Lesson Title: Forming a Conclusion – Data Analysis & Graphs

Lesson Author: Matthew Gudenius (mgudenius@calistoga.k12.ca.us)

Grade Level: 5th grade Subject Area: Science

Time Allotted for the Lesson: *Express in number of class meetings and/or number of hours.*

2 hours

Short Description of Lesson: *Write a brief, yet concise, description of what occurs in this lesson (50 words).*

In this lesson, students will learn how to visually plot and represent quantitative data using charts and graphs. Students will also analyze charts and graphs to note relationships and draw conclusions.

Classroom Layout and Grouping of Students: *Where will learning take place? How will the room be organized? How will students be grouped? (whole group, individuals, pairs, small groups, etc).*

Whole group instruction; individuals or pairs

State Curriculum Standards met in this lesson: *Go to the state curriculum standards at* http://www.isbe.net/ils/Default.htm *(use state standards where you are in preparation) and select the grade content/level appropriate standards that are being met in this lesson. Copy and paste below:*

Science Content Standards for California Public Schools – Investigation and Experimentation (5th Grade)

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:

g. Record data by using appropriate graphic representations (including charts, graphs, and labeled diagrams) and make inferences based on those data.

h. Draw conclusions from scientific evidence and indicate whether further information is needed to support a specific conclusion.

i. Write a report of an investigation that includes conducting tests, collecting data or examining evidence, and drawing conclusions.

National Education Technology Standards for Students (NETS•S) met in this lesson: *Go to the* http://cnets.iste.org/index.html *and select NETS•S 2007 grade level profile (K-2, 3-5, 6-8, 9-12) the appropriate indicator(s) and standard) that are being met in this lesson. Copy and paste below.*

Research and Information Fluency

Students apply digital tools to gather, evaluate, and use information. Students:

a. plan strategies to guide inquiry.
b. locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.

Communication and Collaboration

Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:

a. interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.
b. communicate information and ideas effectively to multiple audiences using a variety of media and formats.

Technology Operations and Concepts

Students demonstrate a sound understanding of technology concepts, systems, and operations. Students:

a. understand and use technology systems.
b. select and use applications effectively and productively.

Instructional Objective(s): *Each instructional objective [learning outcome] for this lesson should identify the A, B, C and D – Audience, Behavior, Condition, and Degree. (Activities are NOT learning outcomes).*

1. Students will successfully transfer a data table from paper to spreadsheet software
2. Students will successfully create a line, bar, or scatter plot graph including title, axis labels, and accurately-plotted data points.
3. Students will select the most appropriate type of chart/graph from 5 given data sets with 80% accuracy.
4. Students will draw conclusions from 5 different data charts with 80% accuracy.

Materials, Resources and Technology:

List all materials (textbook, other books, maps, crayons, research guides) technology resources (computers, printer, scanner, internet connection, cameras, etc) and web addresses that are needed for this lesson. If you are using copyrighted materials, you must include title, author, date, city and publisher.

Materials and resources needed for this lesson

1. Lab log book (or copied data) for each member of each lab group
2. Procedural visual aid (tutorial) for graphing data using spreadsheet software
3. Conceptual visual aid for determining best chart type based on data
4. Tailor's tape measure (one for each pair of students)

Technology resources needed for this lesson

1. Computers with internet access
2. Spreadsheet/graphing software
3. Projector or other classroom display device

Web Addresses needed for this lesson:

Website name (e.g. Yahoo), followed by the site's complete web address (e.g. http://www.yahoo.com)

1. EducationCity.com (Day at the Museum activity): http://us.educationcity.com/start/
2. Google Docs: http://docs.google.com
3. Scatterplot Graphing Your Body: http://www.teachervision.fen.com/tv/printables/TCR/1557342350_44.pdf
4. Charts and Graphs activity (for additional practice): http://fc.portage.k12.wi.us/~caulumj/lesson1.html
5. NCES Create A Graph (extension activity): http://nces.ed.gov/nceskids/createagraph/default.aspx
6. Bar Graphs, Line Graphs, and Scatter Plots: http://edtech2.boisestate.edu/gudeniusm/506/concept/graphs_intro.html
7. Google Docs Graph Tutorial (printable or interactive): http://edtech2.boisestate.edu/gudeniusm/506/procedures/procedures_1.htm

Student's Present level of Performance and Knowledge: *Do the students have the adequate knowledge to complete the lesson successfully? What pre-requisite skills must the students have to complete the lesson content? Include technology skills.*

Students must be able to use basic computer operation procedures – mouse, keyboard, web browser navigation.

Instructional Procedures

Lesson Set:

How will you open the lesson to motivate the students? How will you relate this lesson to previous learning & to real life experiences, to explain the importance of the learning to the students? (requires student involvement)

To get students interested in looking at data, the value of visually representing data, and the importance of carefully selecting and analyzing charts and graphs, students will use the "Day at the Museum" activity on EducationCity.com (this can be done individually, as paired partners, or as a whole-class activity depending on computer availability.)

Techniques and Activities:

*List the step-by-step activities in sequential order as they occur in the lesson. They clearly identify what is to take place in the lesson. Within the procedures a variety of classroom **teaching strategies (methods)** are identified. **Student centered activities** are included as well as **guided practice** of the learning is included.*

1. After the introduction, show students the data you gathered together as part of the previous experiment. What does the data show? Is it easy to tell from looking at one collection of numbers that there is a clear relationship between liquid type and evaporation amount?
2. Show that sometimes the best way to understand a relationship with numbers is to use a chart or graph to visually show the relationship between the numbers. Use the *conceptual visual* graphic to show different types of charts and graphs and how they can visually represent a relationship between numbers.
3. Based on this visual, have students take a silent poll (thumbs up/down) for each chart type to indicate whether they think it would be an appropriate choice of chart for the evaporation experiment (bar graph would be okay, but the best choice is probably line graph due to multiple measurements being taken over time. A 2D scatter plot would only work well if the measurement was taken from multiple samples at the same time. A pie chart would not be appropriate at all for this scenario.)
4. Using a document camera to show your logbook entries and the *procedural visual* tutorial, demonstrate how you would set up your data on a Google Docs spreadsheet (or use Microsoft Word or OpenOffice as an alternative.) In this case, your graph would show "amount of liquid over time" for each type of liquid. Prompt students to think-pair-share discuss the following questions: Does this actually show what we are trying to show? Why or why not? If not, how could we show what we want to show?
5. The graph does not, in fact, show *exactly* what we want to know. What we are looking for is "how much evaporation occurred", but all we have graphed is how much liquid is in the cup at different points in time. How do we change it to show how much liquid has evaporated? We must use *math* to derive our answers. Since evaporation is the amount of liquid that converted to gas and escaped the container, we can determine the evaporated amount by taking the original amount and subtracting however much is left: Voriginal – Vremaining = Vevaporated. Redo the spreadsheet using these new pieces of data and show how the chart changes.
6. The final step is to *draw conclusions* (if possible) from the data. Does the chart show a pattern? Do some lines change while others stay the same? What would this mean? (some liquids evaporated and others didn't) Are some lines steeper than others? (faster evaporation) Are they all the same? (liquid type must not affect evaporation.) This step is one of the most difficult but can be supported with various resources included some math textbooks as well as online activities such as: http://fc.portage.k12.wi.us/~caulumj/lesson1.html

Lesson Closure:

How will the lesson come to a close? The content should be summarized and related to future lessons, and actively involve the students.

The closure will involve two activities. First, show that sometimes a lot of data/measurements can help to show a relationship, and we can do this using a scatter plot. Use the "Scatterplot Graphing Your Body" activity sheet to have students work in pairs to measure their partners and enter the height and head circumference in a shared Google Spreadsheet. Second, use the "graph purpose" quiz and "data conclusions" quiz to test student

Adaptations for Special Learners: *How will you adapt the learning/equipment for students with special needs?*

Students may work alone or in pairs for this assignment. If working as a pair at the computer, both students should be from the same lab group (thus using the same data.) This will allow students with physical or cognitive disabilities to get help from their partners. In addition, the procedure graphic will be provided as a visual aid which will support ELL students and low readers.

Supplemental Activities - Extension and Remediation: *Extensions are additional activities to expand learning on the lesson content. Remediation activities include methods to re-teach the learning for students who need more instruction/practice.*

- Remediation can be made available on student time by providing them with the visual procedural tutorial and computer access. If students seem to be having a lot of difficulty with analyzing charts and graphs, use EducationCity.com and/or the Charts and Graphs WebQuest resource listed at the top of this lesson for more practice analyzing visual representations of data.
- Extension Activity: Go to the NCES Create-a-Graph activities. View examples and then practice making some different graphs!

Assessment/Evaluation: *How will you measure the student's success? Formally or informally? Formal evaluation of student work requires that a grade is taken while informal might be monitoring of work, or class discussion. This section should contain a description of the assessment process, the criteria for achievement, and performance levels. The criteria should directly align to objectives and instruction. Describe your plan for providing feedback to your students.*

- Silent poll (informal formative assessment of student understanding of graph purposes)
- Spreadsheet data table and line graph for class experiment (formal assessment using rubric)
- Identifying appropriate graph/chart (formal assessment quiz)
- Drawing conclusions from data visualizations (formal assessment quiz)
- Informal feedback on individual student experiment charts/graphs

Student Products: What artifact(s) or products will result from the lesson? (such as a report, newsletter, diagram, slideshow, drawing, etc.)

- Spreadsheet data table for class experiment
- Line graph for class experiment
- Data visualization as appropriate for individual student experiments

Adapted from PDF: *Preparing to Use Technology: A Practical Guide to Curriculum Integration (2007)*