**Transportation Education in the New Millennium**

As the world enters the 21st Century, the quality of education continues to be a major factor in the success of a nation's ability to succeed and to 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. While many policy areas in the United States have a long established commitment to education, the focus on transportation issues has been relatively recent.1 This paper provides an insight into the current status of transportation education as an academic discipline. It then examines four areas that will challenge educators and administrators in the 21st Century. Finally, the paper provides several recommendations to support future development in this important academic area.

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 upon 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 a specific framework of their own.

In the 1950s and 1960s, education endeavors in transportation centered at the collegiate 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 a 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 or support to other established academic disciplines. This includes areas of policy growth and innovation, such as defense, communications, energy, environment, urban and rural affairs, as well as the burgeoning aspects of technology.

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.2 This includes

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1 For example, at the Federal government level, funding for agricultural research goes back to the Morill Act of 1862 that established the Land Grant College system throughout the United States.
2 From legislative authority originating from the 1991 Intermodal Surface Transportation Efficiency Act, Congress mandated a series of university transportation centers--later supplemented by university research institutes--to specifically provide leadership in transportation education teaching and research. In 1998, the
funding for teaching and research, as well as a technology transfer network to link transportation education needs. The outcome benefits not only the formal academic, but also the practitioner at various levels who wishes to learn new skills or enhance his/her 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 transforming an existing transportation enterprise.  

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—became 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 is shifting in transportation policy away from "bigger is better" to managing existing infrastructure systems more efficiently. This is being done 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. In order to interest future leaders (including traditionally under represented populations) in transportation careers, elementary and secondary curricula are being developed and revised. At the other end of the learning spectrum, existing professionals are becoming part of a life long learning process that extends to those who wish to continue their 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. It is no longer sufficient to view transportation education as just as series of college courses. It is, and will continue to be, multi-disciplinary and a life long endeavor.

In the 21st Century, four areas will have a crucial impact on future innovation. These are: the impact of globalization, the role of technology, the challenges of changing demographics, and the implications of curricula development. The following sections present an insight into each while the conclusion challenges the reader with a series of next steps in order to maintain the momentum.
The Impact of Globalization

One of the major factors facing the United States and the world at the beginning of the 21st Century will be the impacts brought about by globalization.\(^5\) In private sector transportation endeavors, organizations provide products, services, and research capabilities to a wide, diverse world community that is increasingly 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 and change.

Globalization has and will continue to impact 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 (R&D) 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 hyper-competition in the 21st Century--it provides a wonderful opportunity for education stakeholders to show leadership through innovative research projects as well as utilizing technology and communication to share resources and knowledge.

The Role of Technology

Just as transportation innovations acted as an "engine of growth" in the 19th century during the Industrial Revolution, they are also one of the economic and environment drivers of the technology revolution leading to the 21st Century. The technology revolution that is going on inside and beyond the classroom has a major impact 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, as well as plan future transportation solutions. Within the learning environment, research methodologies and outcomes are bringing about continuing change; for example, not only in tabulating and evaluating complex quantitative problems, but also in how information is shared through web site 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 as well as those who wish to know more about the field.

By combining technology and education endeavors, there is the opportunity to build new technology, improve existing infrastructure, develop world class facilities, enhance

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\(^5\) Globalization has been defined as "…seeing the whole world as nationless or borderless." From Koh Sera's "Corporate Globalization: a new trend".
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.

The Challenges of Changing Demographics

In order 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, technology transfer, and as a means of enhancing teaching for the transportation faculty.

To ensure broader interest and understanding for everyone, opportunities exist to extend the learning process down 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 are the individuals who need to maintain their existing knowledge and skills in the face of massive technological and policy changes going on around them. At the same time, they may be responsible for developing and implementing new 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 in solving issues within their own countries as well as inter dependent transportation issues within a regional or global context.

The Implications of Curricula Development

While the three issues presented above are examples of external factors that are and will impact transportation education's future, there is a fourth, internal issue that is driving change: curricula development and reform. This is important as the field grows in its own right and, at the same time, becomes an important sub-component in other policy fields.

The traditional focus of the engineering curricula is now supplemented by "soft skills" that stress management concepts (e.g., working in multi-disciplinary 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 curricula 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 impacts the environment; not only in the cost to the 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; the public who benefits from their efforts). At the same time, there is the ongoing upgrading of the curricula, based on the impacts of technology on infrastructure development, communications, and product design.

Some of these new specializations may be non-traditional. The topic of ethics as part of the education curricula--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 also 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 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 taking place in the transportation field is the growing emphasis on intermodalism. While, in the past, transportation options were tied to specific modes, recent developments focus on a combination of modes for the same shipment so that travel time and cost can be minimized. Emerging 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. In order to compete and demonstrate leadership, their students must have: 1) technical knowledge and skills; 2) analytical ability; 3) communication (and, in some instances, intercultural) skills; 4) technology/computerization skills, as well as 5) a variety of policy skills. At the same time, they need non-traditional skills, such as the ability to communicate between public and private interests, strategic management of human and capital resources, as well as environmental insights.

To accomplish this, several general and specific requirements are needed. First, educators and administrators must meet continuous, changing demands through the course of study they offer and the research opportunities--both in tools and applications--that their institutions provide. As part of this, 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 in order to supply the tangible resources needed (e.g., funding, scholarships, grants, research opportunities, internships, etc.). Third, educators must build new partnerships that bridge the gap between the academic, public, and private sectors (i.e., public private partnerships). Finally, in a world of highly competitive resources, they need to market their success to academics, and non-academics in order to build interest and support for their programs.

There are numerous benefits of this multi-dimensional approach. 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 systems that not only meets Americas--and the world's--needs, but also remains the benchmark for training, education, and technology transfer in a highly competitive, world wide 21st Century environment.

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