2 Work with linear and nonlinear patterns and relationships in a variety of ways.

F.8.4 Use linear equations and inequality in a variety of ways.

F.12.1 Analyze and generalize patterns of change and numerical sequences, and then represent them with algebraic expressions and equations.

F.12.2 Use mathematical functions in a variety of ways.

F.12.4 Model and solve a variety of mathematical and real-world problems by using algebraic expressions, equation, and inequalities.

Science:

D.8.5 While conducting investigations, explain the motions of objects by describing the forces acting on them.

D.8.6 While conducting investigations, explain the motions of objects using concepts of speed, velocity, acceleration, etc., and apply these concepts and explanations to real-life situations outside the classroom.

D.8.8 Describe and investigate the properties of light, heat, gravity etc., as they interact with material objects in common situations.

D.12.7 Qualitatively and quantitatively analyze changes in the motion of objects and the forces that act on them and represent analytical data both algebraically and graphically.

Physical Education*:

B.8.3 Demonstrate increasing competence in more advanced specialized physical skills.

C.8.1 Understand and apply more advanced movement and game strategies such as explaining and demonstrating strategies involved in tennis doubles.

F.8.2 Solve problems by analyzing causes and potential solutions.

*Note: Revised Wisconsin's Model Academic Standards for Physical Education are expected in 2010. Standards1, 2, 5, and 6 apply as they were drafted in early 2010.

Standard 1: Demonstrates competency in motor skills and movement patterns needed to perform a variety of physical activities.

Standard 2: Demonstrates understanding of movement concepts, principals, strategies, and tactics as they apply to the learning and performance physical activities.

Standard 5: Exhibits responsible personal and social behavior that respects self and others in physical activity settings.

Standard 6: Values physical activity for health, enjoyment, challenge, self-expression, and/or social interaction.

Appendix

2005 Alaska International Senior Games Fly Casting Event Dry Fly Accuracy Rules

Adapted from America Casting Association Rules

1. Equipment

A) Rod

i) Length - Shall not exceed nine feet, six inches (9'6") overall.

ii) Weight - Unrestricted.

B) Reel - Unrestricted.

C) Line - Unrestricted, but shall not be marked in anyway that would indicate distance, nor fastened to the reel at less than fifty (50) feet.

D) Leader - Shall consist of a single leader of natural or artificial gut or gut substitute not less than six (6) feet in length.

E) Fly

i) Description - Official Fly provided by the Event Judge.

ii) Application - Only one fly may be attached to the leader at the tip end. The f1y may be changed at any time, or a lost fly replaced with a fly approved by the Judge.

2. Target Course

A) Targets - Five (5) targets shall constitute the course. Each target shall be anchored so that the total movement for any reason will not exceed one foot in any direction. At no time shall the distance be less than the minimum distance specified in Section 2 B i or exceed the maximum distance specified in 2 B ii.

B) Distances

i) Near Target - The near target shall be placed from twenty (20) to twenty-five (25) feet, as measured from the center of the target to the center of the front edge of the casting box.

ii) Far Target - the far target shall be placed from forty-five (45) to fifty (50) feet, as measured from the center of the target to the center of the front edge of the casting box.

iii) Other Targets - The three remaining targets shall be placed randomly in the intervening space, and not in a straight line perpendicular to the casting box.

3. Time

A) General - Time starts when the caster steps into casting box. Caster shall be allowed eight (8) minutes to complete the casting program without penalty.

B) Time Out - There shall be no time out for any reason, except for outside interference as determined by the Judge. The loss of a fly, unless that loss is caused by external contact such as a tree or a snag on a target, shall not be considered outside interference. The loss of a fly caused by striking any part of the casting platform shall not be considered outside interference.

C) Penalty - A penalty of three (3) demerits shall be assessed for each minute or fraction of a minute overtime.

4. Method of Casting

A) Casting Program

i) General - The casting program shall consist of ten (10) final forward casts, two (2) at each of the five targets in the target course, in the order and as directed by the Tournament Captain. Al1 five targets must be cast before any target may be cast again. Consecutive casts shall not be made on any target. Caster must enter casting box before beginning the casting program.

ii) Responsibility - After stepping into the casting box, the caster shall be responsible for the results and shall accept the score and penalties assessed by the Judge.

B) Casting Style – Single handed (no spey casting)

C) Procedure

i) Initial - Caster shall start with fly or leader in hand and no more than leader plus two feet of fly line extending beyond rod tip.

ii) False Cast - The false cast in which the line, leader and fly are moved through the air without intentionally striking the surface in front of the casting box is the mechanism for letting line out, pulling line in and measuring distance to the next target. The rod must be in motion, in the act of making a false cast, to strip line from the reel. Caster shall not measure line by stripping along the rod. Caster has the option of holding any loose line in either hand or of letting it drop. Caster shall not allow fly to dangle or be blown over a target in spite of wind conditions.

iii) Final Forward Cast - Whenever the intact line, leader and fly settles on the surface in front of the caster on a final forward cast, it shall be scored for accuracy (see Section 5). The fly shall float and be left floating a few seconds. After the Judge has ascertained whether or not the fly is floating, he shall call "Score" and the caster shall proceed to the next target.

D) Penalties

i) Improper Strip - Should the caster strip line from the reel or pull line in through the guides while the fly is on the surface in front of the casting box and the rod is not in motion in the act of making a cast, or attempt to measure the line by stripping along the rod, it shall be scored an improper strip. A penalty of three (3) demerits shall be assessed for each such strip.

ii) Improper Retrieve - Should the caster lift the fly from the water after a final forward cast before the Judge calls "Score" it shall be scored an improper retrieve. A penalty of three (3) demerits shall be assessed for each such improper retrieve.

iii) Improper Cast - Should the caster allow the fly to dangle or to be blown over a target, it shall be scored an improper cast. A penalty of three (3) demerits shall be assessed for each such improper cast.

iv) Fly or leader in Hand and no length more than leader plus two (2) feet of line extending beyond rod tip – A penalty of three (3) demerits shall be assessed for either infraction if caster fails to begin the round as specified in Section 4 C i.

E) Interruption of Casting Program

i) Outside Interference - In the event the caster is interrupted during the Dry Fly round due to outside interference, as determined by the Judge, the caster, if they desire, may make a final forward cast to the last target scored. When the Judge is satisfied that the caster has the approximate line length required to reach the last scored target, they shall then notify the caster the time has started and the caster shall lift the line from the water and proceed to the remaining targets. If the caster does not wish to cast to the last target scored, they may proceed as in Section E ii, except that time will start with the first false cast.

ii) Other Interruptions - If the caster is interrupted during the Dry Fly round for reasons other than outside interference, the caster shall begin false casting and proceed to the remaining targets.

5. Method of Scoring

A) General

i) No final forward cast shall be scored unless the line leader and fly are intact. The Judge shall notify the caster whenever they notice that the fly is off.

ii) Each final forward cast shall be scored where the fly ultimately settles for more than one second.

B) Demerits for Accuracy

i) A fly falling within or on any portion of the target on a final forward cast shall be scored a perfect and shall be assessed zero (0) demerits.

ii) For each foot, or fraction thereof, the fly misses the extreme edge of the target on a final forward cast, a demerit of one (1) shall be assessed.

iii) Maximum demerits for any single final forward cast shall be ten (10).

C) Demerits for Penalties - Penalty demerits shall be in addition to accuracy demerits.

D) Caster's Score - One hundred (100) points less the total number of demerits for accuracy and for penalties shall constitute a caster's score.