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Before You Teach a Laboratory

Preparation Before Lab Begins

1. ***Read the entire laboratory chapter and do the lab activities for yourself.*** This will allow you to make informed choices about which lab activities to assign for your students to work on before, during, or after the laboratory period. This will also allow you to better answer student questions about the laboratory assignments.
2. ***Decide what activities your students should complete before and during the lab.*** Most labs deliberately include more activities than your students could complete in a single lab period, so you can choose the activities that you think will best enable your students to learn what you expect them to learn in the lab time available.
3. ***Check the list of errata for corrections that must be made in the lab that you plan to use.*** Errata are listed on page 4 of this Instructor Manual.
4. ***Assign pre-lab preparations for your students to complete.*** This may include:
 - a. Complete the first activity of the lab before arriving at the lab session.
 - b. Watch the pre-lab video for the lab.
 - c. Take a pre-lab quiz using MasteringGeology™ or other quiz of your design.
 - d. Complete assigned readings in the Lab Manual, class textbook, or other.
 - e. Know what activities must be completed by the end of the lab period.
 - f. Know what materials each student must bring to the start of the lab (as noted in the blue boxes of the Lab Manual that start off each activity and as noted at the start of each laboratory section of this Instructor Manual).
5. ***Review and assemble the Instructor Materials that you must provide during the lab period.*** A list of the Instructor Materials is provided in this Instructor Manual at the start of each for each lab section. They are generic lists only and must be modified by you to avoid confusion and know exactly what to assemble for the laboratory.
6. ***Review each activity and the Answers to Questions for each activity/question that you assign to your students.*** The answers are provided in this Instructor Manual. Some questions have more than one correct answer, depending on how you have presented material for students to read or explore.
7. ***Analyze pre-lab results, if you are assigned a pre-lab quiz using MasteringGeology™ or a similar program.*** Use that information to identify weaknesses and misconceptions of a student or class. Then build a plan for intervention that makes the most of the time that students will have in the laboratory.

8. ***Develop the scope and sequence of the teaching/learning plan that you plan to follow during the lab period.***
- a. What will you do at the start of the lab period? For example, you might:
 - Declare the scope and sequence of what students must do during the lab period, how they are expected to do/record their own work yet work in collaborative groups, and the safety practices that they must follow.
 - Review pre-lab weaknesses and misconceptions and/or use lab PowerPoint to introduce the lab.
 - Review how and where students obtain the materials they need and that you are providing in the lab.
 - Answer questions that students have about the lab topic.
 - b. What will you do during the middle part of the lab period? For example, you might:
 - Allow students to work on activities at their own pace, in groups, or according to some other plan you have devised.
 - Move about the room to be sure students/groups have the materials they need and are on task.
 - Address questions and use guiding questions of your own to help students scaffold from the unknown to the known, or from inability to ability. Implement personal interventions as needed, especially relative to pre-lab quiz results and special needs.
 - c. What will you do near/at the end of the lab period? For example, you might:
 - Review the results of each activity item by item or use the *Reflect & Discuss* questions for formative purposes, to guide learning.
 - Have students submit their individual worksheets for summative assessment –evaluation for a grade.
 - Have students complete a graded post-lab quiz.
 - Have students address the *Think About It* questions linked to the lab and/or the activities that they completed.

During the Laboratory Session

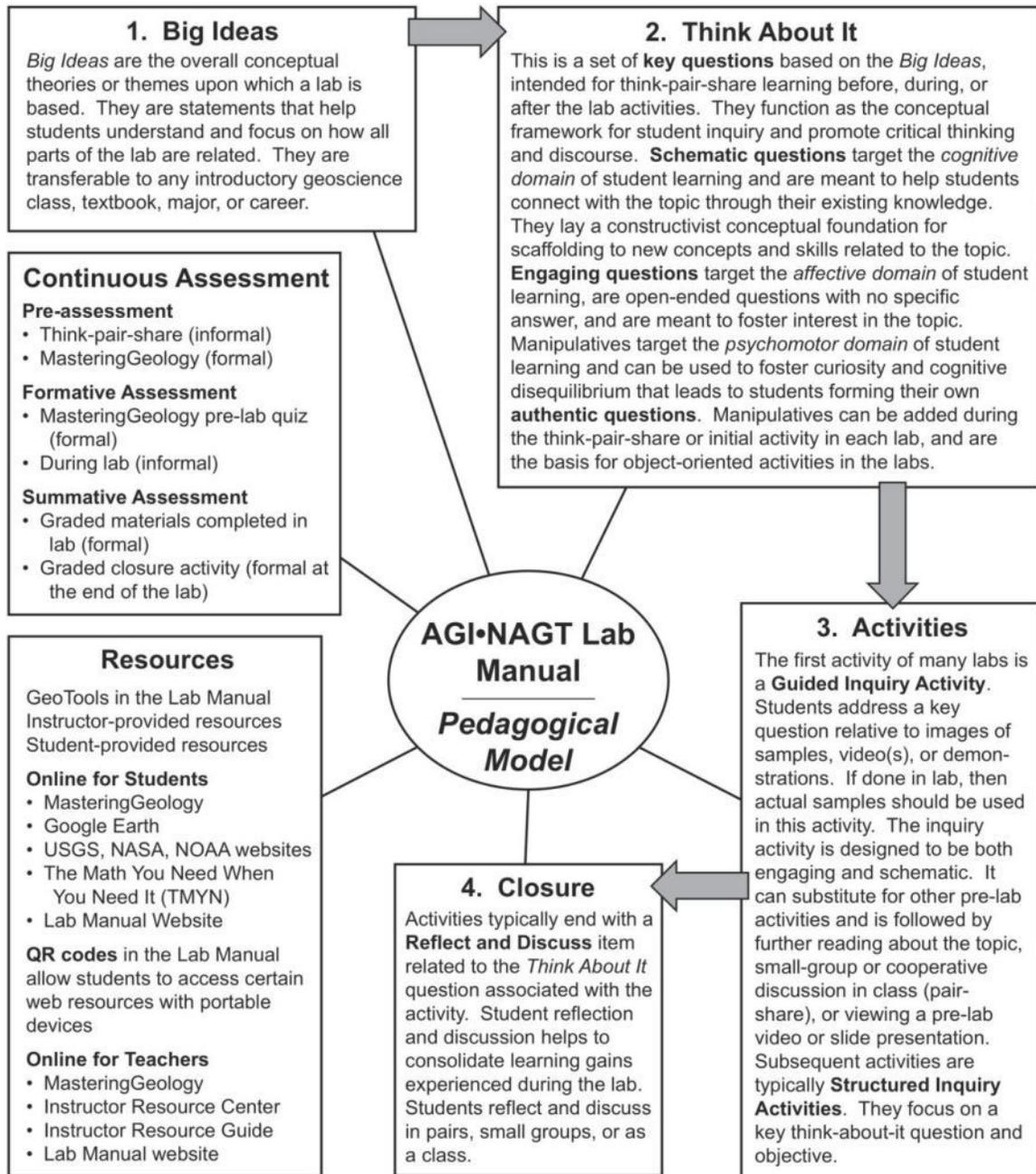
Implement the plan you have developed for the lab. Be a good time manager. Keep the students on task, but do not sacrifice learning in order to keep rigidly to your initial plan. Be flexible. Solicit written or oral feedback from students that might serve to improve the effectiveness of future labs.

After the Laboratory Session

Grade materials and provide grades and feedback to students in a timely fashion. Remember to send any helpful comments, suggestions, and constructive criticisms regarding the *Laboratory Manual* to the Editor, Vince Cronin, via Vince_LM_Editor@CroninProjects.org.

Pedagogical Model

Each lab proceeds from items 1 through 4 and involves resources and assessments.



LABORATORY ONE

Filling Your Geoscience Toolbox

BIG IDEAS: Geology is the science of Earth. Society needs reliable information about Earth as it confronts challenges related to resources, natural hazards, environmental health, and sustainable development. Geoscientists observe Earth using many technologies, from sophisticated airborne or orbital sensors to laboratory instruments and basic fieldwork. We map Earth's surface and describe locations using several coordinate systems. Mapping Earth helps us document change over time and identify where useful resources occur. Mathematics is an important language we use to communicate ideas in geoscience.

THINK ABOUT IT (Key Questions):

- What do we see when we look at different parts of Earth? (Activities 1.1–1.3)
- How is the elevation of a solid block floating in a more dense fluid related to the relative densities of the two materials? (Activity 1.4)
- How can we convert many observations into useful summary data? (Activity 1.5)
- How can we represent data to help us interpret trends and implications? (Activity 1.6)
- How does a variation in density help us understand the broad structure of Earth? (Activity 1.7)

STUDENT MATERIALS

Remind students to bring items you check below.

- _____ laboratory manual with worksheets linked to the assigned activities
- _____ laboratory notebook
- _____ pencil with eraser
- _____ metric ruler (also available on GeoTools sheet 1 or 2)
- _____ calculator or smartphone with calculator app
- _____ drafting compass (Activity 1.7)

INSTRUCTOR MATERIALS

(Check off items you will need to provide.)

ACTIVITY 1.1: A View of Earth from Above

This activity requires a web-enabled device with Google Earth and an Internet connection.

ACTIVITY 1.2: Finding Latitude and Longitude or UTM Coordinates of a Point

No instructor-supplied materials are needed for this activity.

ACTIVITY 1.3: Plotting a Point on a Map Using UTM Coordinates

No instructor-supplied materials are needed for this activity.

ACTIVITY 1.4: Floating Blocks and Icebergs

No instructor-supplied materials are needed for parts A, B, D, and E of this activity.

- _____ Part C: gram balance
- _____ Part C: wood blocks about 8 cm × 10 cm × 4 cm. *Do not use cubes* because they float diagonally. Refer to the instructor notes. One block per group of students.
- _____ Part C: small bucket or plastic basin of water to float wood block (one per group of students)
- _____ Part C: paper towels to clean up spills

ACTIVITY 1.5: Summarizing Data and Imagining Crustbergs

Floating on the Mantle

- _____ large (500 mL) graduated cylinders (one per group of students)
- _____ pieces of basalt and granite that will fit into the large graduated cylinders (one piece of each per group of students)
- _____ gram balance
- _____ washed bottle filled with water or dropper (one per group)
- _____ paper towels to clean up spills

ACTIVITY 1.6: Unit Conversions, Notation, Rates, and Interpretations of Data

- _____ large (500 mL) graduated cylinders (one per group of students)
- _____ pieces of basalt and granite that will fit into the large graduated cylinders (one piece of each per group of students)
- _____ gram balance
- _____ washed bottle filled with water or dropper (one per group)
- _____ paper towels to clean up spills

ACTIVITY 1.7: Scaling, Density, and Earth's Deep Interior

While a drafting compass is listed as a student-supplied material, extra compasses should be available for students who do not have one or who arrive with the kind of magnetic compass used to find directions.

INSTRUCTOR NOTES

1. In Activity 1.1, students need access to Google Earth and the Internet. If this is not available in the lab room, perhaps you can assign this activity as homework. Using Google Earth to explore our planet is a very enjoyable pastime. Finding places from coordinates and finding the coordinates of places are important skills that broaden our