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Lesson Plan: Fall Factors

Essential Question: What is a fall factor and what do climbers need to know?

Desired Learning Outcomes (DLOs): After this lesson, students will be able to:

- Explain what a fall factor is
- Discuss why fall factors are relevant and important for climbers to know
- Describe how to prevent catastrophe with fall factors
- Give examples of situations where fall factors are and are not concerns and why

Background Information:

The instructor must have knowledge of the following: what fall factors are; why they are relevant and important to climbers; why and how we know they are a concern; how we prevent severe falls and what that looks like.

First, a fall factor is the ratio of fall length to rope length, and is relevant to all types of roped climbing. The theory is, the higher the fall factor, the greater the forces generated. During a fall, a climber will generate more speed as he falls and the forces created are transmitted to the equipment, the belayer and the climber. The impact or peak force is the force transmitted at the arrest and is what snaps and breaks anchors. Anchors should be built in terms of "peak force management" and anchor systems are not good enough unless they can withstand the greatest force that can absolutely be put to it, a factor 2 fall. These types of forces are most often times created in a lead climb, but also when using a tether on an anchor point.

Compared to lead climbing, a vigilant belayer when top-roping would not allow the participant to experience an intense fall; the rope is almost always very tight while still allowing the climber to free climb. On a lead climb however, like in a trad, sport, or multi-pitch setting, the belayer should not have the rope tight. Instead, the belayer will be constantly feeding rope to the climber as they ascend so they can clip into the protection as they go. In this case, if the climber falls they will fall down and directly below the top piece of protection, whatever that may be. Again, the fall factor is the ratio of the fall distance to the length of rope in the system. However far you climb up above the belay is how much rope you have in the system, and the fall factor becomes very serious when the climber goes a long distance above the belay anchor without setting any protection. The most intense type of fall, the factor 2 fall, is generated when the climber falls the entire ropes length down and then that ropes length past the belay anchor. This same type of fall can be generated when climbers are tethered into anchors with webbing or slings. If the climber walks or climbs the entire tether distance above the anchor, they will fall the entire tether distance below the anchor. The force generated on these types of falls is how ropes are tested for climbing, ensuring that they can withstand the most intense force that can be generated. It is important to note though, that forces created in real life won't reach the forces in the lab and there a many more factors that come into play in the real world.

We as climbers must understand what our gear can hold and we must build anchors with "peak force management" in mind.

To help prevent this type of severe fall (the factor 2), there are a couple of things that we need to make sure of before climbing. In addition to building our anchors able to withstand a factor 2 fall, the lead climber should place his first piece of protection as soon as possible. Placing the piece of protection immediately makes the fall factors less than 2, as long as the placement is bomber. It is also important to consider the type of belay device and slack for the climb; assisted locking devices like the Grigri do not allow rope slippage, so can create a higher impact since the belay is less dynamic. Some people think that introducing more slack into the rope he would be good, but in fact using a tube device that allows the rope to slip would be better since it allows more of a dynamic belay. If an assisted locking device is the only option, be sure the belayer takes in slack and moves in or prepares to jump when the climber is falling.

Instructor Notes:

Time: This lesson should take some time to prepare the visual aids and practice worksheets, maybe 5-10 minutes and the teaching event should be between 30 minutes to an hour, depending on how the students grasp the information.

Equipment: The equipment for this lesson plan includes materials for visual aids such as white boards or laminated white paper to mark on.

Site: This lesson can be delivered anywhere there is an environment suitable for learning. In a comfortable position near a rock wall (indoor or outdoor) could be potentially beneficial if you wanted to reference the wall.

Activity Sequence:

Framing: The instructor will explain the following as the main points of the lesson:

- What is a fall factor and why it's important?
- When are fall factors are a concern?
- How can we help prevent catastrophes?

Activity (Teaching): The instructor will go through each bullet to explain the topic; students are encouraged to ask questions throughout the explanation of each topic if unclear

1. What a fall factor is:
    a. Fall distance / Rope length
2. When are fall factors a concern:
    a. Lead climbing
    b. Tethered into anchors
3. Why are fall factors important:
    a. Peak force & "peak force management"
4. What does a catastrophic fall look like and how do I prevent that:
    a. Factor 2 falls
    b. Prevent by using appropriate belay devices and techniques

Closing: The instructor will ensure that the students are comfortable with the information before moving onto the scenario worksheets activity, opening up a discussion for the students to ask questions.

1. Questions about:
    a. What a fall factor is?

b. When are they a concern?
c. What is a catastrophic fall?
d. What can we do to help prevent this?

Framing: The instructor will provide worksheets where each student will have a climbing scenario where there is a fall, and they will have to work out the fall factor, explain whether or not is a catastrophic fall. They will have a discussion after they finish the worksheet for clarifications and then they will switch scenarios with another member of the class. The instructor will have each scenario completed beforehand in order to check the student's work.

Activity (Scenario Worksheets): The instructor will have these scenarios printed off ready for the students to work on them, or will have another medium for the students to work out these problems (i.e white boards). It is important the instructor stresses to the students to ask questions if they have concerns. The instructor should have enough scenarios where the student's will not have repeats when they switch. The six scenarios that will be used for this teaching event are as follows:

- Climber is tethered into an anchor with a 48in (2 foot) tether. They walk above the anchor the full extension of the tether but slip and fall down. What is the fall factor?
- Lead climber is ready to ascend and begins to climb after doing the head-to-toe with their belayer. The climber gets 20 feet off the ground before he can place his first piece and does so successfully. He climbs another 5 feet but then slips. What is the fall factor?
- The climber is on a multi-pitch climb and gets to the belay anchor for the second pitch. After setting up the belay anchor and doing his head-to-toe check with his belayer, he begins to climb. He only gets 10 feet off the ground before he takes a fall, without having set any protection yet. What is the fall factor?
- The climber is tethered in with his 48in (2 foot) tether to the anchor. She walks above the anchor 1 foot and then slips. What is the fall factor?
- The climber is doing a sport route and is starting to climb up. She is able to the get the first quick draw on, and also the second. She is 45 feet off the ground and 10 feet above her last anchor when she takes a fall. What is the fall factor?
- The climber is getting ready to lead a trad route and begins to climb. She sets protection 10 feet off the ground, then again at 20, and again at 30(the most recent protection). She climbs 5 above her last protection and falls, but her top protection fails so she falls to the one she set at 20 feet. What is the fall factor?

Closing: The instructor should ask the students if they have any questions about the material before moving on. After answering the questions, the instructor will conclude the lesson. The instructor should hit on the following points:

- Fall factors are crucial to consider in lead climbing, where the consequences are most profound.
- We must build our anchors in terms of "peak force management" so they can hold a factor 2 fall
- Looking forward, our knowledge of fall factors should make us more aware of the risks involved with placing marginal pieces.

References

Long, J., Gaines, B., & John, L. (2006). *Climbing anchors* (2nd ed.). United States: Falcon Press Publishing.

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Lesson Plan: Assessing Natural Anchors

How do you assess natural anchors for rock climbing?
This lesson plan outlines information needed for assessing natural anchors.

Goals and Outcomes
Students will be able to:

- Identify natural anchors
- Demonstrate how to assess natural anchors for climbing reliability
- Discuss what qualities make a natural anchor dependable for climbing

Background Information
Natural anchors are anything that the environment offers to tie into that can support your weight for climbing. They often times are stronger than anything a climber could arrange with nuts or cams and are usually the least environmentally destructive. When a climber is well aware of how to choose and test a natural anchor, they can create a bomber anchor from which to climb.

Instructor Notes
Preparation – The instructor should scope out the site and identify the anchor(s) that she will use to demonstrate assessing for the lesson. The only natural anchors covered in the lesson plan should be the natural anchors that are available to use and demonstrate with at the site. The instructor can mention other anchor possibilities, but will focus on what the chosen site offers. The instructor should have comprehensive knowledge of various different natural anchors and how to assess each.
Time – The lesson plan should take 10-15 to discuss and demonstrate anchor identification and testing.
Site – Lesson plan should take place outside at the top or base of the rock face, wherever there are good examples of the anchor types. Note: if site is not usual place to actually tie into the anchor (like the base), express this to the students. The instructor should have at least one good example of a natural anchor near her to refer to and demonstrate with throughout the entire lesson.
Organization – the students should be arranged around the instructor in order to see the demonstrations for identifying and assessing the anchor.

Activity

1. Framing:
    a. Ask the students the following:
        i. When climbing, would we rather trust something that someone else placed or something that we placed ourselves?

ii. What do we think is stronger, nuts and cams or trees and boulders (when chosen correctly)?
iii. What are natural anchors? (Allow for student answers)
1. Natural anchors are anything that the environment offers for you to tie into that could bear your weight– trees, bushes, rock horns, etc. They are usually stronger, easy and quick to set up and take down and less destructive on the environment.

b. Student expectation? For this lesson, you will learn how to identify and assess various natural anchors.

2. Activities:
a. Ask the students to identify anything that they think could be used as anchor around them and to test it. Have them come back to gather around an anchor you have chosen to use for the example. Ask the following:
i. What are the characteristics of the anchors you have picked out?
1. If student-chosen anchors are within close proximity to example anchor chosen by the instructor, it is an option to take the group around to each one of the anchors chosen by each student to discuss it.
ii. What do we think about the example anchor that has been chosen?
b. Discuss how to identify and choose a natural anchor: Ask students what they think will make a good anchor, then proceed to have a discussion with them about what to look for. Explain acronym SISA (Solid, immovable, size, alive) and discuss the following:
i. Solid?
1. You want your anchor to be as solid as possible; things that are hollow, flimsy, cracked or crumbling are not good options.
ii. Immovable?
1. Anchor: You do not want an anchor that moves.
2. Gear: You do not want to use an anchor that risks allowing gear to slip.
iii. Size?
1. You should be able to put your sling around the anchor and it should be large enough to hold your weight. Trees smaller than 6 inches in diameter will not be used in the Georgia College program.
iv. Alive?
1. If choosing a tree or bush, you want it to be alive. Things that are alive are well rooted and strong.
v. Will it destroy my gear?
1. You do not want to use something that will destroy your gear like a cactus.
c. Discuss how to assess a natural anchor:
i. **SAFETY**: It is important when testing an anchor to be safe. Avoid pulling trees or roots out or pushing boulders off and be prepared to yell down “ROCK” or “TREE” if anything does happen.
ii. Solid:

1. Knock on it – if you hear a hollow noise, do not use and do not trust. Examine for cracks, crumbles or weak rock. If object seems like it is about to break, do not trust it and do not use it.

iii. Immovable:
1. Anchors: Yank, bang, push, pull, knock and kick the anchor. If the anchor moves, budges, dislodges dirt (tree or bush), do not trust it and do not use it.
    a. If immovable but precariously placed (large boulders), do not trust it and do not use it. Most climbers avoid detached boulders, but if large, wedged in between other rocks and resting on a flat platform it could be used.
2. Gear: If the anchor is immovable but does not allow any place for gear to be set without slipping off or moving quite a bit, do not trust it and do not use it. You want your gear to stay in place.

iv. Size:
1. Does this look like it could hold my weight? Can my sling fit around it? Pulling down on the object will help you test it, but use your judgment and be wise when choosing. Search for a better option than the 5-inch diameter tree or bush.

v. Alive:
1. The anchor should show signs of life: green leaves, healthy bark and roots. If easily broken or up rooted, do not trust it and do not use it.

Closing

1. After discussing how to identify and test natural anchors, ask the students to return to the first anchor they identified and to test it using the techniques covered. After they have tested it, have them come back and discuss if they would trust their anchor or not.
    a. It is important to be able to observe students testing their anchor to ensure they are using the techniques properly and not damaging the environment.
2. Ask the students to explain the key components of identifying and choosing natural anchors:
    a. SISA (solid, immovable, size [good], alive) and won't destroy gear
3. Ask the students to explain how to assess if anchors are reliable:
    a. To test: Push, pull, yank, bang, kick, knock, visually assess
    b. What to avoid: hollow sounds, moveable anchors, cracks, crumbles, precariously placed, dead, detached, notches where gear can easily slip,

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