

## Transportation Education

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As the world enters the 21st century, the quality of education continues to be a major factor in a nation's ability to succeed and excel. The United States has been fortunate in the payback received from its investment in learning at all levels. But past achievements and investments in training, research, and technology transfer do not ensure future success. Whereas many policy areas in the United States have a long-established commitment to education, the focus on transportation issues has been relatively recent. In this paper, insight into the current status of transportation education as an academic discipline is provided. Four areas that will challenge educators and administrators in the 21st century are examined. Finally, several recommendations to support future development in this important academic area are made.

Formal education programs and academic research efforts have not always been a determining factor in the development of transportation innovations. Nineteenth century innovations, such as steamboats and railroads, initially came from entrepreneurs' talents. These individuals were not dependent on a formal, academic network. In the 20th century, transportation issues became more complex, and other issues (e.g., economic development, environmental concerns, public spending) became more apparent. Transportation issues were part of the academic agenda but did not have their own framework.

In the 1950s and 1960s, education endeavors in transportation were focused at the college level, mainly through engineering programs. The focus was on the practical matters of building and maintaining America's growing land-, marine-, and air-based systems. In the latter part of the 20th century, transportation education became a discipline in its own right, not just an adjunct to other education programs. At the same time, there was growth in technically oriented programs with a practitioner focus at the junior and community college level.

Development in the field now comes about because of continuing demands and commitments at several levels. First, within the educational establishment, formal academic programs have moved beyond traditional lines (e.g., engineering and science). As a result, transportation education programs are a formal area of study as well as an adjunct to or support for other established academic disciplines. Areas of policy growth and innovation, such as defense, communications, energy, environment, and urban and rural affairs, as well as the burgeoning aspects of technology, are included.

Second, the federal government now provides a financial and staff resource commitment—in some instances matched by state or regional funding—through the establishment of a national university transportation center network. (From legislative authority originating in the Intermodal Surface Transportation Efficiency Act of 1991, Congress mandated a series of university transportation centers—later supplemented by university research institutes—to provide leadership in transportation education teaching and research. In 1998, the Transportation Equity Act for the 21st Century expanded the

number, the funding, and the scope of these programs.) The commitment includes funding for teaching and research, as well as a technology transfer network to link transportation education needs. The outcome benefits not only formal academics, but also practitioners at various levels who wish to learn new skills or enhance their current knowledge base. Finally, the private sector provides a narrower education commitment, one based on a research component to meet the specific needs of a developing product/service or to transform an existing transportation enterprise. (Most basic research continues to be carried out by the public sector, mainly the federal government.)

As the transportation education system grows, the focus is changing in several ways. From an academic standpoint, additional policy areas—as opposed to technical areas—become apparent. For example, students and professors broaden their scope to examine communication between public and private interests, strategic management of human and capital resources, environmental impacts, and most recently, the impacts of computerization and technology. The paradigm in transportation policy is shifting away from “bigger is better” to the more efficient management of existing infrastructure systems. The shift is being accomplished through the use of enhanced management systems and intelligent transportation systems.

At the same time, there is a growing realization that transportation education needs to broaden its focus beyond academic offerings. To interest future leaders (including traditionally underrepresented populations) in transportation careers, elementary and secondary curricula are being developed and revised. For example, the U.S. Department of Transportation has recognized the importance of an ongoing commitment to transportation education through its Garrett A. Morgan Technology and Transportation Futures Program, which supports lifelong learning endeavors and innovation at the elementary, secondary, junior and community college, college, and graduate levels. At the other end of the learning spectrum, existing professionals are engaging in a lifelong learning process. Learning might also involve those who are informally interested in transportation issues.

The above perspective highlights the changing and evolving focus of the “transportation professional.” It is no longer sufficient to have a technical background or to view transportation education as just a series of college courses. It is and will continue to be a multidisciplinary and lifelong endeavor.

In the 21st century, four areas will have a crucial effect on future innovation: globalization, technology, changing demographics, and curriculum development. The following sections present insight into each, whereas the conclusion challenges the reader with a series of next steps to maintain the momentum.

## GLOBALIZATION

One of the major factors facing the United States and the world at the beginning of the 21st century will be globalization, which has been defined as “seeing the whole world as nationless or borderless” (Koh Sera, *Corporate Globalization: A New Trend*). In private-sector transportation endeavors, organizations provide products, services, and research capabilities to a diverse world community that is becoming more competitive. In public-sector transportation endeavors, governments at various levels are responsible for the development, implementation, and maintenance of existing and evolving transportation infrastructures. Transportation education acts as the catalyst to bind these forces together by supporting innovation.

Globalization has affected and will continue to affect the changing academic environment. In a direct sense, it supports the internationalization of resources, not only in

the individual classroom, but also in the research facility that then extends out to the workplace environment. The outcome shares learning innovations and the latest research and development endeavors that go beyond the academic setting. Global transportation education efforts support industrialization, the movement of goods and people, enhanced resources, better communication, and improvements in the quality of life for all countries. Because globalization forces enhanced competition—some call it hypercompetition—it provides a wonderful opportunity for education stakeholders to show leadership through innovative research projects, as well as by utilizing technology and communication to share resources and knowledge.

## **TECHNOLOGY**

Just as transportation innovations acted as an “engine of growth” in the 19th century during the Industrial Revolution, they are also among the economic and environment drivers of the technology revolution leading to the 21st century. The technology revolution is having a major effect on transportation education. Within the teaching environment, the use of computers as a learning tool is revolutionizing how students study existing theoretical and practical problems. Within the learning environment, research methodologies and outcomes are bringing about continuing change, not only in tabulating and evaluating complex quantitative problems, but also (for example) in how information is shared through website addresses and communication links.

The revolution extends beyond the formal classroom since it opens up distance learning opportunities to the academic and to the practitioner, even in remote locations. Technology is also being used as an information and learning tool to interest young students and those who wish to know more about the field.

By combining technology and education endeavors, an opportunity is provided to build new technology, improve existing infrastructure, develop world-class facilities, enhance capital investments, create alternative energy sources, improve the environment, and make better communication alternatives. At the same time, it can be used to create, test, implement, and monitor potential innovations before a financial, environmental, political, or research commitment is made.

## **CHANGING DEMOGRAPHICS**

For transportation education to be relevant to society’s needs, it must take into account the changing demographics in the workplace. For example, the traditional scope of jobs and careers is broadening to include women and minorities in key managerial and leadership positions. Education is a key component in preparing and sustaining these individuals throughout their careers within the transportation hierarchy. The Eisenhower Fellowship Program, as one example, acts as a catalyst for training and technology transfer and as a means of enhancing teaching for the transportation faculty.

To ensure broader interest and understanding for everyone, advantage should be taken of opportunities to extend the learning process to the secondary and elementary levels. Opportunities are developing because of students’ interest in computers and high technology. At the other end of the spectrum, the needs of the older, established practitioners in the field highlight an additional potential within the transportation education system. These individuals need to maintain their existing knowledge and skills in the face of the massive technological and policy changes going on around them. At the same time, they may be responsible for developing and implementing solutions to existing and envisioned problems.

The American transportation education network has broadened beyond the United States to become a world-class model. Therefore, demographics also encompass an international component that prepares practitioners, researchers, and managers from all over the world to solve issues within their own countries as well as interdependent transportation issues within a regional or global context.

## **CURRICULUM DEVELOPMENT**

Whereas the three issues presented above are examples of external factors that affect transportation education now and will do so in the future, there is a fourth, internal issue that is driving change: curriculum development and reform. This is important as the field grows in its own right and, at the same time, becomes an important subcomponent in other policy fields.

The traditional focus of engineering curricula is now supplemented by “soft skills” that stress management concepts (e.g., working in multidisciplinary teams) and policy issues (e.g., moving beyond the needs of local society to cover global issues). At the same time, this can create tensions from an administrative and pedagogical standpoint. For example, at some state institutions, there are limits to the number of hours for a degree, as mandated by the legislature. Therefore, there may be fewer opportunities to include these new, important topics.

The curriculum focus continues to move beyond its traditional base to include other areas of specialization. For example, transportation professionals in the 21st century must have the ability to see how their work affects the environment—not only in costs to air, land, and water, but also in energy use. They must have the skills to understand how their decisions relate to community stakeholders (i.e., the politician who may make the decision and who provides or withholds support, the taxpayers who pay the expenses, and the members of the public who benefit from their efforts). At the same time, there is the ongoing upgrading of the curriculum, based on the effects of technology on infrastructure development, communications, and product design.

Some of these new specializations may be nontraditional. The topic of ethics as part of the education curriculum—a growing component of business school programs in the United States—provides one example of this growing diversity. It is an issue that transcends disciplines and relates to the training requirements of the transportation professional. It begins in the classroom, where the opportunity exists to reinforce the implications of ethical dealings in business situations, which students will face throughout their careers. It extends into the research environment, where scholars need to maintain integrity in their research efforts and relations with others. It continues on to preparing students for their role in the world of commerce, both in the public and the private sectors. This involves not only making and upholding contractual obligations, but also maintaining a standard of integrity (especially in situations where ethical standards differ or do not exist).

Another important change in the transportation field is the growing emphasis on intermodalism. Whereas transportation options were tied to specific modes in the past, recent developments focus on a combination of modes for the same shipment so that travel time and cost can be minimized. Technological innovations are making the option of intermodalism increasingly viable, and the needs of the profession in this area offer challenges for transportation education.

## **DIRECTIONS FOR THE FUTURE**

As leaders in transportation education plan for the exciting changes they face in the 21st century, they must prepare their students in several ways. To compete and demonstrate leadership, their students must have (a) technical knowledge and skills, (b) analytical ability, (c) communication (and, in some instances, intercultural) skills, (d) technology/computerization skills, and (e) a variety of policy skills. At the same time, they need nontraditional skills, such as the ability to communicate between public and private interests, to manage human and capital resources, and to discern effects on the environment.

This can be accomplished only if several general and specific requirements are met. First, educators and administrators must meet changing demands through the courses of study that they offer and the research opportunities that their institutions provide. There must be a continuing commitment to broaden the focus beyond “traditional learning” to “students” of all ages. Second, there must be a commitment by numerous stakeholders to supply the tangible resources needed (e.g., funding, scholarships, grants, research opportunities, internships). Third, educators must bridge the gap between the academic, the public, and the private sectors (e.g., by building public-private partnerships). Finally, in a world of highly competitive resources, they need to market their success to academics and nonacademics to build interest and support for their programs.

This multidimensional approach has many benefits. From a practical standpoint, it develops the next generation of transportation leadership. At the same time, it builds the field of transportation education and creates the necessary innovation to meet known and unforeseen challenges. Finally, it supports the goal of developing a safe, efficient transportation system that not only meets America’s—and the world’s—needs, but also remains the benchmark for training, education, and technology transfer in a highly competitive 21st century environment.