Left: A floor-plan drawing. Right: Geometry students work together to cut foam board.

Learning by Design

Erika Zekos

Learning by Design is a K–12 education program supported by the Boston Society of Architects in Boston, Massachusetts. We work with students in schools across the state on a wide variety of architecture and design-related workshops. Whether it's rethinking a schoolyard layout, designing dream houses, or building a city crafted entirely from recyclable materials, every student in a Learning by Design program has the opportunity to experience design through hands-on and collaborative activities.

The Design Process

The design process, as found in the Massachusetts Science and Technology/Engineering curriculum frameworks, is a process familiar to anyone who has designed anything from a curriculum to an oil painting. The design process can be the scaffolding for student process regardless of the type of project.

One recent program at Holyoke High School in Holyoke, Massachusetts, involved eighty tenth- and eleventh-grade geometry students. I met with each of the six classes for six one-hour periods. As they designed personal learning spaces, they imagined small, enclosed spaces where they would have the perfect conditions for solo studying and relaxing. The classroom teachers and I made sure to focus on the mathematical aspects of architectural design, such as scaled transformations, floor area, and volume.
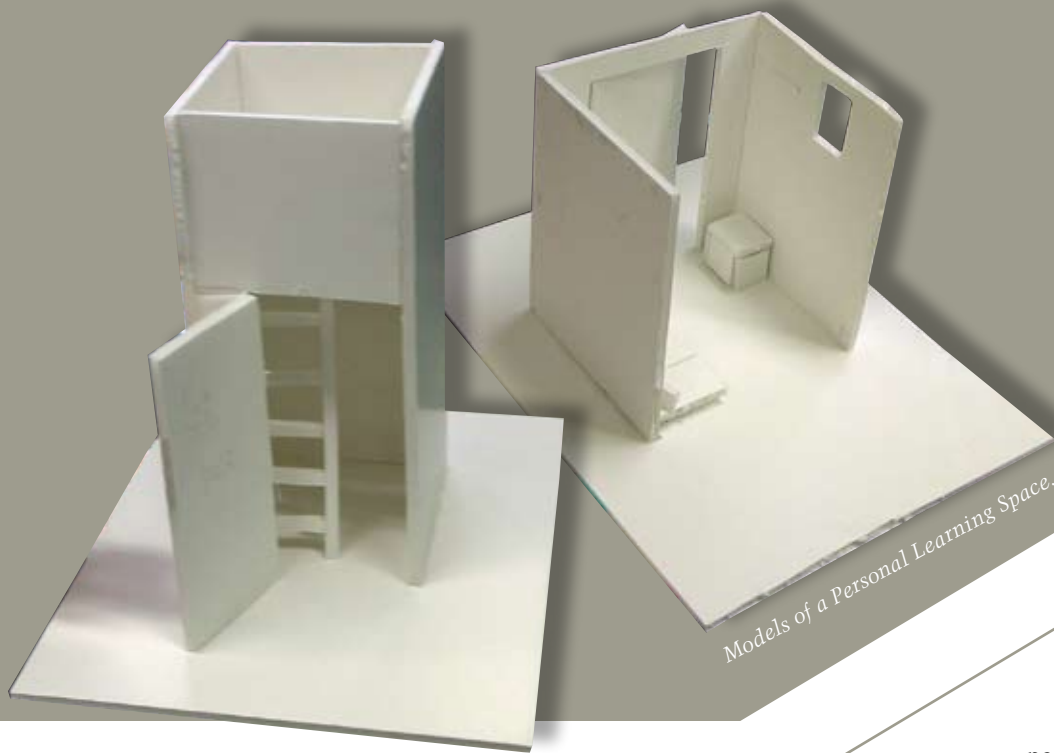
Define the Design Problem

We began by defining the design problem through a series of questions:
1. Who will use the space?
2. What does this space need to provide?
3. When will it be used?
4. Where is the site?
5. Why is a space for learning important?
6. What else should we consider?

Investigating

We started to develop familiarity with architectural language and skills while students began to consider the qualities that their own design would take on. Skill-building activities included learning to think and draw "in scale." Students created scale figures from pipe cleaners to stand in as themselves for the project. Using graph paper, triangles, and scale rulers, students practiced converting "real-life" space to the size of their drawings and models.

Students' research included viewing and discussing slides of different types of learning places (such as schools, storytelling areas, libraries, theaters, homework desks, etc.). They also conducted a survey of other students to ask about how the type of space they work in affects their learning. For homework, students did site analysis by observing, drawing, and writing about the space where their own personal learning space would be located. They measured and drew

Models of a Personal Learning Space.

rough-scale floor plans, site plans, and/or sketch views.

Generate Ideas

By the third session, students were working in teams to brainstorm design ideas. These evolved over several drafts on layers of tracing paper —from general, loosely drawn shapes, to a final specific design. They were limited to a maximum floor area, so they needed to consider square footage as well as furniture, circulation patterns, and relationships of areas to adjacent rooms or the outdoors.

Describe the Solution

By the fifth session, students were ready to communicate their final designs. Working from their early ideas, they drew scaled floor plans and elevation views using drafting tools. They measured and drew spaces, and represented walls and openings such as windows and doors using standard architectural symbols. Teams also built scale models from common art materials (including foam board, corrugated cardboard, and craft supplies). They laid out, cut, test-fit, and glued their model pieces onto a base. Openings were neatly drawn on and carefully cut out, and scale furniture was made. Where roofs were needed, students used geometry and measurement to determine pitch and shapes.

Evaluate the Solution

Along the way, students considered the success of their designs relative to the goals they set out in the first step of the design process. From their initial research and writing to sketches, floor plans, elevations, and models they considered: "How well does my solution solve my design problem? Could the design be modified or improved?"

Present the Solution

In our last session, each student team selected from their portfolio of writings, process sketches, and final drawings to create a design presentation board. They gave oral presentations of their designs to their classmates, a guest architect, and to the school community. From dark and cozy to bright and open, each project reflected each students' own unique needs.

Holyoke High students (60% low-income students; 50% ESL students) have felt both the loss of arts curricula and the increased pressure from standardized testing. A design project within the context of a math class was a departure from the norm and the response from both teachers and students was fantastic. Architecture design programs make good teaching sense: They are flexible and can be incorporated into many different areas of study. They make good learning sense, too: Every student, regardless of learning style, gets to communicate his or her ideas about design. ☙

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