



Investigating Students' Understanding of Light Bulbs and Complete Circuits



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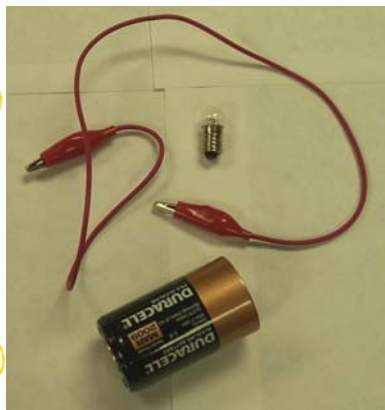


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These are two very common circuits activities. Students can often easily complete the two wire activity, but struggle with the one wire activity. Why?

One Wire Activity



Two Wire Activity





Interview Results

- Interviews conducted on student understanding of circuits and everyday objects.



- Student stated – I thought a light bulb was a circuit in and of itself.



- Further interviews conducted to look for similar and related beliefs.



Our Proposal

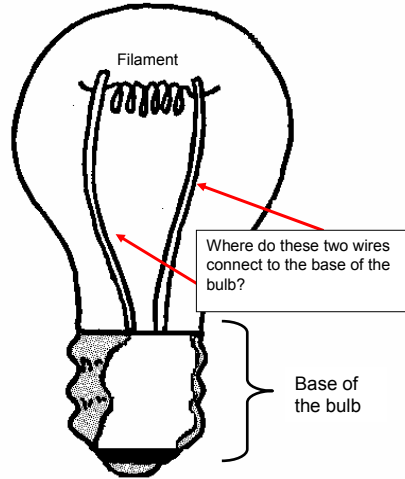
Student difficulties with the one wire activity are a sign of an unawareness of the wiring of a light bulb not a misunderstanding of complete circuits.





Survey

Draw how the two wires indicated connect to the base of the light bulb.



Survey Results



				N
Conceptual	27%	47%	20%	15
Algebra	25%	58%	9%	149
Calculus	72%	18%	5%	124
Total				288



Making Sense of Incandescence



- Approximately 2 hour activity

- Hands-on discovery based, learning cycle based

- Students work in groups



- Rotate between 3 stations

- Includes pre- and post-lab activities



Lab Students

- High School Students (N=13)

- Algebra based course
- Used to recipe-like labs
- 50 minute class period
- Did not complete all activities



- Algebra Based University Students (N=30)

- Used to recipe-like labs
- 2 hour lab period



- Conceptually Based University Students (N=10)

- Had used similar labs
- 2 hour class period



Pre-Lab: Bright Ideas

- Done in-class, individually
- Asks students to explain what they know about
 - Light bulbs
 - Complete circuits
- Fill in a light bulb wiring diagram (same as survey diagram)



Station 1: Getting Hot

- Equipment
 - Light bulb in socket with dimmer switch attached
 - Hot plate with visible heating coil
- Students are asked to hypothesize how a stove and a light bulb work
- Students then compare stove and bulb
- ★ Students learn about the number of connections on a light bulb and that a light bulb is not polarized





Station 2: That Glowing Feeling

- Asks students to problem solve 3 identical looking circuits when only 1 set up works
- Possible problems: blown bulb, bad battery, loose bulb, wire touching plastic not metal, battery connected backwards, tape blocking connection
- ★ Tests and expands students' definitions of complete circuits.



Station 3: Getting Connected

- Goal: Make a Christmas tree light bulb light using a 6 Volt battery and large household socket
- After learning how a socket works, perform the one or two wire activity without a socket
- ★ Explicitly confronts their hypotheses on the wiring of a light bulb





Station 3: Getting Connected

- Goal: Make a Christmas tree light bulb light using a 6 Volt battery and large household socket
- After learning how a socket works, perform the one or two wire activity without a socket
- Explicitly confronts their hypotheses on the wiring of a light bulb

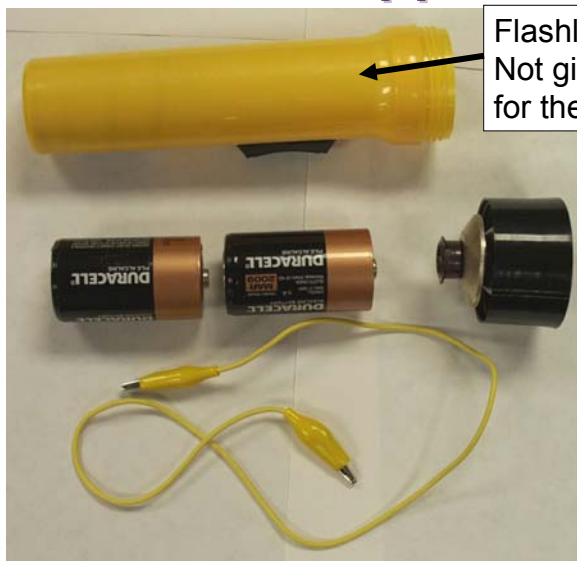


Post Lab: Lighting Up the Night

- Discuss internal wiring of bulb as a class
- Review each station, focusing on definitions of complete circuits
- Given a flashlight and a wire, construct a flashlight without using the plastic casing



Post Lab Apparatus



Flashlight casing -
Not given to students
for the activity.



Lab Results

- All students who completed all the activities ended with the correct model of light bulb



- Some students were not comfortable with the new type of labs



- Students appeared to be learning and having fun



Study Results

- University students quickly and correctly completed the flashlight activity – a modified version of the one wire activity.



- Students demonstrated a clear understanding of complete circuits during trouble shooting station (station 2).





Additional Information

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