New Content for the Transportation Professional: The UMTA–West Virginia University Transportation Education Project

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Deregulation of the freight and airline industries and major structural stresses in public transportation have increased management responsibilities. Different skills and knowledge are now required of transportation professionals because of the variety and complexity of social, legal, economic, and technical factors. New systems and planning skills are needed along with knowledge of current research results. The Urban Mass Transportation Administration (UMTA) Office of Service and Management Demonstrations (SMD) has developed valuable knowledge about innovative transit services and management techniques. UMTA has initiated an effort to transfer such research findings to future transportation professionals.

To transfer knowledge about new transit services and techniques, UMTA/SMD funded the Program for the Study of Technology at West Virginia University (WVU) to develop flexible, concept-based, introductory instructional modules based on SMD findings. Five instructional units were developed and tested in a variety of higher education classrooms. Most professors reacted positively to the new content and the instructional module design. A diffusion-adoptions plan was also developed to promote the use of these units by transportation educators. This technology transfer method is promising and its use should be considered by other transportation agencies such as the Federal Highway Administration and the Federal Aviation Administration, which have a significant research base that should be transferred to educators for use in the preparation of future transportation professionals.

In recent years, transportation systems have experienced a number of significant changes in their operational environments. Deregulation has been a major factor in the airline and freight industries. Many private transportation organizations have undergone major restructuring, making them more rational and competitive to fit new unregulated environments. For example, the position of rate clerk is now obsolete and there is a demand instead for marketing and cost accounting personnel.

Large urban public transportation systems also appear in need of basic changes as a result of spiraling deficits, constrained resources, segmented markets, and structural inefficiencies. Public transportation management has revealed that the skills required to operate single modes are inadequate to deal with the complex communication, political, legal, and marketing demands of efficiently meeting the mobility needs within a region.

Today, transportation professionals require different skills and knowledge needed by future transportation professionals and the type of education necessary to acquire them were major questions faced by the participants at the Williamsburg Conference on Surface Transportation Education and Training in October 1984.

Williamsburg Conference on Transportation Education and Training

Participants at this conference consisted of members of government, industry, trade, and academic organizations who were connected with surface transportation. Groups met to identify the skill and knowledge needs of future professionals in various career groups, including engineers, transportation planners, transit managers, carriers and physical distribution managers, and transportation-related technicians.

There was near unanimity among the groups as to the skills required by surface transportation professionals (with the exception of the technicians). Skill categories that were repeatedly mentioned as critical included strong academic fundamentals, communication, computer, and analytical skills; strategic thinking; entrepreneurship; group dynamics; a global perspective; a systems view; and creativity.

Conference participants differed on the question of what knowledge future transportation professionals should have based on the different information needs required to function in widely different surface transportation fields. Content areas cited as important included new practices from the field, government research, and an understanding of the complex social, economic, and technical variables in transportation.

Undergraduate courses are an important component in the preparation of all professionals. Participants at Williamsburg discussed how such courses might better prepare future professionals for careers in transportation. It was deemed difficult to teach the preceding knowledge and skills directly. Participants concluded that the more feasible approach was to teach them in the context of course content focused on the multivariate and interdisciplinary nature of transportation systems. An example of new content that can facilitate this process would be the knowledge gained from UMTA demonstration projects under the Service and Management Demonstrations (SMD) program.

UMTA/SMD Research and Demonstrations

Created in 1974, the UMTA/SMD program has developed new techniques and lessons in many areas of public transportation,
including bus and rail equipment design, automation, paratransit, rural transportation, and market-based coordinated transportation planning.

In the late 1970s UMTA became interested in the question of how to transfer the knowledge gained from federally sponsored research and demonstrations. After research and pilot projects, UMTA developed a Public Transportation Network of resource contacts, regional facilitators, and developer demonstrators to promote the use of successfully demonstrated service and management innovations by the transit industry.

Many of UMTA’s major lessons from demonstrations have not been technical. For example, it has become clear that public transportation agencies cannot view themselves solely as “operators” of a single mode system but must become “providers of mobility” to a number of groups and segmented markets. Provision of urban mobility can usually be most efficiently arranged by using a variety of modes, services, and operators.

NEW CONTENT FOR TRANSPORTATION EDUCATION

Knowledge of UMTA/SMD research and demonstration projects and the application of these research findings is important for present, as well as future transportation professionals. As a synthesis of government research and direct field experience, the SMD reports are of direct relevance to the Williamsburg Conference call to teach new knowledge and skills in transportation education. Study of these reports provides reality-derived insight into the skills and knowledge needed for strong planning, sound implementation, and careful evaluation of public transportation arrangements.

In the late 1970s it became apparent to UMTA that the availability of published SMD reports in Washington, D.C., was having little effect on college and university transportation courses. Many students focusing on careers in transportation remained unaware of the significant, necessary, and exciting changes occurring in the management of transportation systems. At the same time, most transportation textbooks had little content on public transportation, particularly content that explored the complex forces and variables affecting public transportation systems.

With these issues in mind, UMTA funded the Program for the Study of Technology through the National Transportation Center at West Virginia University in 1983 to undertake a project to develop instructional modules based on UMTA/SMD innovations for use in the formal education of future transportation professionals.

IMPLEMENTATION OF A TECHNOLOGY TRANSFER APPROACH

The major question facing the Technology Education Project team in January 1983 was how can the results of UMTA/SMD demonstrations be made available to transportation educators in a form they will find valuable, acceptable, and easy to use? The answers to these types of questions are the focus of diffusion research, a branch of inquiry related to the social, communication, and marketing sciences that studies voluntary technology transfers and how to effect them. The project team began by investigating the content to be transferred, the characteristics of transportation educators (primarily professors in higher education), and the nature of university instructional materials.

It was found that the field of transportation education is highly diverse. Transportation educators are scattered throughout hundreds of colleges and universities and no national directory exists. They have a wide range of values and interests and they teach in many disciplines, including engineering, public administration, urban planning, technology, geography, and so on. This diversity presented unique problems.

The content selected for transfer consisted of concepts and knowledge derived from demonstrations in public transportation. The major lessons of UMTA/SMD research and demonstrations are conceptual rather than technical. Concepts such as market and needs-based planning, the use of a variety of transportation modes, and the importance of private-sector involvement emerged from the research. These are central lessons for public transportation professionals and users to understand if the mobility needs of communities are to be met adequately and efficiently.

Undergraduate and graduate instructional materials are of many types. After research and telephone interviews with professors teaching transportation courses, the research team decided to use text-based modules with illustrations that could be photocopied or made into overhead transparencies. Other instructional features that were selected included student review questions and activities, a thorough reference list, statements of content objectives, and an introduction designed to assist professors in effectively using the packages.

DEVELOPMENT OF THE INSTRUCTIONAL MODULES

The following criteria were developed to guide the module development process. The instructional modules were designed to:

1. Fit a cross section of existing courses,
2. Be adaptable to varied class schedules,
3. Be concept oriented,
4. Ensure low-cost reproduction and use,
5. Be designed for use by faculty,
6. Allow for effective use by professors unfamiliar with the topic,
7. Be self-contained teaching units, and
8. Stimulate interest in new transportation methods.

The five instructional modules were developed using the following procedures:

1. Analyze UMTA-developed materials and, in conjunction with UMTA, select content best suited for redesign and inclusion into diffusible instructional modules. The five module topics selected were paratransit, transportation brokerage, market segmentation planning, public transportation pricing, and rural public transportation.
2. Analyze topic, content, and relevance of UMTA research
and produce draft instructional unit. UMTA-developed and other research documents were analyzed and synthesized to develop units that met the preceding criteria.

3. Arrange for review of module draft by selected content experts and transportation educators. A field review questionnaire was developed and sent with the first draft of each individual module (without illustrations) to persons with expertise in the topic area. Although most reviewers were transportation professors, system operators, consultants, members of nonprofit organizations, and state employees were also involved. Altogether, 33 completed field reviews of the five modules and a number of letters and phone calls were received. Many of the reviews at the first draft stage included written comments on the draft copy. The field review process resulted in the development of accurate, usable, and acceptable materials.

4. Revise drafts of each module based on external reviews and prepare finished modules.

5. Arrange for classroom field testing and evaluation of modules by college and university transportation educators. Each professor who volunteered to field test the modules was provided a draft copy (with illustrations) of a particular module, a field test questionnaire, and a request that the module be used for 1 hr in a graduate or undergraduate course with content related to transportation. Eighteen survey forms were returned.

6. Prepare and submit camera-ready copy of completed modules.

USE OF AND REACTION TO THE INSTRUCTION UNITS

The five modules developed in 1983 and 1985 were field tested formally in classrooms 18 times by 14 transportation educators. Eleven of the courses were in civil engineering departments, three were in city and regional planning, and one each in industrial studies, marketing, geography and planning, and transportation. The units were presented for from 1 to 6 class hr with a median of 2 hr. Nine classes contained undergraduate students, five were graduate classes, and four contained both graduate and undergraduate students. Thirteen of the field tests were conducted at major state universities. Three were conducted at smaller state universities; one each was conducted at a private university and a technical institute.

More than 60 people submitted written comments on the modules at different phases of their development. The following conclusions are based on 18 formal field test responses. The reviewer comments on first drafts provided background for interpreting the field-test questionnaires. When asked whether the criteria had been met, at least 15 of the 18 agreed that all of the criteria had been met except low-cost reproduction (11 yes, 5 undecided, 2 no), usable by teachers unfamiliar with content (9 yes, 7 undecided, 2 no).

On the ease of reproduction question, some of the respondents believed the materials were too lengthy. This comment was balanced by others who suggested inclusion of topics such as mathematical analysis, routing details, and vehicle types and costs. Because there were no comments on the question of use by teachers unfamiliar with content and because no one indicated there were criteria not met, it is possible that respondents were undecided because of their extensive knowledge of the topics. Some respondents agreed that the modules stimulated interest in transportation methods, but they did not believe the content of the modules was "new." "New" is an ambiguous word to ask people to judge.

Appendix A in the original paper (available from the authors) lists all 18 responses to the question, "What do you think the students got out of the module?" Respondents generally believed that the units helped the students understand the complexity of modern public transportation and the success of various new practices in differing situations. On the negative side, the most common criticism was a call for more quantifiable content and more or less space devoted to particular topics. The focus of the modules, like that of UMTA's entire demonstration program, is on planning cost-effective transportation systems to meet the real mobility needs and markets of people in target areas. The modules were designed to supplement, not replace, the usual content of courses in various transportation-related disciplines.

THE DIFFUSION/ADOPTION PLAN

During 1985 a plan was developed for use by UMTA to disseminate the instructional modules for adoption by transportation educators. The purpose of the plan was to appropriately and cost-effectively motivate transportation educators to gain awareness, inquire about, order, and use the instructional modules. The plan has three major components: a mass-oriented diffusion phase, a personal contact-oriented adoption phase, and an ongoing evaluation and revision process.

Because transportation educators are widely scattered and teach in a variety of institutions and disciplines, it was found that the most effective way to contact them was through professional organizations related to transportation or their disciplines. The diffusion phase uses a brochure mailing, conference presentations, and professional publications to make as many transportation educators as possible aware of the instructional units and to stimulate orders and inquiries.

The adoption phase of the plan has been designed to use personal contacts to encourage the use of the modules in relevant courses through follow-up phone contacts, personal contacts at conferences, and the involvement of early adopters in the diffusion process. An organized evaluation process is an integral part of the plan. Implementation of the plan is scheduled to commence in 1986.

CONCLUSIONS AND RECOMMENDATIONS

The transfer of UMTA/SMD research results through the development and diffusion of flexible, concept-based instructional modules is a promising method for adding to the content of transportation education courses designed to meet the needs of future transportation professionals. Testing and refinement of this technology transfer process should continue. If the transfer methods developed during this research prove successful, they hold promise for effecting the transfer of other federally sponsored research findings to higher education classrooms.
Certainly, it is plausible that such an approach can aid students of highway construction by providing them with an introductory synthesis of FHWA findings on the development of life-cycle costing as a technique in deciding which highway construction methods and materials to use. Such a unit might be of interest in engineering, public administration, and economics classrooms.

Other transportation agencies, such as the Federal Aviation Administration, which have significant research bases that should be transferred to education programs, should consider the potential of the technology transfer process as it relates to the real goal of transportation research and transportation education—to better meet the mobility needs of all citizens.

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