Dream House Design

Dream House Design is a project for **grades 5-12** in which students develop and communicate their ideas about themselves and the house of their dreams. The project intrigues students, draws on multiple intelligences, incorporates higher-level thinking skills and respects the ways in which children learn and create.

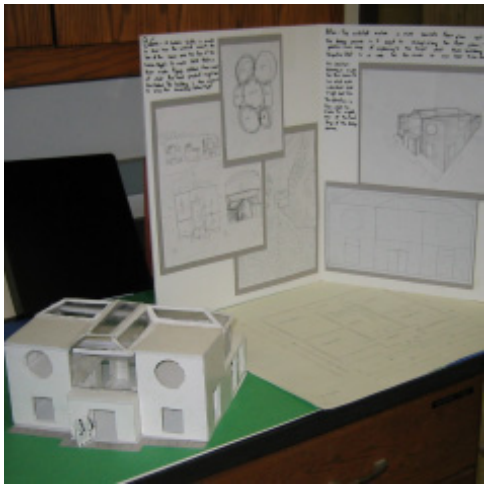
This project can run for **8-12 sessions, each 1.5 hours in length**. Estimate 1-2 sessions for architectural awareness activities and a walking tour; 3-5 sessions for planning and drafting; 2-4 sessions for model-building, and 1-2 sessions for creating presentation pieces, evaluating and presenting.

Dream Room Design is a simpler version of this process, in which students in **grades 3-8** design, draw plans for, and build a 3d scale model of a one-room personal space. It can be completed in **6 sessions, each 1.5 hours in length.**

Over the course of **six 1.5-hour sessions** the students work alongside professional architects and explore design as a career path. They also use many skills and concepts from the **MA Curriculum Frameworks**, including:

Mathematics: geometry; estimation and measurement; scale and proportion
Science & Technology/Engineering: the engineering design process; structure and materials; ecosystems, energy systems and sustainable design
Social Sciences: community as a reflection of its people

Visual Arts: materials, methods and techniques of schematic drawing, sketching and model-building; graphic design; drafting, revising and exhibiting; the elements and principles of design
English Language Arts: research and surveys; developing a vocabulary of architecture and design; composition, oral presentation.



Program Details + Learning Standards Alignments:

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In general the **Dream House Design** process goes like this:

Define the Design Problem:

Who, What, When, Where, Why and What Else?
Guided by their *Design Process Checklist*, and aided by hands-on activities, students develop and write out their "design programs," carefully-thought-out parameters that will inform each student's process of design.

Who and When: Students make ¼" = 1' scale figures to represent themselves. They write details about themselves and their dream houses (who will live here, and when… future occupations, families, hobbies, etc.) They are introduced to the concept of Universal Design: design for people of all ages and abilities.

Skill-building Activities with Scale: Students use *Scale Rulers,* math tiles, their scale figures, and kits of colored foam core pieces to gain a better understanding of scale spaces and square footage. Groups of four students use their bodies to demonstrate what 4' x 4' of real space looks like; and estimate how many 4' x 4' spaces it would take to cover a classroom.

Where: Students view sample *Site Plans* (which show landscape features in scale and in 2d plan view); then work as a group to build a 3-d scale site for a house model. They discuss how natural elements, topography, geography, climate and solar orientation affect a site. The students then write descriptions of their houses' location and site.

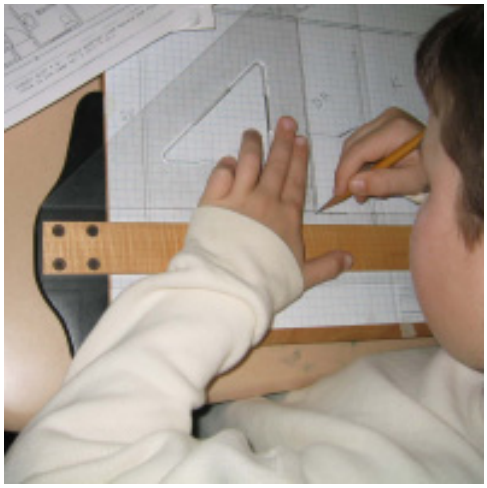
Drawing a Site Plan: **T**he students draw site plans for their houses. A site plan may include: main house, outbuildings, roadways and trees, lines indicating hills, water features and indication of solar orientation.

Why and What: The students each brainstorm a written list of verbs to complete the phrase *"In my house I need places and spaces to… [sleep, work, cook, store things, grow things….]"* and discusses his ideas with other students. Then, for each verb, the students write a word or two describing that room, area or space. They complete the phrase *"so I will design a*…. [*sleeping loft, studio, kitchen, closet, greenhouse…]"*

What Else: The students may also describe some less tangible design criteria for a house— for example, one may want a building to be beautiful, or welcoming, or filled with light; to fit into the context of the buildings or nature around it; or to convey a sense of uniqueness, identity or style.

Investigate the Design Problem

Architectural Walking Tour: The students observe, measure, draw, photograph and write about local houses. Drawing and writing in sketchbooks, they note design features they wish to incorporate into their own house design, and consider how different spaces feel. They come to see how natural, structural and geometric features, and the elements and principles of design work together in a building.



Architectural Awareness Activities: Students develop a common vocabulary of design as they *view and discuss slides of houses*. They identify elements and principles of design and natural, structural and geometric design features as they *trace a building façade.*

Working in teams, they act out structural principles, and then demonstrate these principles using common materials in the *Being a Structure* activity.

The students may also: survey people about their houses; collect magazine clippings; and learn more about houses from books, the internet, real estate ads, and so on.

Generate Ideas: brainstorm, list, sketch, diagram…. and Choose the Best Solution

Creating Bubble Sketches: Working from the information written on their *Design Process Checklists,* the students develop their ideas for floor plans on layers of trace paper. Ideas for spaces evolve over several drafts—from general, loosely-drawn shapes, to more specific designs. Not-so-good ideas are left behind and good ideas become more clearly defined. Considerations include size and shape of areas, circulation patterns and relationships of areas to adjacent rooms and to the outdoors.

Describe the Solution through a Prototype (drawing or model)
In these sessions the students communicate their design ideas. After being introduced to the tools and the processes involved, and practicing those skills, the students draw scale floor plans and elevation views, and build 3d scale models.

Floor Plans: Working from their site plans and bubble sketches, each student draws a scale floor plan:
- — using drafting tools to draw horizontal and vertical lines
- — drawing in ¼" = 1' scale and in plan view
- — using graph paper and scale rulers to measure spaces
- — representing walls, windows, doors using standard symbols
- — revising through several drafts.

Elevations: Students also learn how elevation views develop from a floor plan. They use scale to determine the height of a building's walls, windows and doors. They draw elevations of their house on ¼" graph paper. Come model-building time, they will use their elevation drawings to better visualize their building in 3d and to lay out their foam core model pieces.

Computer-aided-drafting: The Instructor demonstrates how designers use CAD software to draw floor plans, elevations and 3d views of houses. As a follow-up activity, students may use CAD software to design.

Building 3-d Scale Models: The students work from their site plan to build a 3-d site (on a cardboard base) for their model. Next, they lay out, cut, test-fit and glue their model pieces onto the base: exterior walls are completed first; interior walls may be built next, floor by floor, then porches and decks. Windows and doors can be neatly drawn on, carefully cut out, or cut and pasted from handouts. Then, students use geometry and measurement to determine roof pitch and shapes; test-fit roof pieces from paper; then cut and build their final roof planes.

As an additional activity, the students may translate the ideas drawn on their site plans into 3d landscape features. Landscapes may be crafted from common art materials; and built upon a cardboard base.

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Younger students may create models from boxes rather than build with foam core. They begin their planning by selecting one or more boxes [e.g. shoe boxes or gable style take-out boxes]; determining the square footage of each box in ¼" = 1' scale; and arranging the boxes to create a final shape for their house. Then they develop floor plans to fit those spaces; and insert copies of their floor plans into the box. Once their floor plans are complete the students return to working with their boxes, covering surfaces to represent siding and interiors, adding windows, doors, roofs, and so on.

Redesigning the Solution as needed: Mini-evaluations and group design meetings during the drawing and model-building phases help students to improve their designs.

Evaluate the Solution

Reviewing their work — from initial writing, to bubble sketches, to floor plan, to elevation, to model — the students consider the success of their designs. In writing, the students consider: "Does my design solution solve my design problem? How well does it solve my problem? Could the design be modified or improved?"

Present the Solution

Each student selects from their portfolio of writings, photographs, process drawings and final drawings to create a design presentation board — a graphic means of displaying design ideas. Media presentations may also be developed. After oral presentations are developed and practiced, students present their final projects

Additional Activities

Students may also:

— visit an architect's studio
— study the works of prominent architects
— draw perspective and/or interior views of their house models
— draw floor plans using CAD software
— write articles about their houses for "homes magazine;" or write real estate ads featuring their houses
— create video tours of their houses
— study their own house or apartment; draw a floor plan of those spaces; write a design review of those spaces
— calculate the area and the total cost per square foot of their model house
— work together to layout a floor plan, in full scale, on an outdoor space.

Dream Houses is a personal process of design for students. They use a multitude of math, spatial and design skills because they want to communicate their ideas down to the last detail. It is wonderful to listen in on students' conversations as they design, as they seriously debate the merit of enlarging a family room, or moving a wall, or reversing a staircase, all in the name of creating better spaces. As one teacher wrote: ""Students always say, "Why do we have to learn math?" or "I don't understand what this has to do with the real world!" My students need this — this makes math real."

Program Details + Learning Standards Alignments:

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Mathematics Standards

Number Sense and Operations

6.N.4 Demonstrate an understanding of *fractions* as a ratio of whole numbers…

6.N.9 Select and use operations to *solve problems* involving addition, subtraction, multiplication and division.

6.N.14 Accurately and efficiently add, subtract, multiply, and divide positive *fractions* and mixed numbers.

6.N.16 *Estimate* results of computations with whole numbers, and with positive fractions, mixed numbers, decimals, and percents. Describe reasonableness of estimates.

Geometry

6.G.1 Identify *polygons* based on their properties, including types of interior angles, perpendicular or parallel sides, and congruence of sides,…

6.G.2 Identify 3d shapes … based on their properties, such as edges and faces.

6.G.3 Identify relationships among *points, lines, and planes*, e.g., intersecting, parallel, perpendicular.

6.G.7 Identify types of *symmetry*, including line and rotational.

6.G.9 Match 3d *objects* and their 2d *representations*, e.g., nets, projections, and perspective drawings.

Measurement

6.M.1 Apply concepts of *perimeter and area* to the solution of problems. Apply formulas where appropriate.

6.M.2 Identify, measure, describe, classify, and construct various *angles, triangles, and quadrilaterals*.

6.M.3 Solve problems involving *proportional relationships* and units of measurement, e.g., same system unit conversions, *scale models*, maps, and speed.

8.N.3 Use ratios and proportions in the solution of problems involving… scale factors.

8.N.10 Estimate and compute with fractions, integers, decimals, and percents.

8.N.11 Determine when an estimate rather than an exact answer is appropriate and apply in problem situations.

8.N.12 Select and use appropriate operations—addition, subtraction, multiplication, division, and positive integer exponents—to solve problems with rational numbers.

8.M.1 Select, convert and use appropriate units of measurement or scale.

8.M.2 Given the formulas, convert from one system of measurement to another.

8.M.3 Demonstrate an understanding of the concepts and apply formulas and procedures for determining measures, including those of area and perimeter/circumference.

8.M.4 Use ratio and proportion (including scale factors) in the solution of problems.

8.P.4 Identify the slope of a line as a measure of its steepness and as a constant rate of change from its table of values, equation, or graph. Apply the concept of slope to the solution of problems.

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Science and Engineering Technology Standards

Engineering Design Gr 6-8; Gr 9-10

2.1 Identify and explain the steps of the engineering design process, i.e., identify the need or problem, research the problem, develop possible solutions, select the best possible solution(s), construct a prototype, test and evaluate, communicate the solution(s), and redesign.

2.2 Demonstrate methods of representing solutions to a design problem, e.g., sketches, orthographic projections, multiview drawings.

2.3 Describe and explain the purpose of a given prototype.

2.4 Identify appropriate materials, tools, machines to construct a prototype of a given engineering design.

2.5 Explain how such design features as size, shape, weight, function, and cost limitations would affect the construction of a given prototype.

1.1 Identify and explain the steps of the engineering design process [see 2.1 above].

1.2 Demonstrate knowledge of pictorial and multi-view drawings (e.g., orthographic projection, isometric, oblique, perspective) using proper techniques.

1.3 Demonstrate the use of drafting techniques with paper and pencil or computer-aided design systems.

1.4 Apply scale and proportion to drawings, e.g., ¼" = 1'0".

1.5 Interpret plans, diagrams, and working drawings in the construction of a prototype.

Communication Gr 6-8

3.1 Identify and explain the appropriate tools, machines, and electronic devices (drawing tools, computer-aided design, and cameras) used to produce and/or reproduce design solutions (engineering drawings, prototypes, and reports).

3.4 Identify and explain how graphic symbols and icons are used to communicate a message.

Construction Gr 6-8; Gr. 9-10

5.1 Explain how forces of tension, compression, torsion, bending, and shear affect the performance of bridges.

5.2 Describe and explain the effects of loads and structural shapes on bridges.

5.1 Distinguish among tension, compression, shear, torsion; explain how they relate to materials in structures.

5.4 Differentiate the factors that affect the design and building of structures, such as zoning laws, building codes, and professional standards.

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Visual Arts Standards

STANDARD 1 Methods, Materials, and Techniques: demonstrate knowledge of the methods, materials, and techniques unique to the visual arts.

STANDARD 2 Elements and Principles of Design: demonstrate knowledge of line, texture, shape, form, pattern, symmetry, space and composition [balance, repetition, rhythm, scale, proportion, unity, harmony, emphasis].

STANDARD 3 Observation, Abstraction, Invention, and Expression: demonstrate their powers of observation, abstraction, invention, and expression…Create 2D and 3D artwork…

STANDARD 4 Drafting, Revising, and Exhibiting: demonstrate the processes of creating and exhibiting artwork: drafts, critique, self-assessment, refinement, and exhibit preparation; visualize concepts in clear schematic layouts**;**, assess and reflect on work orally and in writing, revise work based on criteria; maintain a portfolio of sketches and finished work; prepare artwork for exhibitions.

STANDARD 5 Critical Response: describe and analyze their own work and the work of others using appropriate visual arts vocabulary;

STANDARD 6 Purposes and Meanings in the Arts: describe the purposes for which works of architecture were and are created; interpret the meanings of artistic works; describe how artistic production can shape and be influenced by the aesthetic preferences of a society.

STANDARD 7 Roles of Artists in Communities: describe the roles of artists, patrons, cultural and arts institutions in societies past and present.

STANDARD 8 Concepts of Style, Stylistic Influence, and Stylistic Change: demonstrate understanding of styles, stylistic influence, and stylistic change; identifying when and where art works were created; analyzing characteristic features of art works from various historical periods, cultures, and genres.

STANDARD 9 Inventions, Technologies and the Arts: describe, analyze how artists use and have used materials, inventions, and technologies; describe how artists use computer technology in their work.

STANDARD 10 Interdisciplinary Connections: apply knowledge of the arts to the study of other disciplines; apply knowledge of other disciplines in learning in and about the arts.

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English Language Arts Standards

Standard 1: Discussion
Standard 2: Questioning, Listening, and Contributing: gather relevant information for a research project or composition through interviews.
Standard 3: Oral Presentation
Standard 4: Vocabulary and Concept Development

Standard 9: Making Connections: relate a literary work to information about its setting.

Standard 19: Writing
Standard 20: Considering Audience and Purpose
Standard 21: Revising
Standard 22: Standard English Conventions
Standard 23: Organizing Ideas in Writing
Standard 24: Research
Standard 25: Evaluating Writing and Presentations

Standard 27: Media Production