

## How Can We Design a House that is Simple, Decent, Affordable, and Green?

Unit Overview	This is an architectural design course in which students design floor plans, elevation plans, and site plan and construct a model. The specific task is to design a house that would be “suitable” as a Habitat for Humanity house. The design needs to be simple, decent, affordable, and green. Within the unit, there are multiple lessons to teach the learning objectives. The unit culminates with students presenting their designs to a panel of experts from Habitat for Humanity and architecture and construction fields.
Standards Addressed	<p>Maine State Learning Results</p> <p>Mathematics: F. Measurement: 1. Use measurement tools and units appropriately and recognize limitations in the precision of the measurement tools. 2. Derive and use formulas for area.</p> <p>Science: M. Implications of Science and Technology: 4. Analyze the impacts of various scientific and technological developments.</p> <p>Visual Arts: A. Creative Expression: 4. Create original works using different media, techniques, and processes to communicate ideas.</p> <p>English Language: G. Stylistic and Rhetorical Aspects of Writing and Speaking: 9. Deliver oral presentations that reliably support and provide details for the explicitly stated generalizations.</p>
Learning Objectives	<p>Students will:</p> <p>Analyze data of income and housing costs in Portland, Maine</p> <p>Design a house that uses space efficiently</p> <p>Calculate square footage of rooms and house</p> <p>Design a house that utilizes passive solar to help with heating and cooling</p> <p>Design a house the utilizes qualifications for LEED (Leadership in Environmental and Energy Development) certification</p> <p>Apply basic strategies that reduce the cost in construction</p> <p>Adhere to the <i>Architectural Graphic Standards</i></p>
Teacher Preparation Time	20 minutes per lesson
Class Time	The entire unit takes approximately 12 weeks of 75 minute blocks. A significant amount of time is provided to students to draw.
Materials Needed	<p>Computer-Aided-Design software OR traditional drafting tools consisting of T-square, triangles, scales, paper, and pencil</p> <p>graph paper</p> <p>large paper approximately 17” x 22”</p> <p>markers</p> <p>Text: <i>Architecture: Residential Drawing and Design</i> by Clois Kicklighter</p> <p><i>The Solar House</i> by Daniel D. Chiras ISBN 1-931498-12-1</p>
Activity Sheets	Minimum and Average Room Sizes

Plans of houses already constructed by Habitat for Humanity  
Note-taking Sheets on Room Planning, Chapters 5, 6, 7 of textbook

Procedure  
for Pre-Planning  
and Drawing the  
Floor Plan

1. Square Footage of Houses: Instruct students to measure the length and width of the house in which they live and to calculate square footage. The objective is to help students to understand “size”. Most people do not know if a 24' x 36' house is small, medium, or large.
  - a. Instruct students to share their dimensions and square footage; to categorize them as small, medium, or large; and to create a range of square footage for each category
  - b. Compare sizes of above categories with average size of a Habitat for Humanity home
  - c. Compare dimensions and square footage with spaces that students already know such as the classroom, a football field, or a 2 car garage, floor tile
2. Room Sizes: Instruct students to measure the length and width of each room in the house in which they live and to record on Minimum and Average Room Sizes activity sheet. Discuss how their rooms compare with minimum and average.
3. Layout of Rooms: Class discussion of layout of rooms.
  - a. What rooms should be located near each other? What rooms should not be located near each other?
  - b. Discuss quiet and noisy spaces.
  - c. Discuss ways to save money by locating plumbing in same vicinity to reduce amount of materials and labor.
  - d. Discuss doors that may conflict or block walking path when opened.
  - e. Discuss human habits such as dropping book bag, and briefcase near the entrance when you return home from school or work. How can this area be designed to accommodate this human behavior?
  - f. Assign students to sketch and analyze the floor plan of the house in which they live.
4. Room Planning: Use jigsaw method of instruction to have students read and teach Room Planning chapters 5, 6, and 7 in the textbook.
5. Sketch: Tell students to begin sketching the floor plan. They may use graph paper. Prepare students that they will revise the floor plan many times before it meets the standards of design.
  - a. Tell students to draw their floor plan on large paper with large marker. The plan needs to be seen by the entire class.
6. Critiques: Each student will present their preliminary floor plan to the class. The class will critique them by 1) making a complement and 2) making a suggestion or asking a question. The teacher uses the critiques as “teachable moments” to reinforce design concepts learned in chapters 5, 6, and 7 in the textbook.
7. Arrange for guest speakers:

	<ul style="list-style-type: none"> <li>a. Person to describe Habitat for Humanity</li> <li>b. Habitat for Humanity site supervisor to discuss the requirements of a HFH home</li> <li>c. An owner of a Habitat for Humanity home to discuss the power of owning a home</li> </ul> <p>8. Provide additional design parameters such as</p> <ul style="list-style-type: none"> <li>a. Designing the length and width of the house in multiples of 4' to reduce waste of materials and labor by cutting sheet rock, plywood...</li> <li>b. Exterior walls are 6" thick and interior walls are 5"</li> </ul> <p>9. CAD: Demonstrate how to use the computer-aided-design software or traditional drafting tools. Demonstrate how to measure with the scale 1/4" = 1'.</p> <p>10. Time: Provide students time to draw their floor plans applying the previous information and the following information. Continue to provide teacher-to-student feedback as well as student-to-student feedback.</p> <p>11. Solar Principles: Assign each of the 14 passive solar principles to pairs of students. Students will study and teach the class. Students are then expected to incorporate the principles into the house designs. <i>The Solar House</i> by Chiras</p> <p>12. Teach students about stairs: different styles; advantages and disadvantages of each style; sizes; and how to draw</p> <p>13. Teach students about doors: different styles; advantages and disadvantages of each style; sizes; and how to draw</p> <p>14. Teach students about windows: different styles; advantages and disadvantages of each style; sizes; and how to draw</p> <p>15. Teach students how to label rooms, dimension, code the windows and doors, and title block.</p>
<p>Procedure for Drawing the Front and Side Elevation Plan</p>	
<p>Procedure for Constructing Model</p>	
<p>Procedure for Presenting Their Architectural Plans and Models to a Panel of Experts</p>	<ul style="list-style-type: none"> <li>1. Talking Points: <ul style="list-style-type: none"> <li>a. Students will review and reflect all that they have learned about house design, solar principles, and LEED criteria.</li> <li>b. Students will prepare a description of how their architectural plans meet each of the above criterion. These will be their "talking points".</li> </ul> </li> <li>2. Discuss what makes a good presentation and write a rubric. Include categories of</li> </ul>

	<ul style="list-style-type: none"> <li>a. visual examples</li> <li>b. oral clarity</li> <li>c. depth of knowledge – talking points</li> <li>d. professionalism – how to portray confidence</li> </ul> <p>3. Practice presenting to the class and receive feedback</p> <p>4. Final presentation can be accomplished in two ways.</p> <ul style="list-style-type: none"> <li>1) Students can set up stations around the room similar to a science fair. Experts can move from student to student and listen to the student's presentation.</li> <li>2) Student can present to the entire panel of experts at the same time.</li> </ul> <p>5. Experts will use the rubric to rate each student's plans and presentation and to offer feedback.</p>
Assessment	<p>Product Descriptor for floor plan</p> <p>Rubric for Presentation</p>
Resources	<p><i>Architecture: Residential Drawing and Design</i> by Clois Kicklighter</p> <p><i>Architectural Graphic Standards</i></p> <p><i>The Solar House</i> by Daniel D. Chipras</p> <p>Habitat for Humanity</p>