Yale-New Haven Teachers Institute®

Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
2006 Volume IV: Math in the Beauty and Realization of Architecture

Introduction

Architecture is a profession where the arts and sciences fuse together to create environments beneficial for human habitation. Earth's natural resources create the basis for people to discover what to use and how to use it for adaptation to create environments. Human senses readily assess the aesthetic and pragmatic processes for sorting out what to use, when, and how much is required to achieve the goal. The processes for designing and constructing objects, buildings, or environments challenge not rigid but broad inclusiveness of applied knowledge that inherently involves many varied applications of mathematics.

Beauty rises from the embrace of the visual delight, the perfection of function, and the efficiency of operation that captures a wholeness for the intended purpose. Many tools used in the process are vital to the success of developing the things and environments people use. As an example, the elegance of a great tree symbolizes nature's illustration of the breadth and wholeness of beauty, strength and durability. A tree in the landscape demonstrates the simple lever principle and shows us many limits and variations for applications. Using those same principles we can experiment with design, with material, and with construction methods so that even the design process creates an authentic aura of beauty when good solutions are achieved.

Our natural environment not only provides the materials for our projects, it also provides the sources for variations of structural geometries, of light, of thermal, of olfactory, of audio, of tactile, of air flow, and of material durability. Learning about these factors, together with establishing relationships of one to another, reflects the enrichment we experience from living in the world that surrounds us on a daily basis. Although such a vast knowledge base enables rational design, developing the ability to observe and learn from these sources can be exciting for the beginning learner to discover, and for the experienced learner to share the exhilaration of continuous learning.

The physical and mechanical properties of each material form its unique identity. That data is used to assess the opportunities and limits of that material when used to design an object. How material pieces are formed, cut, molded and connected provides the designer with critical information. The size, strength, stability, and durability of each architectonic piece depend on the translation of basic data into realistic form and performance requirements. Also, form givers depend on a subjective sense of artistic relationships. Movement, rhythm, repetition, vibration all emerge from the material, the relationships, and the connectivity of abstract ideas to real objects. Even music is composed with beauty firmly anchored in human understanding of composition and applied mathematics.

Historical precedents exist as illustrations of thoughtful achievements to learn about successes and failures in our built environment. Historical, and cultural, examples inform our design processes and spurs us to value our precedents as we seek new forms, new materials and new applications.

This seminar focused on architecture as a broad basis to explore the teaching of mathematics. The inclusion of a project to design and construct a model provided an opportunity to experience how making things, individually created, implants a unique learning method. Curriculum units included a wide palette of topics such as Roman aqueducts, bridges, cultures, music, geometric forms, and housing, each with a wide range of mathematical applications suitable for the kindergartner as well as for the advanced twelfth grade level. With opportunities for students to observe, analyze, design and construct projects the inclusive activities for these units offer learning opportunities beyond the classroom. The curriculum units created for this seminar recognize the importance of the talents and interests of individual students as they learn about principles of life through the focus on applied mathematics in architecture.

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