Educational Infrastructure in an Age of Globalization: Intelligent Buildings, Virtual Facilities, and Virtual Instruction?

by MaryAnn C. Gaines

Parents, educators, and the public want the most effective, up-to-date education available for their children. National and state goals call for instruction that prepares today's students for a fast-paced, global economy. Most state legislatures mandate curriculum that includes proficiency in the use of technology and an understanding of global economics. Though legislatures frequently increase mandates, they seldom increase funding for implementing those mandates. Therefore, educators are often forced to educate the "business person of tomorrow" with outdated curriculum and inadequate technology, in buildings designed for a post–World War II economy. To renovate and update current educational facilities or build "intelligent buildings" that will accommodate present and future technology will cost billions of dollars. Legislators resist increasing taxes for such purposes, which may put these new facilities out of reach for the educational community.

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Nonetheless, it is time for educators to follow the lead of business and consider intelligent buildings or virtual facilities.

BUSINESS TRENDS

An intelligent building "provides a responsible, effective and supportive intelligent [technological] environment within which the organization can achieve its business objectives" (Worthington 1997, 16). The Intelligent Building in Europe (IBE) research focuses more on the occupants of buildings and the tasks they are trying to accomplish than the technology inside the building. Information technology is simply one of the ways the building helps or hinders occupants, "but it is not the reason for the building's existence" (Worthington 1997, 16). The idea of an intelligent environment or "intelligent" buildings leads to the idea of a "virtual" or "logistical" city.

The business world is already looking toward facilities and technology that support the virtual or logistical city, in preparation for the fast-approaching age of the "knowledge economy." At the same time that business leaders are thinking ahead, many school districts are just beginning to renovate older buildings and building new facilities to accommodate technology for the fading "information age" and "service economy." As Worthington (1997, 2) noted,

Planners, designers, and facilities managers are faced with a new paradigm of work. The shift from a 'service' to a 'knowledge' economy requires a refocusing of expectations. Whilst the service economy was concerned with organizing data and products (within a road, rail, and telephone infrastructure, supported by bureaucratic organizations) the knowledge economy's main asset is information and ideas, enhanced by a worldwide information and communications network within an organizational structure of communities of interest. The global production line is a reality where, through group work and concurrent working design, manufacturing and support can be undertaken in a variety of centers.

As information, communication, and technology drive the success of organizations, business planners for physical facilities are moving away from "property focused buildings to being business service providers" (Worthington 1997, 4). Many businesses have already begun a painful reconstruction process of eliminating and discarding facilities that no longer meet "knowledge age" and globalization needs. The restructuring process involves leaner staffs and flexible office space. As Worthington (1997) stated, the "essence" of the new workplace is:

• a collection of working places, networked by technology;
• a small number of key, company-owned buildings that reflect corporate values and enhance faster, informed communication, team spirit, and a sense of trust;
• convenient and amenable to support the busy and innovative professional;
• a short-lease rental space at a reasonable rate, with the owner committed to treating his or her tenant as a business part-

ner rather than a hapless servant of encumbered capital; and
• appropriate technology well integrated with the business operation, supporting and enhancing performance.

Buildings must be flexible to accommodate the uncertainty of future business occupants. The more specialized the facilities, the more complex, expensive, and less flexible they become to operate. Adrian Leaman (in Worthington 1997, 16), a consultant and researcher, has defined the "logistical city": "Time and logistics—organizing things to be in the right place at the right time—take over from spatial factors as the dominant constraints influencing settlement geography. The logistical city is coming about because the factors which govern city forms and building types are not disappearing but *exchanging places, primarily as a result of technical change.*"

Leaman has argued that environmental constraints on carbon dioxide and other pollutant emissions are forming preconditions for the logistical city. Though restraints on the environment will increase, information can be moved more cheaply. As Leaman (in Worthington 1997, 16) concluded, "As information becomes better packaged, more dynamic, more organized, and more reliable to send and receive . . . the need to be profligate with energy and space-intensive travel (like commuting or international business travel) will be lessened."

In time, the Computer Integrated Building (CIB) may move toward "intelligent areas, cities, or regions" as opposed to being limited to a building. Yet Worthington (1997) noted several barriers to the development of intelligent networks. First, large "gaps" remain in the technologies. Integration has not yet been achieved within building automation, and that must occur before attempting integration be-

tween building automation and information technology. Second, data communications are still at a rudimentary level. Many users struggle with wide area networks, which must feel as comfortable as the telephone if a virtual corporation is to thrive. Third, we must address bandwidth limitations. Increasingly complex technology applications have greatly increased the demand for bandwidth for data communications. Without a complete reorganization, the radio spectrum will not be able to cope with demand. Fourth, we must resolve conflicts between data security and seamless voice and data communications. Organizations are naturally concerned about the security of corporate information and technology systems. Finally, management systems must be restructured to support work in many locations. Recent forms of data communication allow people to work from their homes or remote office locations, yet very few organizations have modified their procedures to make these changes effectively.

Office buildings are often, as Worthington (1997, 17) noted, "in the wrong place, incapable of change or do not meet the needs of people who use them." Because the logistical city will place much greater demands on building performance, "buildings will need to be healthy, safe, comfortable, energy efficient, adaptable, cheap to run, easy to manage, accessible by people without cars" (Worthington 1997, 17). Most workers will telecommute from home. Only those workers needing closer supervision will work in the office every day. Work or project teams will come together to complete a project then split up

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into small groups or work alone. They may meet in hotels, conference suites, or other areas rather than a distant home office. The business trend will be to minimize the cost of wasted time and maximize highly skilled, mobile, knowledgeable workforces.

In response to the mobile needs of the business community, the London Center (2002) has advertised virtual office space with a prestigious business address recognized worldwide. The center's Web site offers full office support with video conferencing, fax and e-mail services, secretarial services, secure computer networks, and other assistance necessary to run a business. Physical facilities such as boardrooms, meeting rooms, and executive suites are available for long- or short-term lease. Other organizations—including the Texas-based Corporate Office Centers (2002) and the European Intelligent Building Group (2002)—offer "on demand" office space.

There is a great potential for fast-growing virtual cities in the business world, but can educational institutions with aging facilities and infrastructures keep up with rapidly changing technology to become "virtual schools" preparing students for "virtual business worlds" located in "virtual cities"? Just as current office buildings are not meeting the needs of 21st-century business, current educational facilities cannot meet the needs of students who will become future workers in a global economy. If the workplace is reappraising "the way we work, the space we occupy, the technology we require, and the work group settings" (Worthington 1997, 17) we use, should not educators be reappraising the way we use and maintain physical fa-

cilities in educating the global citizen and business person of the future?

EDUCATIONAL PERSPECTIVE

The General Accounting Office (GAO 1995) reported to Congress on school facilities and their design for the 21st century. The GAO (1995) asked, "Do America's schools have the physical capacity to support learning into the 21st century?" Educators and administrators from across the country clearly did not believe so (GAO 1995).

Despite the growing possibilities of virtual facilities, many public and private K–12 schools and institutions of higher learning, though equipped with inadequate infrastructure, are struggling to update existing equipment and expand technology to provide virtual instruction via Internet, video conferencing, and distance learning. For private and post-secondary schools, course offerings through distance learning is proving to be a lucrative means of increasing student enrollment. For students and parents, virtual education is proving to be a convenient, time-saving alternative to hours spent driving to attend classes at on-site physical buildings. Convenience, saving time, and access to more-individualized instruction seem to be preferred to the advantages of meeting with a group on campus. This increasing preference is demonstrated by the dramatic growth of online schools from kindergarten through the university levels. Virtual education is big business and growing with "virtual" speed. More than one million students are now plugged into the virtual college classroom. Compared to the 13 million attending brick-and-mortar schools, this may not seem like a significant number. Yet Gubernick and Ebeling (1997) predicted that the number of virtual college students would triple by the turn of the century. The "turn of the century" has come, and virtual

education continues to grow exponentially. Educational institutions seem comfortable with a limited amount of virtual learning, but they are not anxious to expand course offerings or expand to the point of becoming schools without physical buildings. The advent of virtual education opens wide the doors of educational institutions to expanded use of virtual facilities.

The growth of virtual education has modified the need for traditional educational facilities. Given the convenience of accessing online courses anytime and anywhere, students of tomorrow may very well opt to learn in settings other than public schools. More and more public and private schools and universities are venturing into the arena of virtual education. With educational physical facilities becoming more and more expensive to renovate and maintain, how long will funding agencies be willing to support the enormous costs of traditional facilities when virtual facilities offer such relatively inexpensive and flexible alternatives? Parents of public school students who have to ride a bus for an hour to a physical facility to engage in virtual instruction because the school enrollment is too low to provide advanced classes will likely decide to help their child access virtual education from another, more convenient location. With more and more parents turning to home schooling and enhancing the educational experience through computerized curriculum and virtual field trips, will the public school system, as we know it, survive (Virtual High School 2002)?

Faced with a shortage of teachers nationwide, will future teachers be managing virtual classrooms rather than traditional ones? Public education, as currently known, may become as obsolete as the one-room schoolhouse of the past. Future educators may be teaching students in various geographic locations connected with one

another and the classroom through computers and video conferencing. Today's school facilities may be replaced with satellite campuses located in day-care centers, students' homes, or public libraries to provide the convenience of virtual education. Parents telecommuting to work from home should be comfortable with their children telecommuting to school from home where they, as parents, can supervise their children's education while working. Parents still commuting to work in the traditional sense must still arrange day care services for the hours after children leave school. Why not drop off all the children, regardless of age, at a facility that can educate all ages in one location through virtual technology?

IMPLICATIONS FOR PRACTITIONERS

Many critics of virtual instruction would argue that "it" will never happen. Despite the decline in numbers of teachers, educator organizations and teacher unions still fear that teachers will be replaced by technology. Many teachers say that face-to-face contact between pupil and teacher is essential to learning, and many parents prefer to leave the education of their children to the public school system in traditional settings. The inevitable challenge of how to address high school athletics and extracurricular activities in a virtual setting is an impasse for much of the public. Other critics of technology and virtual education fear that only the wealthy will be able to afford the needed technology. They suggest that poor, minority students, unable to afford technology, will continue to suffer. Still other opponents say that virtual education will work for older students, but the younger ones will not be able to manage the technology. It is not developmentally appropriate, they suggest—and who will supervise them? Most virtual schools have found innovative ways to address concerns by insisting that children have mentors or supervision before enrolling, by providing technology and supplying scholarships to needy students, and by offering socialization activities and athletics for groups of online students enrolled from the same geographic area (Christa McAuliffe Academy 2002; Virtual High School 2002).

THE NEED FOR RESEARCH

The rapid growth of virtual education and facilities presents a danger that the enthusiasm and expansion of online instruction will overtake and bypass the need to research and explore the impact of these approaches on children. Though preliminary research indicates that adults can learn as effectively with online courses and perhaps score better on tests, there is a need to explore how effectively younger children are learning with technology (Van Scoter, Ellis, and Railsback 2001; CNET News.com 1997; Kozlowski 2000). At the same time, it would be wise to establish some pilot studies to measure student achievement and determine whether or not there is real monetary savings to educational institutions moving toward a virtual education approach. A survey of parents, students, and teachers could provide information that would give educators an idea of how many parents and teachers would participate in a virtual approach. Even though the possibilities are exciting, research could provide information that would avoid making virtual education "just another fad."

Though critics continue to argue that virtual education cannot adequately and appropriately educate the nation's students (McCluskey 2002; Reeves 2001; Rudich 1998; Russell 2001), business leaders are convinced that there is another way. Just as some of our ancestors believed that it was never intended for mankind to fly, visit the moon, talk via telephone to people miles away, or use other "newfangled" in-

ventions, those generations and ours have embraced the innovations that prove useful to us and seem to advance the comfort level of society. Two generations ago, most people would never have believed that we would be flying across the globe in hours, commuting and communicating via computer in seconds, and making regular visits to the moon and other planets. Virtual education and facilities will soon become an everyday reality—stranger things have happened.

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