Tareas calificadas por los compañeros: Foster students' inquiry skills

Revisar los trabajos de tus compañeros
¡Felicitaciones por enviar tu trabajo! Ahora tus compañeros pueden revisarlo. Para obtener tu calificación, también debes revisar los trabajos de algunos de tus compañeros. Tu calificación debería estar lista antes del **18 de feb. 2:59 -05**.

Revisar tareas

Instrucciones | Mi presentación | Discusiones

Transistors and Logic gates

Enviado el 14 de febrero de 2021

Enlace para compartir

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1. First describe the subject matter of the lab or learning activity.

There are two main concepts to learn with this activity, the first is related to electronics-physics, it is the Ohm law that describes the beheaviour of voltage, current and resistance in a circuit. The second is related to mathematics-computer science, it is the binary-boolean logic, given 2 inputs A and B we can define and implement several operations that are the foundation of computers operation. My field is computer science so i really like this activity because it combines elements from physics, computer science and engineering.

In this lab we use somo basic electronical devices:
- Led lights of 5V
- Resistors with different Ω values
- NPN transistors
- Red, green and black copper wires
- A white protoboard
- a charger of 5V or alternatively a 9V battery with an adapter.
- Integrated circuits chips

The idea of the lab would be teaching briefly the Ohm law and boolean logic, then demonstrate and explain the basic circuits (YES, NOT, AND, OR) and finally give students the challenge of building 2 more complex circuits NAND, NOR and XOR.

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2. Describe how you would include student inquiry in the aim of the lab or learning activity. What is the research question your students should be able to answer during the activity?

This lab would correspond to an structured inquiry, i would teach how to use the set of materials (basic electronical devices) and methods (measure voltage, resistance and current using a multimeter, make connections, calculate correct use of resistors to avoid damaging components, etc). The task of building a circuit that makes a given logical operation has several solutions, the simple desirable ones use the scientific concepts and require some reasoning about current flow.

Because we can measure all variables easily it would be possible to asign a predict-observe-explain task during the lab, for example draw and calculate variables in some sections of your circuits and then build it and measure the variables with a multimeter in the circuit.

Finally i would give every group a set of integrated circuits (small chips) with erased or sharpie covered labels (no way to read product information) and ask them to describe what does every chip do logically and physically.

I think the research questions would be
- What does a transistor and what properties of semiconductors does it use to operate?
- Which path does current follow when a circuit divides in several paths?
- How is the logical concept of True-False related or associated with the physic value of voltage?
- which types of devices generate specific effects on the circuit variables and how much?
- How can we implement logical operations using circuits?
- What probable causes (heat, irregular energy source, imperfection or properties in materials, etc) can be theorized as sources for differences between calculated and measured values of the variables?

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3. Describe your expectations of your students' achievements/learning outcomes at the end of the inquiry activity. How should students apply a method? use materials? and present their results to answer the research question you have raised?

How should students apply a method?
I would expect my students to prupose a logical model and then design and build a circuit that implements it, for that they'll need to know the beheaviour of electric flow and the effect some electric devices have on it. They should measure voltage and show with led lights that their design is functional.

use materials?

Students should choose and place electronical devices in a protoboard to obtain circuits that satisfy the asked functionality.

present their results to answer the research question you have raised?
I would ask a report on the lab. I would eexpect at least to see this 3 things.
- Visible examples of Ohm law quantitatively and qualitatively and some pruposed sources of calculated-measured variable value differences.
- Which devices, assumptions, conventions and methods can engineers use to make computing devices from electric circuits.
- Ideas on why and how does each component satisfies a task on altering physical variables.

I expect students to achieve this outcomes because we would have preparation from previous lectures and also guidance during the lab.

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4. Describe the way you plan to support your students in completing the task and developing the desired inquiry competencies during this activity.

As i said, the idea is demonstrate some examples of circuit design and building, and then ask them to create another with a given function. If i see or some group tells me they are having difficulties i would first ask them to describe what problem do they have and observe their circuit, then i would ask them how did they worked in design and build to see if i can note any misakes done in the theoretical part. If their design is correct i would tell them to check with a multimeter that electricity flow is flowing as expected in different parts of the circuit, so they could search for damaged components (resistors, transistors, etc) or damaged sections in the protoboard. If my students show further problems i would highlight the aspects they could have possibly misunderstood like the role of polarity vcc-ground, the correct use of resistors to protect components but still offer enough voltage for their operation, and the internal operation and correct use of the protoboard. Also if needed i could show that group again a new demostration on the needed skills (choose, calculate, measure, etc) without offering the solution.

Another important aspect is that because the task has several solutions i would try to talk with each group to check that they are using both logic and physics to obtain the most simple ideal solution and not a complex but lazy working solution. If any group is doing this hands on minds off i would explain again the concepts and ideas that they could use to improve their design.

So to summarize i would be constantly checking what each group is trying and i would be attentive to any difficulties my students could have.

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5. Student learning - How would you know if your inquiry based lesson will lead to an improved learning outcome for your students?

Before:
I think the learning would be successful because we make the scientific concepts of Ohm law and resistance, voltage and current visible and relevant. We also highlight the combination of physics theory to computer science logic to show practical uses in computation engineering when we build circuits to do simple boolean tasks.

To be honest this lab is a lot more significative for students if they make mistakes, because then they should apply complete theory to understand what to adjust. Also as i said before i think inquiry can be created by asking ideas on the properties of materials and the sources of error in measured-calculated values.

After:
I would ask them for a report or a manual to verify that students have correctly learned both the concepts and skills related to this activity. Also on the next lecture i would ask some random students what they understood and how does they think the lab experience relates with the next topics.

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6. Reflection - How is the teaching you have described in this assignment different from how you usually teach or how you were taught as a student?

When i was a student we had to do a similar lab for a subject called "computer elements". The lab was done on second week, it is an introductory but still cool asignment to the subject.

Anyway i did not like that my proffessor did most of the teaching in previous lectures and we did not learned much with the lab. In lectures we studied boolean logic and physics Ohm law but for the lab we were poorly guided on how to apply these concepts. The proffessor just drawed two circuits and asked for us to build them. Because she had already given as the draw design, building the circuits was easy and if we had any issue we could just begin changing components (guess a resistor, led light, transistor was not working and change it). She also taught us on how to use a multimeter but we were asked to use it just to check that led lights were receiving 5V (in my pruposed lab we use it to verify electric flow through the circuit to better understand flow beheaviour).

So the problem i had when i was taught is that it was not a good scientific experience. It was a problem solution task wihout enough tools for learning the hows and whats of the activity.

The pruposed plan i show highlights both the science and engineering aspects of the lab and we combine demonstration to structured inquiry to help students learn and develop an understading of the related skills and concepts.

Editar envío

Comentarios

Comentarios

Solo el estudiante puede ver comentarios que se dejan para ese estudiante y la persona que dejó el comentario.

JS

Comparte tus ideas...