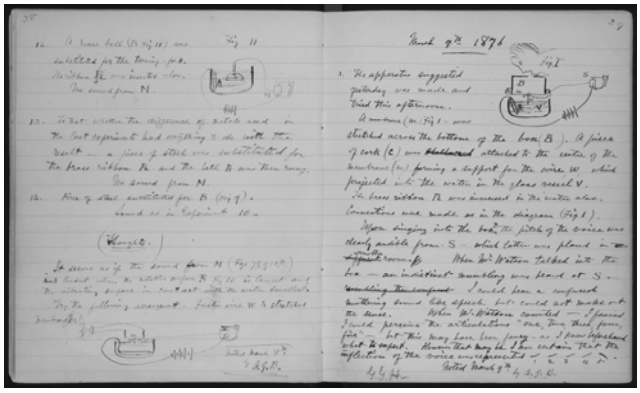
Winter 2011 Teaching with Primary Sources Quarterly
Learning Activity – Elementary Level

Exploring the Scientific Method: "Mr. Watson - Come Here – I want to see you."



Bell, Alexander Graham. *Notebook by Alexander Graham Bell, from 1875 to 1876*. Manuscript. From Library of Congress, *The Alexander Graham Bell Family Papers, 1862-1939*. http://memory.loc.gov/cgi-bin/ampage?collId=magbell&fileName=253/25300201/bellpage.db&recNum=20

OVERVIEW

Overview

Working in pairs or groups, students analyze key pages from the laboratory notebook of Alexander Graham Bell to discover the elements of the scientific method. Successful scientific investigation requires methodical, careful testing of hypotheses and recording the results.

Objectives

After completing this activity, students will be able to:

- identify the elements of the scientific method;
- analyze a manuscript; and,
- describe the scientific method using evidence from this manuscript.

Time Required

One 45-minute class period; activity extension idea requires additional class period.

Recommended Grade Range

4-5

Topic/s

Science/Scientists

Subject

Science

Standards

McREL 4th Edition Standards & Benchmarks
http://www.mcrel.org/compendium/browse.asp

OVERVIEW (CONT'D)

Science
Standard 12. Understands the nature of scientific inquiry
Level II (Grades 3-5)
1. Knows that scientific investigations involve asking and answering a question and comparing the answer to what scientists already know about the world
5. Knows that scientists' explanation about what happens in the world comes partly from what they observe (evidence), and partly from how they interpret (inference) their observations

Historical Understanding
Standard 1. Understands the historical perspective

Credits
Adapted from a lesson plan created by Lynn Dille, TC Williams High School, Alexandria City Public Schools, Virginia

PREPARATION

Materials
Have these materials ready before the activity.

-Print one copy per student of set 1 (see attachment), which includes the first page of the manuscript excerpt cited below and the page transcription:

> Bell, A. G. *Notebook by Alexander Graham Bell, from 1875 to 1876*. Manuscript. From Library of Congress, *The Alexander Graham Bell Family Papers, 1862-1939*. http://memory.loc.gov/cgi-bin/ampage?collId=magbell&fileName=253/25300201/bellpage.db&recNum=20

-Print enough pages from set 2 so that each student will have one manuscript page and the corresponding page transcript

-Print two copies per student of the Library of Congress Primary Source Analysis Tool: http://www.loc.gov/teachers/usingprimarysources/guides.html

-(Optional) Prepare to display the Library of Congress Primary Source Analysis Tool to complete together as a class (note: the online version can be completed online and saved or printed)

-Print one copy for teacher's use of the Teacher's Guide to Analyzing Manuscripts: http://www.loc.gov/teachers/usingprimarysources/guides.html

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PROCEDURE

1. Introduce the activity to the students by leading a "Think, pair, share" response to the prompt:

   What modern scientific invention for communication—for example, the telephone, the computer—has the greatest impact on your daily life? Why?

2. Explain that all of these inventions owe their existence to the application of the scientific method, and in this activity students will investigate the major elements of that method. They will analyze key pages from the journal of a famous scientist to discover the process that led, more than 100 years ago, to the invention of a communication device still in use today.

3. Post the following where students can see them and read aloud to the class:

   Understanding Goal: Successful scientific investigation requires methodical, careful testing of hypotheses and recording the results.

   Investigative Question: What are the necessary elements of successful scientific investigation?

4. Distribute one copy per student of the following: the first page from the journal excerpt, its transcription and the Primary Source Analysis Tool. If possible, display the Primary Source Analysis Tool and complete it as a class as students analyze the manuscript.

5. Begin by guiding the entire class in observing details about the page using questions selected from the Library of Congress Teacher's Guide to Analyzing Manuscripts.
   Possible questions include:
   - What do you notice first? Describe what you see.
   - How much of the text can you read? What does it say? Circle any unfamiliar words.
   - What do you see on the page besides writing?

6. Continue guiding students' analysis of the journal page as they reflect on their observations. Encourage them to make inferences based on their observations. Possible questions to use from the Teacher's Guide include:
   - Who do you think created this manuscript?
   - Why do you think this manuscript was made?
   - Who do you think was intended to read it, if anyone?

7. As students observe and reflect on the page, encourage them to ask questions to lead to more observations and inferences. Possible question prompts include:
   - What do you wonder about…Who? What? Where? When? Why? How?

8. Explain that students will now work in assigned pairs or in groups to examine three additional pages from this same manuscript (one page per pair or group). Distribute the remaining three journal pages along with the accompanying transcriptions among the class.

PROCEDURE (CONT'D)

9. Distribute additional copies of the Primary Sources Analysis Tool and instruct students to record their observations, inferences and questions about their new page on this sheet. Remind students to circle any unfamiliar vocabulary on the manuscript page or transcription.

10. After students have independently analyzed their additional pages, invite pairs or groups to share their findings, page by page. Take notes on the board of overall trends in their observations, inferences and questions.

11. Lead a class discussion to identify patterns of the scientific method as evidenced by the scientist's journal and connect this evidence to the understanding goal.
    Possible questions to ask students to support with primary source-based evidence include:
    - Who is the scientist who wrote this journal?
    - Which important communication device does this scientist document the process of inventing in these journal pages?
    - Based on the process documented in these pages, what do you think are the elements of the scientific method? Describe them.

12. Review (or introduce) the elements of the scientific method, and conclude by identifying which of these elements were evidenced by the analyzed pages from Bell's notebook and which ones may have been in other pages of the notebook.

    Note: generally, the elements of the scientific method are as follows:
    - Define the question
    - Observe, i.e., gather data and resources
    - Form hypothesis
    - Perform experiment, collect data
    - Analyze data
    - Interpret data, draw conclusions that may lead to new hypothesis
    - Share results
    - Retest (typically done by other scientists)

ACTIVITY EXTENSION

Provide students with additional primary source documents (see examples below) to analyze for corroborating evidence relating to the elements of the scientific method. Have students work in pairs or groups, assisting them as necessary.
Possible manuscripts include:

Wright, O. 1903. Diaries and Notebooks: 1903, Orville Wright (Image 26). Library of Congress: American Memory, The Wilbur and Orville Wright Papers at the Library of Congress. Available: http://memory.loc.gov/cgi-bin/ampage?collId=mwright&fileName=01/01007/mwright01007.db&recNum=25

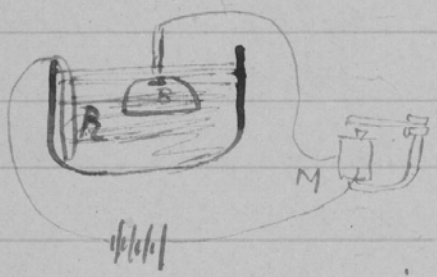
Berliner, E. 1884. [Note on battery experiment, 1884 Feb. 6]. Library of Congress: American Memory, Emile Berliner and the Birth of the Recording Industry. Available: http://memory.loc.gov/cgi-bin/ampage?collId=berl&fileName=09010107//berl09010107.db&recNum=0

EVALUATION

- Students' active participation in independent work, including written and verbal presentation of responses using the primary source document as evidence
- Students' active participation in class discussions

12. A brass bell (B Fig 11) was substituted for the tuning-fork. The ribbon R was inserted also. No sound from M.

Fig 11



13. To test whether the difference of metals used in the last experiment had anything to do with the result — a piece of steel was substituted for the brass ribbon R and the bell B was then rung.

No sound from M.

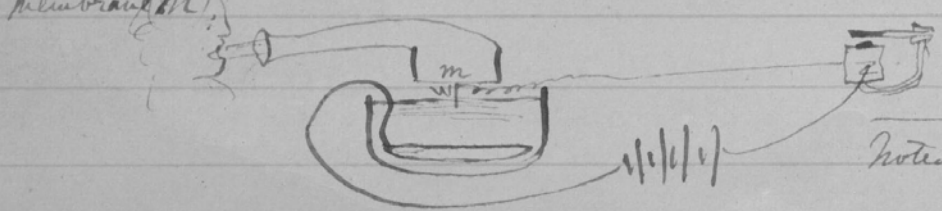
14. Piece of steel substituted for B (Fig 9).

Sound as in Experiment 10.

(Thoughts.)

It seems as if the sound from M (Fig 7, 8, 9, 10, 11,) is best loudest when the metallic surface B Fig 10 is largest and the vibrating surface in contact with the water smallest.

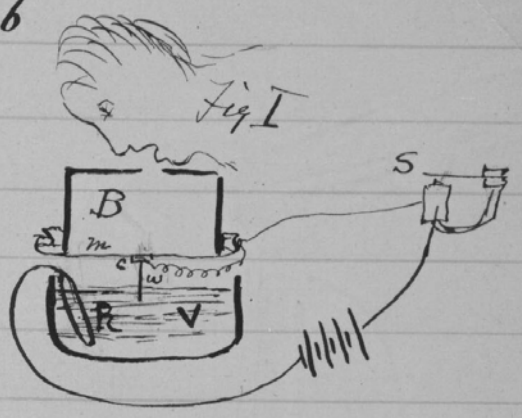
Try the following arrangement. Fasten wire W to stretched membrane R.



Noted March 8th
by A.G.B.

http://memory.loc.gov/cgi-bin/ampage?collId=magbell&fileName=253/25300201/bellpage.db&recNum=20

March 9th 1876



1. The apparatus suggested yesterday was made and tried this afternoon.

A membrane (m) Fig 1 – was stretched across the bottom of the box (B). A piece of cork (c) was ~~shellacked~~ attached to the centre of the membrane (m) forming a support for the wire w, which projected into the water in the glass vessel V.

The brass ribbon R was immersed in the water also. Connections were made as in the diagram (Fig 1).

Upon singing into the box B the pitch of the voice was clearly audible from – S – which latter was placed in ~~a~~ ~~different~~ another room. When Mr Watson talked into the box – an indistinct mumbling was heard at S. – ~~resembling the confused~~ I could hear a confused muttering sound like speech but could not make out the sense. When Mr Watson counted – I fancied I could perceive the articulations "one, two, three, four, five" – but this may have been fancy – as I knew beforehand what to expect. However that may be I am certain that the inflection of the voice was represented ⁄ ⁄ ⁄ ⁄ ⁀ .
1 2 3 4 5

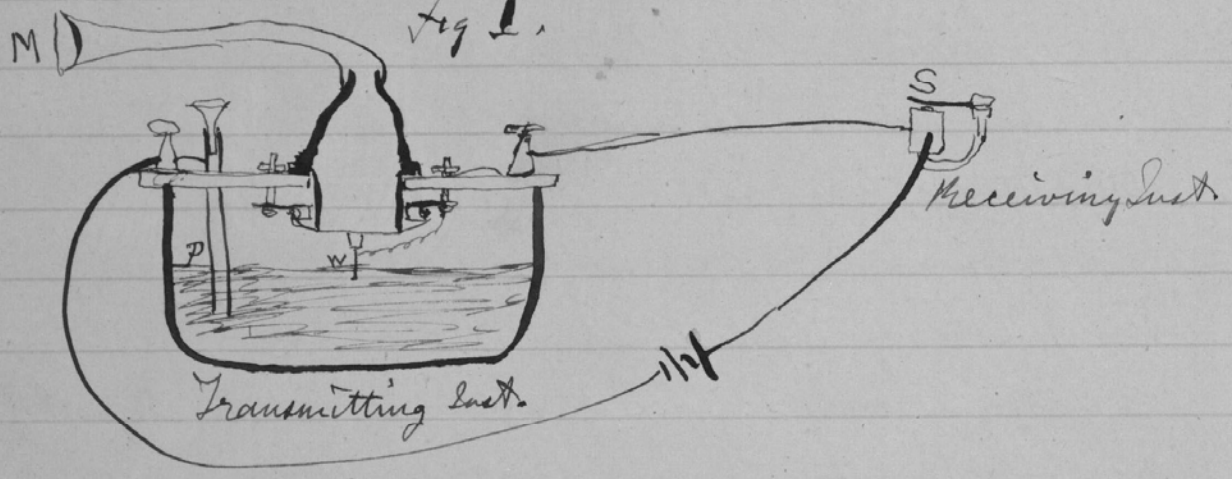
Noted March 9th by A. G. B.

G. G. H.

http://memory.loc.gov/cgi-bin/ampage?collId=magbell&fileName=253/25300201/bellpage.db&recNum=20

March 10th 1876

Fig I.



1. The improved instrument shown in Fig. I was constructed this morning and tried this evening.

P is a brass pipe and W the platinum wire M the mouth piece and S the armature of the Receiving Instrument.

Mr. Watson was stationed in one room with the Receiving Instrument. He pressed one ear closely against S and closed his other ear with his hand. The Transmitting Instrument was placed in another room and the doors of both rooms were closed.

I then shouted into M the following sentence: "Mr. Watson — Come here — I want to

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see you". To my delight he came and declared that he had heard and understood what I said. I asked him to repeat the words — ~~He said~~ He answered "You said 'Mr Watson — come here — I want to see you'." We then changed places and I listened at S while Mr Watson read a few passages from a book into the mouth piece M. It was certainly the case that articulate sounds proceeded from S. The effect was loud but indistinct and muffled. If I had read beforehand the passage given by Mr Watson I should have recognized every word. As it was I could not make out the sense — but an occasional word here and there was quite distinct. I made out "to" and "out" and "further"; and finally the sentence "Mr Bell Do you understand what I say? Do-You-understand-what-I-say" came quite clearly and intelligibly. No sound was audible when the armature S was removed.

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Transcription

38

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