Reading the River, Summer 2002

A Study of Duck Creek
Grades 7-8

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Study of Duck Creek
The eighth and seventh grade students at Saint Joseph School, Cold Spring, will begin an on-going study of Duck Creek in Campbell County.

Background Context:
St. Joseph School is a parish school operated by St. Joseph Catholic Church in Cold Spring. The School and Church are situated on a 22 acre site on Alexandria Pike. The head of the north fork of Duck Creek is on our school property.

In 2001, after a year of study and approval by the required governmental agencies St. Joseph Parish began a project in cooperation with Cinergy, our local electric service provider. By filling in the valley at the head of the north fork of Duck Creek the Parish would gain about four and a half acres of flat land which can be used for sport fields and future construction. Cinergy would get a site for the burial of fly ash, a waste product of coal burning electricity generation.

This development provides us with the opportunity to observe and document the ecological succession which will take place in the riparian area at the head of the north fork of Duck Creek; possibly for years to come.

We will take the opportunity, also, to study other sites along Duck Creek, following it to its mouth on the Ohio River. We will also compare the creek to a pond in Campbell County.

Context
These lessons will be part of several units in the 8th grade life science classes throughout the school year.
First lesson: An Introduction to Dissolved Oxygen & review of pH:

Context: This lesson is part of a unit on ecology.

As a result of this activity, students will be able to
- use the LaMotte test kit to find the amount of dissolved oxygen in a sample of water.
- explain the term “dissolved oxygen”
- use the LaMotte test kit to find the pH of a water sample

Materials:
- LaMotte test kit
- classroom aquarium
- overhead transparency

Activity Procedure:
Using the overhead transparency and the class aquarium, explain that the oxygen which fish in the class aquarium, and other aquatic animals, breathe is O\(_2\) - the same as we breathe, not the O in H\(_2\)O. The aquarium pump moves the surface of the water, bringing in more O\(_2\).

Use several student volunteers to demonstrate the use of the LaMotte kit Dissolved Oxygen test. Lead the students in demonstrating each step in the instructions accompanying the LaMotte kit DO test.

Have one student use the thermometer in the LaMotte kit to read the temperature of the aquarium.

Next, use several student volunteers to demonstrate the use of the LaMotte kit pH test. Lead the students in demonstrating each step in the instructions accompanying the LaMotte kit pH test.

Record these three measurements in student notebooks.
**Second lesson: Measuring Dissolved Oxygen, temperature & pH in the Duck Creek:**

Context: This lesson is part of a unit on ecology.

As a result of this activity, students will be able to go to a creek and
- use the LaMotte test kit to find the amount of dissolved oxygen in a sample of water.
- use the LaMotte test kit to find the pH of a water sample
- read and record temperature using a thermometer
- explain the term “dissolved oxygen”

Materials:
- LaMotte test kit
- notebooks
- digital camera
- creek

Activity Procedure:
The class will be divided into the following five groups (each group will have a different job than last time):
- the photo documenting group
- pH group
- DO group
- location recording group
- temperature group

The class will walk down to the head of Duck Creek. Along the way the photo documenting group will use the school’s digital camera to document the present stage of the ecological succession of the land behind our classroom. Particular attention will be given to the hill above the head of the creek and the other riparian area at the head of the creek.

At the head of the creek:
- the photo documenting group will use the digital camera to document the work of the other groups. Also this group will photograph any litter polluting the creek.
- the pH group will use the LaMotte Kit to test pH
- the DO group will use the LaMotte Kit to test DO
- the location group will use a metric tape measure to measure the distance from a permanent feature and the location where the DO, pH, and temperature are measured.
- the temperature group will use the LaMotte Kit thermometer to measure temperature
- all of the measurements will be recorded in the students’ notebooks. Later this data will be transferred to a data base, so that the data can be compared to future data on the creek.
Third Lesson: Gathering Information about Invertebrates

Context: This lesson is the first in a unit on invertebrates.

Research in the library and/or on line

As a result of this activity, students will be able to answer these questions:

1. What is an invertebrate?
2. What is a macroinvertebrate?
3. Give examples of macroinvertebrates that live in water.
4. What is the macroinvertebrate’s role in the aquatic food chain?
5. Do macroinvertebrates tell us anything about water quality? What?
6. What is the riparian area of a stream?

Materials:
• library reference books
  • students’ notebooks
  • computer internet access

Activity Procedure:
The class will go to the computer lab and library to research the questions, above.
After the research, the class will return to the classroom to discuss their findings, making sure that all the students are sharing accurate information.
Fourth lesson: Observing Water Quality, Including Invertebrates in Duck Creek:

Context: This lesson is part of a unit on invertebrates.

As a result of this activity, students will be able to go to a creek and
- explain what an invertebrate is
- gather invertebrate specimens from a stream
- use a taxonomic key to identify invertebrates
- gather pH, DO, temperature and conductivity data in an on-going study

Materials:
- LaMotte test kit, including conductivity meter
- notebooks
- digital camera
- creek
- small animal nets
- small, white plastic tubs
- water proof boots
- Key to Aquatic Macroinvertebrates in Ky.*
- permission to enter the neighbor’s property

Activity Procedure:
- The class will be divided into the following five groups (each group will have a
different job than previously):
  - the photo documenting group
  - pH group
  - DO group
  - location and flow rate group
  - temperature group
  - conductivity group

- The class will walk down to Duck Creek, leaving school property through a gate near
the creek, following the creek on the neighbor’s property.

- Along the creek:
  - the photo documenting group will use the digital camera to document the work of the
other groups. Also this group will photograph any litter polluting the creek.
  - the pH group will use the LaMotte Kit to test pH
  - the DO group will use the LaMotte Kit to test DO
  - the location & flow rate group will use a metric tape measure to measure the distance
from a permanent feature and the location where the DO, pH, and temperature are measured.
  - This group will also use a stick, measuring tape and stop watch to measure the flow rate
(speed of the water flow)
  - the temperature group will use the LaMotte Kit thermometer to measure temperature
  - all of the measurements will be recorded in the students’ notebooks. Later this data
will be transferred to a data base, so that the data can be compared to future data on the creek.
  - additionally, each group will use a net to catch invertebrates from under rocks and in
gravel. If some pairs of water proof boots can be obtained, some students may wade into the
water to kick up gravel behind a net to capture some specimens.
  - Netted specimens will be put into stream water in the white plastic tubs.
- Use the Key to Aquatic Macroinvertebrates in Ky.* to identify the invertebrates that were found.

- Record the number and species in a data table in the student notebooks.
  - All of the measurements will be recorded in the students’ notebooks. Later, when we return to the building, these data will be transferred to a computer database.
Fifth lesson : Looking for Bacteria at School, including Fecal Coliforms, in Duck Creek

Context: This three day lesson is part of a unit on Bacteria, following teacher lead discussion of bacteria and demonstration of sterilization of nutrient agar and pouring of Petri dishes.

As a result of this activity, students will be able to
- describe locations where many and few bacteria would be likely found
- determine the presence of fecal coliform bacteria
- count colonies of bacteria on a Petri dish to determine the level of bacterial contamination

Materials:
- fecal coliform test kit (Science Kit Boreal)
- pre-sterilized Petri dishes, one per student
- pressure cooker
- nutrient agar powder
- water
- sterile cotton swabs* (can be wrapped in foil and sterilized in pressure cooker), one per student
- sterile pipettes*
- sterile bottle or jar*
- several permanent markers
- clear tape
- notebook
* These can be sterilized by heat and pressure.

Activity Procedure:
In a previous class, the teacher would demonstrate the preparation of nutrient agar, including sterilization by heat and pressure in a pressure cooker. (15 lbs. pressure, 250 degrees Fahrenheit for 15 minutes) Also, the teacher demonstrates pouring the agar into the Petri dishes by sterile method.

First day: Have a volunteer (or two) from each class go to the creek during their recess time and collect, in sterile bottles, a water sample from each of the first two test sites.
- As a class demonstration, have a student volunteer, fill a fecal coliform test tube with creek water.
- Have another volunteer measure one milliliter of creek water in a sterile pipette, and dispense it onto the nutrient agar of one Petri dish.
- Have another volunteer measure one tenth of a milliliter of creek water in a sterile pipette, and dispense it onto the nutrient agar of one Petri dish.
- Swirl the two Petri dishes, to spread the water over the whole surface of the dish.
- Invert the dishes and put in a warm place to incubate for 24 hours.

Second day: Have a class brainstorming discussion to hypothesize about where bacteria might be in our school, then let each student each student pick one of these places or things to sample.
- Give each student a Petri dish (previously poured with sterile agar). Students write their name on the bottom (small side) of the Petri dish. Teacher checks to see if students wrote in the right place, because this is the same side where the sample will be placed.
- Record the source of the sample in student notebook.
• Each student also gets a sterile cotton swab (or pipette for liquid samples.)
• Students go to gather their samples.
• Sample is gathered by removing the swab from its foil pouch, holding one end of the swab, then swiping the other end across the surface of the sample. The cotton swab must then be placed immediately in the waste can.
• Open the Petri dish just enough to insert the swab. On the same half of the dish as their name, the swab is then swiped across the nutrient agar, side to side, covering the agar. (Some students have trouble seeing the agar, and they accidentally swipe the sample onto the inside top of the dish. To help the students understand where the agar is, and how fragile the agar is, the teacher can open one sterile plate and show the students the water drops which condensed on the inside of the lid and then carry the dish around the room and let them each touch the surface of the agar).
• Alternately, a sample may be gathered by using a sterile pipette. You must hold only the top of the pipette and plunge the pipette into the liquid (aquarium water, school milk carton, o.j., water fountain sample, creek water, for example). Placing an index finger on top of the pipette, the one milliliter or one tenth milliliter of liquid can be measured onto the agar.
• Tape the dish closed. Invert the dishes and place them in a warm place in the room. (If you have an incubator, you can control the temperature at about 26 degrees celcius / 80 Fahrenheit.) Incubate for 24 to 48 hours.

Third day: Students will count the colonies on their dish. Each colony can be assumed to have grown from a single bacteria cell, so you can get a qualitative measure of the amount of bacteria present in the sample collected. The measured, liquid samples give you a quantitative measure of the bacteria present in the liquid.
• Data is recorded in student notebook, then shared on the chalk board and discussed.
• All of the data from the creek will be recorded in the students’ notebooks. Later, when we return to the building, these data will be transferred to a computer data base.
Sixth lesson: Observing Water Quality, Including the Riparian Area at the Mouth of Duck Creek:

Context: This lesson is part of a unit on plants.

As a result of this activity, students will be able to go to a creek and
  • explain what an invertebrate is
  • gather specimens from a stream
  • use a taxonomic key to identify some invertebrates
  • gather data in an on-going study
  • observe changes, differences, in different sites along the creek
  • evaluate the riparian area of the site

Materials:
  • LaMotte test kit
  • notebooks
  • digital camera
  • creek
  • fecal coliform test tube
  • small animal nets
  • small, white plastic tubs
  • water proof boots
  • Key to Aquatic Macroinvertebrates in Ky.*
  • Ky. Watershed Watch Habitat Assessment Field Data Sheet
  • permission to enter the property

Activity Procedure:
  The class will be divided into the following seven groups:
  • the photo documenting group
  • pH group
  • DO group
  • conductivity group
  • bacterial group
  • location and flow rate group
  • temperature group

  The class will be chaperoned by parent volunteers and taken parent cars, to a site near the mouth of Duck Creek, where the creek flows into the Ohio River. This site is near the intersection of Ky 1998 and Ky 8.
  Here, the class will repeat the procedure carried out further upstream, with the following addition:
  • Each group will also survey the riparian area at this site.
  • All of the data will be recorded in the students’ notebooks. Later, when we return to the building, these data will be transferred to a computer data base.
Seventh lesson: Observing Water Quality, Including the Riparian Area at the First and Second Sampling Sites:

Context: This lesson is part of a unit on plants.

As a result of this activity, students will be able to go to a creek and
• explain what an invertebrate is
• gather specimens from a stream
• use a taxonomic key to identify some invertebrates
• gather data in an on-going study
• observe changes, differences, in different sites along the creek
• evaluate the riparian area of the site

Materials:
• LaMotte test kit
• coliform test tube
• notebooks
• digital camera
• creek
• small animal nets
• small, white plastic tubs
• water proof boots
• Key to Aquatic Macroinvertebrates in Ky.*
• Ky. Watershed Watch Habitat Assessment Field Data Sheet
• permission to enter the property

Activity Procedure:
The class will be divided into the following thirteen groups or persons:
• the photo documenting person*
• pH group*
• DO group*
• conductivity person*
• bacterial test group
• 2 location and flow rate groups (one group at each site)
• temperature person*
• 4 invertebrate groups (two groups at each site)
• 2 riparian survey groups (one group at each site)
*These groups will visit and gather data at both sites.

The class will be assisted by parent volunteers or teacher aids. We will return to the first two sampling sites, gathering data that wasn’t collected earlier, and re-doing those original tests. Here, the class will repeat the procedures carried out at the mouth of the creek. All of the data will be recorded in the students’ notebooks. Later, when we return to the building, these data will be transferred to a computer data base.
Eighth lesson: Observing Pond Algae and other Protists:

Context: This lesson is part of a unit on protists.

As a result of this activity, students will be able to
- explain what a protist is
- gather algae and other protist specimens from a pond
- use a taxonomic key to identify protists
- gather pH, DO, temperature and conductivity data in an on-going study

Materials:
- LaMotte test kit
- notebooks
- digital camera
- pond
- sampling jars
- water proof boots
- Key to Protists
- permission to enter the neighbor’s property

Activity Procedure:
The class will be divided into the following five groups (each group will have a different job than previously):
- the photo documenting group
- pH group
- DO group
- temperature group
- conductivity group

When we arrive at the pond:
- the photo documenting group will use the digital camera to document the work of the other groups and the pond site.
- the pH group will use the LaMotte Kit to test pH
- the DO group will use the LaMotte Kit to test DO
- conductivity group will use the conductivity meter to measure pond water
- the temperature group will use the LaMotte Kit thermometer to measure temperature
- each group will gather water samples to be examined under the microscope back at school
- all of the data will be recorded in the students’ notebooks. Later these data will be transferred to a data base, so that the data can be compared to future data on the creek.

Back at school students will view samples under microscopes and use a taxonomic key to identify and sketch specimens in their notebooks.