



Lesson Plan Template

Author's Name: Matt Souza

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| Title: Designing a Keychain Flashlight Enclosure | | |
| Content Area: Mathematics & Industrial Technology | Grade: 10-12 | Duration: 2-3 class periods |
| Career Technical Industry Sector: | X | Engineering and Design Industry Sector |
| Standards and Benchmarks: | <p>Grades Eight Through Twelve - Mathematics Content Standards</p> <ul style="list-style-type: none"> • Geometry 8.0 Students know, derive, and solve problems involving the perimeter, circumference, area, volume, lateral area, and surface area of common geometric figures. • Geometry 16.0 Students perform basic constructions, such as angle bisectors, perpendicular bisectors, and the line parallel to a given line through a point off the line. • <p>Engineering Design Pathway Standards:</p> <ul style="list-style-type: none"> • C4.1 Understand the commands and concepts necessary for producing drawings through traditional or computer-aided means. • C4.4 Use the concepts of geometric construction in the development of design drawings. • C5.1 Understand the commands and concepts necessary for editing engineering drawings. • C5.2 Know the various object-altering techniques. • C5.3 Know the CADD components and the operational functions of CADD systems. • C5.4 Apply two-dimensional and three-dimensional CADD operations in creating working and pictorial drawings, notes, and notations. • <p>SCANS Competencies:</p> <ul style="list-style-type: none"> • C5 Acquires and evaluates information. • C6 Organizes and maintains information. • C7 Interprets and communicates information. • C8 Uses computers to process information. • F1 Reading: Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules. • F3 Arithmetic: Performs basic computations; uses basic numerical concepts such as whole numbers, etc. • F4 Mathematics: Approaches practical problems by choosing appropriately from a variety of mathematical techniques. | |



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| | <ul style="list-style-type: none"> F10 Seeing Things in the Mind’s Eye: Organizes and processes symbols, pictures, graphs, objects and other information. |
| Objectives: | <p>Using the four flashlight parts drawn in the previous lesson, the student will:</p> <ul style="list-style-type: none"> Place the parts on a circuit board as an assembly drawing. Design an enclosure for the parts which allow them to function as a working flashlight. |
| Resources and Materials: | <ul style="list-style-type: none"> Sample parts; i.e. – push button switch, battery, LED Measuring devices; i.e. – vernier calipers, micrometers, standard ruler Sample circuit board for part placement Examples of existing keychain flashlights Samples of ergonomic design Internet access – research ideas for flashlight enclosure |
| Differentiation: | <p>Higher level students: Draw matching halves of flashlight enclosure; save drawing and have it “printed” on a rapid-prototyping machine.</p> <p>Lower level students: Draw lower half of flashlight enclosure. (May work with higher level student in a peer teaching mode to develop matching top half.)</p> |
| <p>Preparing Students for the Lesson:</p> <ul style="list-style-type: none"> Transitions Expected Behaviors | <p>Transitions:</p> <p>Review simple circuit and polarity of LED’s. Show some examples of how other flashlight enclosures have been designed. Demonstrate how parts may look soldered to a printed circuit board. Discuss need for access to push button on switch. Discuss ergonomics – How do you want the flashlight to feel?</p> <p>Expected Behaviors:</p> <p>Use the tools and other resources appropriately. It is alright to help a peer solve a drawing problem, but not to do the drawing for them. Respect each other’s need for parts and tool, sharing appropriately when necessary.</p> |
| <p>Teaching the Lesson (Lesson Sequence/ Activities):</p> <ul style="list-style-type: none"> Motivation/ Anticipatory Set Pre-Assessment/ Activating | <p>Motivation / Anticipatory Set:</p> <p>During these past few days, you have drawn the necessary parts for a keychain flashlight. Now it’s time to put the parts together on a printed circuit board, get them working, and create an enclosure that you and all of your friends would be proud to show off!</p> <p>Pre-Assessment / Activating Background Knowledge:</p> <p>Review construction of a part from geometric shapes. Discuss tolerances and the combining of multiple parts into a final assembly.</p> <p>Teacher Input, Modeling, & Checking for Understanding</p> <ul style="list-style-type: none"> Demonstrate on an electronic breadboard how the parts work together to create a flashlight. |



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| <p>Background</p> <p>Knowledge</p> <ul style="list-style-type: none"> • Teacher Input, Modeling, & Checking for Understanding • Guided Practice • Closure | <ul style="list-style-type: none"> • Show how this circuit can be reduced in size using a printed circuit board. • Show samples of flashlight parts mounted on PC boards in different configurations. • Discuss pros & cons of different configurations. • Discus possible ergonomic designs – What would look and / or feel good? • <p>Guided Practice</p> <p><i>To Draw the Assembled Circuit Board:</i></p> <ol style="list-style-type: none"> 1. Open Solid Works 2. Select “Create an ASSEMBLY” 3. Set-up the drawing to use inches as the default measurement. 4. Create a flat surface for a PC board as per the drawing and dimensions on the front white board. 5. Import your four flashlight parts onto this drawing. 6. Place the parts in a configuration which will allow the circuit to function properly. <p>Independent Practice</p> <p>Now that you have your parts located on your circuit board, you are ready to design an enclosure which will permit access to the push button portion of the switch. Remember, this enclosure needs to completely encase the flashlight circuitry, and permit access to the battery when it expires. (You will need to use a screw from the Solid Works toolbox to accomplish this!) Remember to constantly check for clearance between all of the flashlight parts and the enclosure. Last but not least, consider the look and feel (ergonomics) of your design</p> <p>Closure</p> <p>Now that you have completed designing an enclosure for your flashlight, you will be given the real parts and printed circuit board to assemble. Your enclosure design will be sent out to be printed on a 3-D printer – more commonly referred to as a Rapid Prototyping machine.</p> <p>Once the enclosure has returned, you will attempt to assemble the entire flashlight. Let’s hope that you have taken good measurements and drawn an accurate model for your enclosure!</p> |
| <p>Assessment:</p> | <p>Informal Assessment: During the lesson, the teacher will monitor student progress while circulating around the room and looking at computer monitors.</p> <p>Formal Assessment: Students will turn in (electronically) files for flashlight enclosure. Students will also turn in completed (rapid prototyped) flashlight with all internal circuitry. Drawings and flashlight will be assessed with the attached</p> |



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| | rubric. (Lesson 2 Rubric) |
| Notes & Reflections: | I know there will be considerable amendments to this lesson once I teach it to my classes in the fall of 2010. My hopes are that this will be a springboard of practical applications of drawings done by my students. |

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| Externship Sites: | Sierra Innotek, Cameron Park, CA 95682-9673 |
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