

Making a Case for Design-Based Learning

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In the last five years I have served on several national committees concerned with the contribution arts education makes to achieving the goals of education reform in K-12 classrooms. As a university graphic design educator and the only designer on those committees, I frequently must represent the issues and concerns of many design educators and professionals, including architects, industrial designers, planners, landscape architects, and interior designers. I am continually struck by the perceptions that leaders in art education hold about design and the missed opportunities to promote design as a bridge between fine arts and other areas of the curriculum, such as science, mathematics, social studies, and language arts. As someone who holds two degrees in art education, as well as one in design, I am equally concerned by the lack of design instruction in the preparation of K-12 art teachers. It is especially curious given the pervasive assumption that design is a sub-discipline of art, the frequency with which art education and design programs reside in the same academic unit in US colleges, and the exploding number of applications by high school seniors to college design programs.

In a series of articles for *Arts Education Policy Review* I hope to acquaint art educators with some of the thirty-year history of design education in K-12 classrooms, show its relationships to the goals of education reform, illustrate its success as a strategy for integrating curricula, and discuss its potential for curbing marginalization of the arts in schools. In each case, I will argue that the inclusion of design education in the preparation of teachers and administrators, within and outside the arts, offers additional strategies for improving teaching and learning.

The reform research and classroom examples that I use come largely from a two-year study by the National Endowment for the Arts (NEA) on the use of design in K-12 schools. The results of that study appear in *Design as a Catalyst for Learning* (1998), published by the NEA and the Association for Supervision and Curriculum Development. The book documents that work of more than 160 teachers at all grade levels and in all subject areas and presents a convincing case for the inclusion of design activities in curricula.

The goals of the reform movement sound very familiar to design educators and their public articulation supports what designers have long known: The learning outcomes of a design education are consistent with what experts agree are necessary skills, knowledge, and attitudes for individual success and the nation's global competitiveness in the next century.

If we ignore for the moment the objects that designers make and the issues of style with which they are so often associated, we find dynamic examples of learning and problem solving perfectly suited to an environment of ever-expanding information, diverse citizen needs, and great uncertainty created by the failure of traditional problem-solving models. One also finds people who make things work in a variety of real-life contexts through their ability to manage complexity and the interconnectedness of actions in a rapidly changing world. Responsible for these highly relevant outcomes is a pedagogy that openly supports multiple learning styles and intelligences and that provides valuable strategies for performance-based assessment. So close is the fit between the outcomes of a design education and the reform agenda, that many new teaching and assessment strategies actually borrow the language, as well as process models, from design education: hands-on problem solving, project-based instruction, and portfolio assessment.

Design educators have turned their attention to demonstrating how the pedagogy of design education and the problem-solving processes of designers provide practical strategies for achieving the goals of education reform in today's classrooms. Since the 1960s, a small cadre of architects, graphic designers, industrial designers, landscape architects, and planners have worked with K-12 teachers to illustrate how design can be used to teach other subjects. Their goal has not been to introduce yet another subject into an already full curriculum or to promote professional education that would result in increased applications to college design programs.¹ Neither are they interested in providing purely aesthetic or technical dimensions to work in other disciplines. Instead, they seek to expand the pedagogical repertoire of teachers to improve the delivery of whatever content teachers must impart and to demonstrate the application of creative problem solving to improved student performance in any subject area and in daily life.

Understanding Design and the Design Process

Before any discussion of the relationship between design and reform goals, there must be an understanding of what is meant by design and the design process.

As a member of the development team for the National Assessment of Educational Progress in the Arts, I had the occasion to observe a 1993 meeting of the oversight committee for the group creating the *National Standards for Arts Education*. For the first time in the history of national testing, standards and assessment development followed roughly parallel schedules, offering some opportunity for collaboration. When asked by A. Graham Down, then director of the Council for Basic Education, if the standards committee felt design had been adequately considered in the articulation of visual arts standards, Harriet Fulbright, from the Center for Arts in the Basic Curriculum, responded that "design was simply another subspecialty of the arts, like stained glass" and, therefore, did not merit specific consideration in the language of the document or formulation of its standards. It was the tacit assumption of the standards committee, and apparently many arts education leaders, that whatever general standards described student achievement in the visual arts appropriately reflected achievement in design. Because design is different from fine arts and crafts, that assumption left significant holes in the standards.

The notion that design is a sub-discipline of the visual arts and a body of knowledge already addressed in the college education of art teachers is commonly encountered by design educators. The goals of art education, as demonstrated by classroom assignments and student portfolios, as well as by the national standards, appear to fall into several broad categories: mastery of technique, promotion of self-expression, and acquisition of an abstract visual language (sometimes referred to as "the elements and principles of design"). Although some of the standards and the Getty Center for Education in the Arts promote a discipline-based approach that expands teachers' concerns to include aesthetics and historical/cultural issues (most frequently taught through art history), few designers find the range of issues that drive their work covered by those categories of content and instruction.

In responding positively to a 1976 report for the British secretary of state for education and science, titled "Design in General Education," designer and researchers Nigel Cross described design as a "third area of education" and detailed its relative position among disciplines:

The sciences value objectivity, rationality, neutrality, and a concern for the "truth."...The humanities value subjectivity, imagination, commitment, and a concern for "justice."...[The designerly way of knowing] involves a combination of knowledge and skills from both the sciences and the humanities....Design has its own distinct things to know, ways of knowing them, and ways of finding out about them. (Cross 1983, 221-222)

Not many years after the publication of that report, the United Kingdom adopted a national curriculum in design and technology for all students in the United Kingdom and ten years later broke new ground with a performance-based national assessment of the discipline.²

Although the work of an architect differs in scale, purpose, and technology from the practice of graphic design, a common process unites the problem solving in these and other design disciplines. An open-ended alternative to the scientific method, and more easily explained and analyzed than intuition, this cyclical process begins with the identification of a problem, involves research and the ranking of priorities that often appear to be in competition with each other, tests the viability of multiple solutions through prototypes, and ends with the evaluation of objects against a socially mediated set of performance criteria. The very notion that there is a problem to be solved and that its origins and priorities may reside outside the personal context of the designer and apart from aesthetics separates design from art. Concern for users or audiences, human factors, modeling of concepts, and teamwork permeate the design process, placing self-expression lower in the designer's hierarchy of values that guide the development of form. Design is user-centered, not artist-centered. As an inherently interdisciplinary activity, design addresses the social, economic, cultural, cognitive, physical, and technological dimensions of a situation and takes into account the complex systems of which any design solution must be a part. Design is a social, not individual, production and therefore shares responsibility for its outcome with the audiences who make meaning of it through its use.

Design frequently relies on information from outside the arts to define and solve problems. The solution to a design problem may be a plan for human activity, not an object or an environment, as in the community reclamation of a vacant lot for future use as a park. It may involve the application of scientific principles, as in the design of a hovercraft that reduces friction or a biome that supports the interdependency of animals and plants. It may include the design of an information system, apart from its visual aesthetics, that determines the structure through which information will be encountered and used. It may involve the design of methods for the visual/spatial analyses of concepts, such as motion, through models and videotapes. Although design most frequently results in a beautiful or intriguing object or environment, the goal is rarely aesthetic only. The mediation of aesthetics and form by concern for physical use, cultural posi-

tioning, cognitive affordance, technological and mass production, and economic appropriateness presents problem-solving opportunities that differ significantly from those assigned in a visual arts classroom. It is those unique qualities of design and how they are taught that hold significance for the reform of teaching and learning practices in schools. And it is the interdisciplinary nature of design that makes its usefulness in the reform effort immediately apparent to educators in a variety of fields.

Design and Education Reform

A Nation at Risk

Although there is considerable disagreement about the causes and remedies, educators, policymakers, and citizens agree that today's schools are not as successful in preparing tomorrow's adults as they might be. *A Nation at Risk*, the 1983 report of the National Commission on Excellence in Education, launched more than a decade of effort to achieve and sustain the nation's global dominance in "commerce, industry, science, and technological innovation" through education reform. Conclusions reached in that landmark study cited the lack of connection between in-school experiences and the rest of children's lives and an emphasis on facts rather than on how to acquire and use knowledge as serious deficiencies of our education system. Further, leaders challenged all schools to engage students through individual ways of learning and multiple points of entry to subject matter.

Under that reform imperative, schools tightened their requirements and increased periodic standardized testing of students at all levels. Along with promoting achievement measured against national benchmarks, many schools decentralized program control, experimenting with site-based management that placed decision-making in the hands of local principals, teachers, and parents.

In spite of those efforts to raise standards of public education and to experiment with curriculum structure, there was little attention paid to the content of education or to how such content could be delivered most effectively. In her review of a decade of education reform, Diane Massell writes:

The kind of standard-setting launched by *A Nation at Risk* did not directly address the academic content of schooling. It required more seat time in courses labeled science and mathematics, for example, but did not ensure the quality of science and mathematics courses that students would receive (Massell et al. 199, 5)

Further, the report's focus on sustaining "commerce, industry, science, and technological innovation" left little room for directly linking arts education to reform initiatives. A case could be made that a more creatively prepared workforce enhances work in any discipline, but it would be a stretch for more mainstream educators in non-arts disciplines to connect the outcomes of a middle school freehand drawing assignment with later achievement in the corporate boardrooms and technological think tanks of America.

Design educators, however, watch with interest the public relations effort by art educators to link reform with the arts, knowing that a stronger case could be made if spokespersons for the arts commanded a greater understanding of design and its accomplishments in the classroom.

Goals 2000: Educate America Act

Making a truly convincing public case for the arts was equally difficult under the *Goals 2000: Educate America Act*, which resulted from a 1989 summit convened jointly by the National Governors Association and President George Bush. Although the arts were eventually included among core subjects before the passage of legislation in 1994, the impact of the visual arts on achieving high learning outcomes by America's youth was generally lost on the public and educators in other subject areas. Despite former National Endowment for the Arts chair Jane Alexander's impassioned speech to arts education leaders several years ago, explaining that the arts have a role to play in each of the eight goals, the typical PTA member or high school principal would have a tough time imagining that painting, sculpture, and art history classes held much import as a national strategy for achieving weapons-free schools.³ The lesson learned from Alexander's speech was to not promise more than can be delivered and to focus the message on only the clearest connections between the arts and national goals.

Design-based experiences have potential for achieving some of the Goals 2000 aspirations and for making apparent the connection between national goals and thinking and acting in the arts. The act expresses concern that "all students learn to use their minds well," with the implication being that schools currently pay less attention to building students' range of cognitive abilities than to the subjects of their thought. Design experiences require that students move fluently among linguistic, visual, and computational modes of thought

in the solution of problems for which there are many right answers. Further, they engage students in setting ambitious rubrics against which their work will be judged. In designing a cage to house a pet snake, students must inventively apply their knowledge in science, mathematics, construction technology, drawing, and public speaking to present a compelling case to school administration that the reptile should remain in the classroom. In designing a research station for scientists in the Antarctic, students must weigh a range of environmental and human factors against the aesthetic and psychological demands of living and working environments. Such problems, which often place equally desirable outcomes in competition with one another, engage students in complex problem solving that exercises a range of cognitive skills and values.

Goals 2000 also encourages schools to involve students in the life of their communities and to participate in problem solving that has direct application to everyday life. Design projects are centered in the problems of our daily lives and the places in which we live. Across the country, teachers and students model the decision-making processes of their communities through design projects such as planning cities, creating and constructing parks and playgrounds, and publishing posters and newspapers on important issues. In many instances, design projects are precisely the vehicle through which teachers demonstrate the application of abstract disciplinary concepts at work in the real world. Numerous stories of these student activities extending beyond the school day and spanning years are testimony to the motivating power of projects that have a real life in the community.

The Secretary's Commission on Achieving Necessary Skills

The 1992 report of the *Secretary's Commission on Achieving Necessary Skills* (SCANS) is one the easiest reform documents to link to a design-based teaching and learning approach. Drafted for the US Department of Labor by representatives from education, business, labor, and government, the report identifies the skills and competencies needed by workers of the future to "encourage a high performance economy characterized by high skills, high-wage employment." The report distinguishes the elements of being "educated" and introduces a set of higher-order competencies necessary for a productive workforce in the economic and political life of the nation. Among those competencies are use and manipulation of information, use and allocation of available resources, use of technology, understanding systems, and use of interpersonal skills

Although a literate citizenry knows how to interpret, judge, and act on information, its members must also be active makers of messages, able to manipulate information in ways that lead to discovery and the application of new knowledge. Design activities develop the ability to enhance and transform ideas through the visualization, manipulation, and application of data to problem solving. Through design projects, students learn to reveal meaning in facts, to view the same information from many viewpoints, and to expose various dimensions of data through alternative forms of presentation.

The role technology plays in that manipulation and application of data is increasingly important to work, but so is the development of technology itself. Design projects encourage the invention of new ways of doing work more effectively, as well as the critical evaluation of technology in the service of ideas. Beginning with simple projects and moving toward more complex technological solutions, design problems encourage students not to accept the limitations of current technology in the solution of problems. Aesthetic principles such as economy of form are derived directly from the problem at hand.

Voluntary National Content and Performance Standards

From the early to mid 1990s the nation focused efforts on developing a set of curricular expectations for core subjects in schools. On the heels of an announcement of national educational goals by the governors and the White House in 1989, a working group recommended national voluntary standards against which to measure achievement in America's schools. Congress established a special council to examine opinion on high-level standards in a variety of subject areas to "raise the ceiling for students who are currently above average and to lift the floor for those who now experience the least success in school" (National Council on Educational Standards and Testing 1992). The standards describe what every US student should know and be able to do in various subjects, representing a "common vision of competence and educational effectiveness...not how those results ought to be delivered" (Consortium of National Arts Education Associations 1994, 12).

As mentioned earlier, the national standards for arts education fall short in representing design as having something to do with art and in promoting its unique qualities as a means for establishing relevancy of the arts to reform goals and improved quality in the teaching of other subjects. The word *design* is mentioned in the preambles to each grade level section, but there is no reference to design in the standards themselves and objects created by designers must be presumed to be works of art. Notably absent is the notion that context has anything to do with the creation and critique of form (in other than art historical terms). Culture is implied to be almost exclusively

a matter of ethnicity and geography, not of users or communities defined through common interests and needs. Although communication is the first standard listed for the arts as a whole, it does not appear as a specific standard in the visual arts in a manner that reflects the goals of design, implying that audience is irrelevant or at least secondary to the production of visual, spatial, and temporal form.

Neither is there discussion regarding the specific and unique contributions design experiences bring to the development of students' cognitive abilities or to the application of visual and spatial thinking to daily life. Problem solving is not mentioned, and the connections between visual arts and other non-arts disciplines are described as arising from comparisons of subject matter or materials in historical art objects to issues in other disciplines, not through the application of thinking skills to contemporary purposes other than aesthetics. "Structures and functions," in which one might assume design concepts would be particularly accommodated, are naively described as matters of artistic choice and detached from any evaluation of context, technology, or use.

The group developing the 1997 National Assessment of Education Progress (NAEP) in the arts tried to address those omissions in creating the framework and specifications for testing. The word *design* appears throughout the NAEP documents, and design concepts are identified separately in performance descriptions. Discrete design activities appear in the assessment instruments used for the visual arts. The reporting of students' design abilities, however, will depend on the perceptions of scorers who are primarily art teachers and artists, not designers.

Fortunately, national standards and assessment in the visual arts are not the only vehicles for promoting the relevance of design to school reform. The standards in other disciplines hold great promise for the introduction of design activities into the curriculum and for building a public case for the relevance of visual/spatial/temporal education in US schools.

Ironically, some of the most direct applications of design to education are represented in the standards for science education, which many view as logical, analytical, and antithetical to art. The American Association for the Advancement of Sciences (AAAS) launched Project 2061 in 1985, with the goal of encouraging systemic education reform in the discipline. The blueprints for the initiative were set forth in their report, *Science for All Americans*, and in a 1993 publication titled *Benchmarks for Science Literacy*. *Benchmarks* states that the goal of science literacy is, in part, to help people "make sense of how the natural and designed worlds work" (AAAS 1993, xi). That explicit reference to design is carried through in the national science education standards compiled by the National Research Council in 1996.

The science standards acknowledge that young children can carry out design activities that employ scientific principles long before they are able to engage directly in scientific inquiry. Design provides direct experience for students with materials and the forces of nature. In designing their own environments, products, and communication, very young students learn how to exercise creativity within challenging constraints, communicate visually, and work in teams.

In the middle grades, the standards call for students to differentiate between science and technology, understanding that scientists pose questions about the natural world and designers and engineers propose solutions to human problems. The standards ask students to analyze and critique products, environments, and built systems in the world around them and to create their own structures within the context of specific users.

The National Research Council finds that high school students equate science with progress but technology with environmental problems. The council also notes that older students "respond positively to the concrete, practical, outcome orientation of design problems before they are able to engage in the abstract, theoretical nature of many scientific inquiries" (National Research Council, National Academy of Sciences 1996, 191). Therefore, design activities provide a valuable tool for bridging the gap between theory and application, as well as demonstrating the positive influence of creative problem solving in developing sustainable environments.

Design activities in the sciences range from physics problems in which students invent technology for accomplishing some specific purpose (e.g. moving the stones into place on a tall building with contemporary construction equipment or packaging an egg to survive a thirty-foot drop) to environmental problems (e.g. designing biomes and habitats that acknowledge natural forces). In many cases, students engage in visualization that replicates invisible processes or explains relationships in the built and natural worlds (e.g. videotaping animal movement and explaining it in a computer multimedia presentation).

In the English language arts standards, published by the National Council of Teachers of English and the International Reading Association in 1996, the importance of visual thinking to reading and writing is stressed. The authors encourage creating mental pictures for concrete and abstract information; extracting information from charts, maps, and photographs; and using those forms in making persuasive arguments. Students should use symbols and schematic diagrams to communicate about relationships and processes.

The notion that the teaching of writing is now visual, as well as verbal, is reinforced by Vassar English professor Michael Joyce (1994). Joyce describes a technological shift in human consciousness, brought about by hypermedia, that is as consequential as the shift from an oral to print culture. In Joyce's opinion, the teaching of writing is very much a visual/spatial endeavor and relies heavily on skills once associated exclusively with graphic design.

In the national standards for civics and government, compiled by the Center for Civic Education, the authors cite the preparation of students as active participants in the political life of their communities as a critical mission for education. The standards encourage the use of dynamic models for such participation and call for students to conduct research and build coalitions in their communities. Numerous examples of teachers engaging students in public design issues occur in social studies classes at all grade levels (e.g. designing standards for commercial development, designing a park, saving a historic building). Students use many visual skills on these projects, ranging from mapping, drawing design documents, building models, and constructing computer visualizations, to critical analysis of the success of existing design solutions.

Technology education, a recent addition to curricula that often replaces traditional "industrial arts," is receiving increasing national and international attention. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) discusses that area in its series *Innovations in Science and Technology Education*, and the Organization for Economic Cooperation and Development (OECD) cites technology as an emerging discipline worldwide. Although many technology classes focus almost exclusively on the acquisition of computer software competency or on isolated projects interspersed in other subject areas, truly innovative technology curricula that rely heavily on design experiences can be found in the best schools. The OECD description of learning outcomes in technology education classes has much in common with initiatives by design education.

It can draw pupils into a different practice of solving human problems and needs. Some of the means are practical and operational, often involving the making of artifacts, but others require thinking about the design of new systems and environments. (Black and Atkin 1996, 88)

In the United States, the National Center for Improving Science Education (NCISE) published a study titled *Technology Education in the Classroom: Understanding the Designed World*. The study identifies a disjointed national approach to the teaching of technology in US schools, but it also highlights worthy practices in which students invent products and the technological systems for manufacturing, packaging, and marketing them. The NCISE report calls for strategies that will improve instruction consistency across the nation.

The International Technology Education Association (ITEA), with funding from the National Science Foundation and NASA, also addresses that consistency problem through its *Technology for All Americans Project* to develop national voluntary standards. Design plays a clear role in ITEA's attempt to move instruction away from materials-based exercises with prescribed outcomes to the mastery of operational skills, processes of invention, and critical thought.

New Performance Standards in Applied Learning

"Content standards specify 'what students should know and be able to do'; performance standards go the next step to specify 'how good is good enough'" (National Center on Education and the Economy [NCEE] and the University of Pittsburgh 1997, 3). The New Standards Project, under the direction of the Learning Research and Development Center at the University of Pittsburgh, builds directly on the content standards developed for each discipline with the goal of making them operational and assessable.

The segment of the project dealing with applied learning performance standards is slightly different. Applied learning focuses on

Connecting the works students do in school with the demands of the twenty-first century workplace..., on the capabilities people need to be productive members of society, as individuals who apply the knowledge gained in school and elsewhere to analyze problems and propose solutions, to communicate effectively and coordinate action with others, and to use the tools of the information age in the workplace. (NCEE 1997, 5)

Identification of that segment of performance is not an appeal for a new subject in the curriculum but is acknowledgment that such competence applies to all subject areas.

In reading those standards and the projects developed to assess student competence, one finds great congruency with design. Problem solving is a primary concern. The middle school standards ask students to design a product, service, or system to meet specific needs; to

improve a system in response to understanding the way people, machines, and processes work; and to plan and organize an event from concept to completion. Tools-and-technique-related standards call for students to make effective use of information technology and to present project plans and results to audiences beyond the school. Evidence of achievement must be concrete and demonstrated through a work product.

Assessment strategies for the applied learning standards use design projects as the instruments of evaluation: designing and building a wheelchair access ramp; conducting an energy audit of the classroom and designing procedures for reducing waste; designing and conducting a community survey to inform local or city council decisions about the future use of a community-owned building; and publishing a brochure advertising the school to new students. In field testing these activities, however, researchers found teachers in the fifty middle school test classrooms had no prior experience with such design projects.

The message of reform is clear: Society expects students to be creative, competent problem solvers who use their minds well and who command information and technology in the service of improving people's lives. Although the causes of failures in our current system may be subject to debate, there is little doubt that future decisions about education will be measured against that imperative. It is equally clear from studies of K-12 classrooms and from national standards in various disciplines that many teachers see the use of design experiences as a practical strategy for accomplishing reform goals. Whether design is taught by art teachers or by educators in other disciplines, its use in K-12 classrooms is likely to grow.

What Role Will Art Education Play in the Adoption of Design-Based Approaches?

The remaining unanswered questions concern the role that art teachers will play in the broader adoption of design-based strategies for education reform and how they will acquire the design education necessary to assume a leadership role in developing curricula that include design.

The promotion of a discipline-based approach to art education, as promoted by the Getty, certainly strengthens one type of understanding about the arts, but it is a risky political stance in a climate of education reform that so clearly values interdisciplinarity and building observable connections between school subjects and students' everyday lives. Distinguishing, whether explicitly or implicitly, between "high" and "low" art further distances the discipline from many students' lives and obscures the possible applications of art that students are likely to make in their future work. Design education offers a successful history of curricular innovation, proven pedagogy, and students' achievement that can place art education at the center of the reform agenda. Its inherent interdisciplinary nature makes it well suited to teaching art across the curriculum without forcing arbitrary connections (such as naming scientific objects in historic paintings) or placing art in the technical service of other disciplines (such as producing an illustrated book report).

To capture that strategic position for art education, however, progress must be made in acquainting art teachers with the concepts and processes of design. Despite claims of national arts leadership, few art teachers are prepared to address design issues in arts instruction or to facilitate cross-disciplinary uses of design within schools.

College art education programs view focused classes in drawing, painting, sculpture, and various crafts-related disciplines (ceramics, fibers, metal, etc.) as critical preparation, but most art teachers have taken no design classes beyond a freshman-level course in basic design. Those fundamental courses in two- and three-dimensional design bear little resemblance to the problem solving demanded in K-12 classroom applications or in professional design practice; they focus almost exclusively on general principles of composition and color. Their titling as "design" is coincidental and confusing, given that their sole intent is to introduce the elements of visual form (line, color, texture, etc.), not the design process or its applications. Further, most are taught through a third generation, decontextualized Bauhaus pedagogy, reinforcing early twentieth-century European aesthetics under the guise of "universal" form. That is the antithesis of the designer's concern for context and audience.

Providing a design-based education for art teachers will mean opening up access to overloaded design courses for non-majors. These courses usually involve fifteen to twenty students in highly specialized work environments and vertical course structures that require extensive prerequisite study. Collaborative agreements must be reached between art education and design departments to make this work.

Design professors also should be engaged to teach art history and studio-based courses within art education departments, promoting study of the discipline as a subject of investigation as well as a process of production. Currently, design history enters art educators' consciousness, if at all, through a few references in a general art history course. Most art history departments do not employ faculty who specialize in design history. Therefore, design objects are likely to be presented as extensions of theory in painting and sculpture, not as

responses to technological, economic, social, and cultural forces that may have little to do with fine arts. The typographic investigations of Filippo Tommaso Marinetti, for example, appear in most art history books as sidebars in discussions of Futurist painting and sculpture, despite their pivotal role in defining the movement. In fact, Marinetti's work was a pictorial strategy for mapping linguistic relationships that had its origins in poetry and typographic technology, not in painting (Drucker 1994, 108-109). And because the canon of art history organizes content around artists and objects, not ideas or problems, the anonymous work of designers frequently goes unnoticed even though it may appropriately define the visual character of a historic period.

Further, art educators must learn to engage students in the evaluation of design objects and environments as readily as they do the objects of art. The critique of design solutions is rarely, if ever, mentioned in art education but is a regular topic of popular magazines and newspapers, such as *Time*, *Business Week*, *Newsweek*, and the *Wall Street Journal*. K-12 students demonstrate considerable ability to critique the effectiveness of design objects from the perspective of use, cultural fit with audiences, and technological origins, in addition to aesthetic and political points of view. Yet rarely are they asked to do so in an art class.

There are slightly more than one hundred programs in architecture, fifty in industrial design, and twenty-five hundred in graphic design in USA colleges and universities. Many of them exist side-by-side with other programs in the arts, including art education. They offer an array of courses and faculty from which curricular components could be developed. If art teachers are to accept responsibility for instruction in design, as art leaders imply in their defense of national arts standards, college art education programs must revise curricula to guarantee that graduates receive appropriate preparation in design. Without such revision, other disciplines are likely to claim design expertise, furthering political agendas that marginalize the arts. By developing course content in art education programs that addresses design on its own terms, not as a subset of fine arts or art history, future teachers of art will develop the confidence to create design problems as easily as they do art problems.

For teachers who have completed their pre-service education, there are opportunities to broaden design experience through workshops and in-service programs. A number of program authors conduct seminars and projects in schools. Here, the emphasis is on integrating the art teacher into a teaching team in ways that place design at the center of cross- or interdisciplinary study. That is in direct opposition to strategies in which the art teacher works in the service of other disciplines, providing only cosmetic embellishments for activities and products that otherwise disregard the arts. These workshops also encourage the involvement of administrators to ensure an ongoing support environment for design activities.

Through design, there is a central role of the arts to play in the reform agenda. It is a role that is easily explained to policymakers and the public alike. Designers welcome art educators as partners in the challenge of demonstrating the power of visual education.

Notes:

- 1 Most college-level design programs in architecture, graphic design and industrial design have application numbers that greatly exceed their enrollment capacities. Many departments admit one student for every ten who apply, and others must screen students at the sophomore level for entry to design study from a general arts foundation year. Frequently, high enrollments in college design programs compensate for under-enrolled fine arts programs in the same academic units. For that reason, any high school recruitment efforts by designers are likely to be focused on explaining the discipline to students who already show interest in design and on encouraging students whose skills are well matched to the demands of the profession, not on increasing applicant numbers or dissuading students who are better suited to study in fine arts.
- 2 A team led by Goldsmith's College professor Richard Kimbell identified performance-based methods for testing students' active and reflective skills in design. Literature documenting that work provides useful guidelines for testing any art-based activity. Kimbell also heads a research unit studying how designers think and the implications for curriculum and instruction.
- 3 Alexander spoke to members of an action planning committee whose work eventually led to the formation of the Goals 200 Arts Education Partnership, located in Washington, DC.

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