SCIENCE-MATH

Lesson Starters

A. Research red-tailed hawks (RTHs). Create a 2-3 minute report to share with your class. Or research RTHs and two other local raptor species: compare-contrast habits, challenges, etc. Locate RTHs nearest your school. Research/observe their habits, challenges, etc.

B. Identify elements of the ecosystem in which Pale Male lives. Review Charles Kennedy's remarks (6:28) about adaptation. Then cut to end of film (1:15:10) where Frederic asks Charles if Pale Male's young can make it the city. Discuss the adaptations made by the hawks and do some predicting about how future generations will fare and why.

C. Learn about conservation science and advocacy as a class project. Contact a local wildlife agency official, birding (Audubon!) or conservation group, raptor rehabilitator, state park, etc and start a learning relationship. You might: inquire about local Red-tailed hawk populations, local raptor issues/human interface; do some field observation with the local expert and/or invite the person to your school, share products from Pale Male-related assignments with the expert, watch the film with this person, arrange a periodic email relationship with this person/agency to share updates back and forth.

D. Investigate laws protecting birds, e.g. Migratory Bird Treaty Act of 1918. Discuss concepts such as conservation, extinction, extirpation, etc.

E. Research the specific threats posed by human-introduced poisons to raptors and other important groups of birds and mammals. Begin with the "Silent Killers" section of the website.

Lesson Plan 1
Classification of Living Things

Objectives:

- Students will identify that birds are one of the five living kingdoms.
- Students will identify characteristics, nest, eggs, young, habitat, and food of the red-tailed hawk.
- Students will understand the importance of observation in developing science.
- Students will integrate their knowledge and ideas of red-tailed hawks into the presentation of a book.
- Students will interpret the information that they researched into a visual presentation.

Introduction:

1. Students will watch the first 5 minutes of *The Legend of Pale Male* for inspiration for their own research. Students will understand that out of the blue this red-tailed hawk came to Central Park in New York City and adjusted to humankind for 28 years.
   Note: It is important to emphasize that for the past 100 years the Red-tail Hawk has not inhabited this park.
2. Students will research the food chain, key behaviors, migration pattern, and the habitat of this species. Students will understand that this fearless hawk makes it in New York City because of the pigeons, squirrels, and rats it is able to hunt. Students will discuss the daily survival of the Red-tailed hawk.

Procedure:

1. As students watch the video they will take notes on the following areas:
   - Physical Characteristics (Nest, Eggs, Young)
   - Habitat (Food, Hunting)
   - Interesting Facts
2. Students will spend time working online completing research for their books and presentation.
3. Students will take notes and create a five-paragraph expository essay, "The Force of Nature."
4. Students will create a simple book or digital slide presentation with a table of contents:
   - Characteristics
   - Nest, Eggs, and Young
   - Habitat
   - Food, Hunting
   - Interesting Facts
   - Bibliography

Extensions:

- Have class compile a glossary of interesting/important terms.
- Find out about some actual local red-tails. Invite in an ornithologist or raptor rehabilitator to give background.

Conclusion/Assessment:

Students will visually present information they researched in front of the class or to a broader audience: e.g. parents, other faculty, a local birding group, ornithologist, or bird rehabber. (This is a great opportunity to build a mutually beneficial relationship with local bird/conservation groups.)

Lesson Plan 2

The Many Wonders of Optics

There are many good mathematics and science investigations in the realm of optics such as telescopes, binoculars, and microscopes. Here is the backbone of an extended lesson on optics:

1. How do large telescopes such as Lincoln Karim's 'Hubble' work? Compare the applications of Lincoln's telescope with those of the original Hubble Space Telescope. (e.g. Astronomy, Astrophysics, Field Biology, Photography, Cinematography…)
2. How does Lincoln know from the focusing on his binoculars that he is exactly 3,000 ft from the nest? 1:05:45
3. How do binoculars and spotting telescopes (for nature observation) work? Are they all very similar? What is the relationship between the telescopic power of scopes and binoculars, the width of their lenses, and their field of view? Why do these things matter to the users of such equipment? Why do people carry binoculars in hand and place spotting scopes on tripods?
4. What kind of glass is used in binocular and spotting scope lenses? Does it vary among brands and types of devices? Why is glass quality and glass treatment important? Explore glass specifications for field optics companies such as Swarovski, Leica, Nikon, Eagle, and Bushnell. Have an optics retailer or birding group bring in sample optics of various types and have students experience using them and then comparing specs and costs.
5. What kind of prisms and mirrors are used in binoculars and scopes? How are they calibrated? What does the binocular-making process look like?
6. What properties of light and color spectrum are important in the building of optics?