Developing Technology Education Leaders for the 21st Century

What is being done...to provide leadership for the profession in the future?

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Many years of work have been devoted to bringing the technology education profession into the 21st century. Much effort has been directed toward changing the name and image of the profession. During the past five years, a major curriculum development project has successfully produced *Standards for Technological Literacy: Content for the Study of Technology (STL)* (ITEA, 2000) and the current implementation phase of the project. In addition, a wealth of instructional materials including textbooks, curriculum guides, audiovisuals, and computer-based software aimed at K-12 programs have been developed in support of technological literacy. However, not enough attention has been given to professional development programs and initiatives needed to produce quality teachers and leaders to continue and sustain the momentum the profession has enjoyed during the past several decades. This critical issue should pose a very important question for the profession since a significant number of our current technology teachers and administrators are reaching retirement age. **What is being done within the profession to develop teachers and administrators to provide leadership for the profession in the future?** This is the big question facing technology education in the coming years. The State of Maryland is attempting to address this issue through the Technology Education Leadership Project, a teacher enhancement initiative funded by the National Science Foundation and the Maryland State Department of Education Division of Career Technology and Adult Learning.

The Technology Education

Leadership Project (TELP) began during the summer of 1998 as a state-wide project designed to enable in-service technology education teachers to develop leadership skills and to more effectively deliver instruction that results in students achieving the technology outcomes identified by the State of Maryland. TELP is addressing a long-term goal of Maryland educators to enhance technological literacy for all students (K-12) by integrating the study of mathematics, science, and technology as a required component of the educational program. The TELP project is based at the University of Maryland Eastern Shore (UMES) and coordinated by the Department of Technology. The UMES Department of Technology offers the only approved technology teacher education program in Maryland.

Need For Professional Development

In 1992, the Maryland State Board of Education passed new public high school graduation requirements. Among the changes was the require-

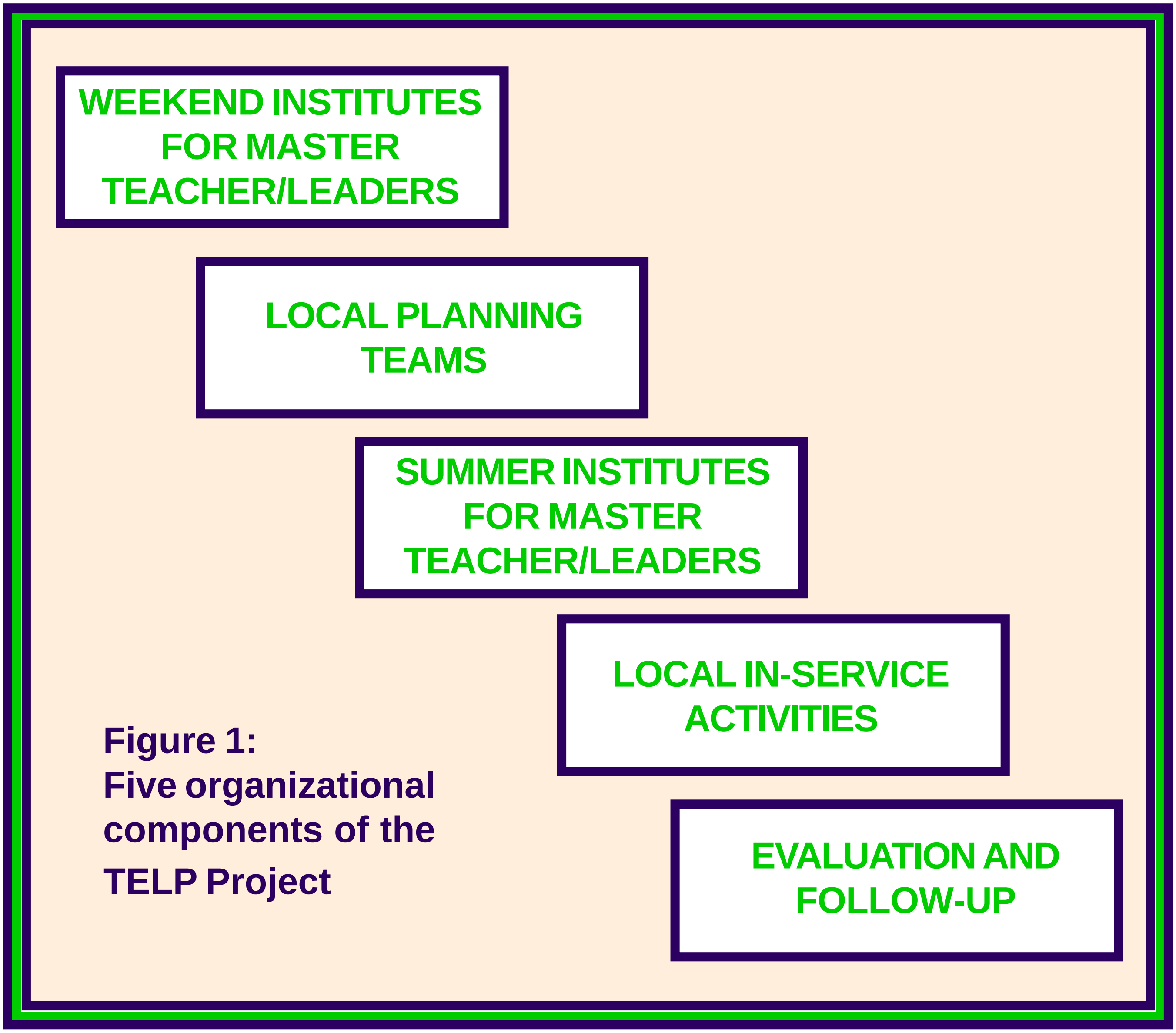
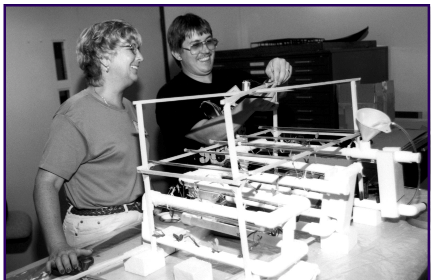


Figure 1: Five organizational components of the TELP Project

ment that all students earn one credit in technology education. As a result of this policy, all Maryland school systems have developed technology education courses to meet the graduation requirement. The approved changes in the scope, content, and complexity of technology

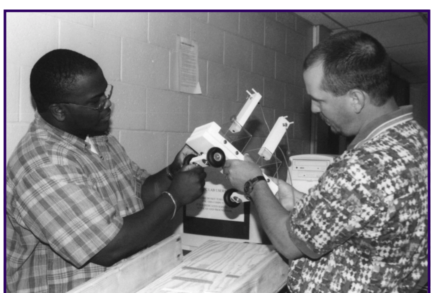


Teachers completing Biotechnology Activity

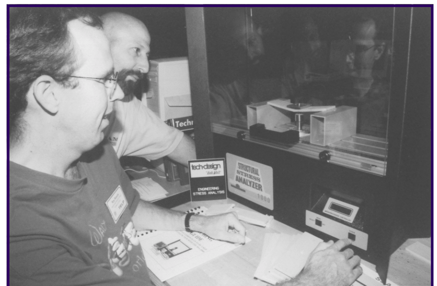
education course offerings at the middle school and high school levels created the need to provide in-service and continuing education experiences for technology education teachers. It was found that many teachers were working with limited or outdated knowledge and had not been exposed to new and innovative approaches to assist students in learning about technology in support of technological literacy. Although attempts at meeting professional development needs were implemented over the past several years, a more intensive, focused, and long-term effort was needed to make substantial progress. In addition, the recently released *Standards for Technological Literacy (STL)* emphasizes the critical need for in-service and pre-service professional development.

Selection of Teacher Leaders

In the early fall of 1998, ninety (90) Teacher Leaders were recruited from Maryland's 24 school systems. Each local supervisor of technology education was asked to recommend five to ten potential Teacher Leaders who met the following qualifications: (a) prior leadership experience; (b) certification in technology education; (c) access to appropriate facilities at his/her school; and (d) demonstrated exemplary teaching. The response from the supervisors yielded more than 150 potential participants. A series of regional information sessions and dinners were held throughout the state to familiarize potential participants with the project and the three-year commitment that would be required if selected. The application required an essay from each potential Teacher Leader outlining his or her reasons for wanting to participate in the project and a survey of current knowledge of specific technology education content and teaching/learning strategies. More than 100 teachers completed applications and, from



Adjusting crash test vehicle for Modular Technology Teaching/Learning Activity



Materials testing using structural analysis module

that group, 90 Teacher Leaders were selected by the project directors to participate in the project.

Project Organization and Content

TELP staff providing professional development instruction included university professors from the Department of Technology, local supervisors of technology education, and exemplary public school technology education teachers. Instruction included technical study of the core technologies, selected teaching/learning strategies, and facilitative leadership. Teacher Leaders received intense training in years one and two of the project in preparation for the delivery of a local in-service in year three. The project involved five components: (a) Summer Institutes, (b) local planning teams, (c) Weekend Institutes, (d) local in-service activities, and (e) evaluation and follow-up (see Figure 1).

Twelve Weekend Institutes for Teacher Leaders provided training during the school year. Weekend Institutes were conducted on Saturdays in October, November, January, and April of years one, two,

TELP Summer Institutes 2000

Week 1 - Group A

SESSION I SESSION II SESSION III	June 19 July 10 July 31	June 20 July 11 August 1	June 21 July 12 August 2	June 22 July 13 August 3	June 23 July 14 August 4
	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
8:00 - 9:45 a.m.	BIOTECHNOLOGY	BIOTECHNOLOGY	OPTICAL TECHNOLOGY	OPTICAL TECHNOLOGY	THERMAL TECHNOLOGY/R&E
9:45 - 10:15	BREAK	BREAK	BREAK	BREAK	BREAK
10:15 - 12:00	BIOTECHNOLOGY	BIOTECHNOLOGY	OPTICAL TECHNOLOGY	OPTICAL TECHNOLOGY	THERMAL TECHNOLOGY/R&E
12:00 -1:00	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
1:00 - 2:45	BIOTECHNOLOGY	BIOTECHNOLOGY	THERMAL TECHNOLOGY/R&E	THERMAL TECHNOLOGY/R&E	THERMAL TECHNOLOGY/R&E
2:45 - 3:15	BREAK	BREAK	BREAK	BREAK	BREAK
3:15 - 5:00	BIOTECHNOLOGY	BIOTECHNOLOGY	THERMAL TECHNOLOGY/R&E	THERMAL TECHNOLOGY/R&E	THERMAL TECHNOLOGY/R&E

Week 2 - Group A

SESSION I SESSION II SESSION III	June 26 July 18 August 7	June 27 July 19 August 8	June 28 July 20 August 9	June 29 July 21 August 10	June 30 July 22 August 11
	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
8:00 - 9:45 a.m.	MECHANICAL TECHNOLOGY	MECHANICAL TECHNOLOGY	MECHANICAL TECHNOLOGY	MECHANICAL TECHNOLOGY	ENGINEERING DESIGN & DEV
9:45 - 10:15	BREAK	BREAK	BREAK	BREAK	BREAK
10:15 - 12:00	ENGINEERING DESIGN & DEV	ENGINEERING DESIGN & DEV	ENGINEERING DESIGN & DEV	ENGINEERING DESIGN & DEV	ENGINEERING DESIGN & DEV
12:00 -1:00	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
1:00 - 2:45 P.M.	PRODUCT GENERATION T/L	PRODUCT GENERATION T/L	PRODUCT GENERATION T/L	PRODUCT GENERATION T/L	ENGINEERING DESIGN & DEV
2:45 - 3:15	BREAK	BREAK	BREAK	BREAK	BREAK
3:15 - 5:00 P.M.	PRODUCT GENERATION T/L	PRODUCT GENERATION T/L	PRODUCT GENERATION T/L	PRODUCT GENERATION T/L	

Figure 2: Typical Summer Institute Schedule of Study

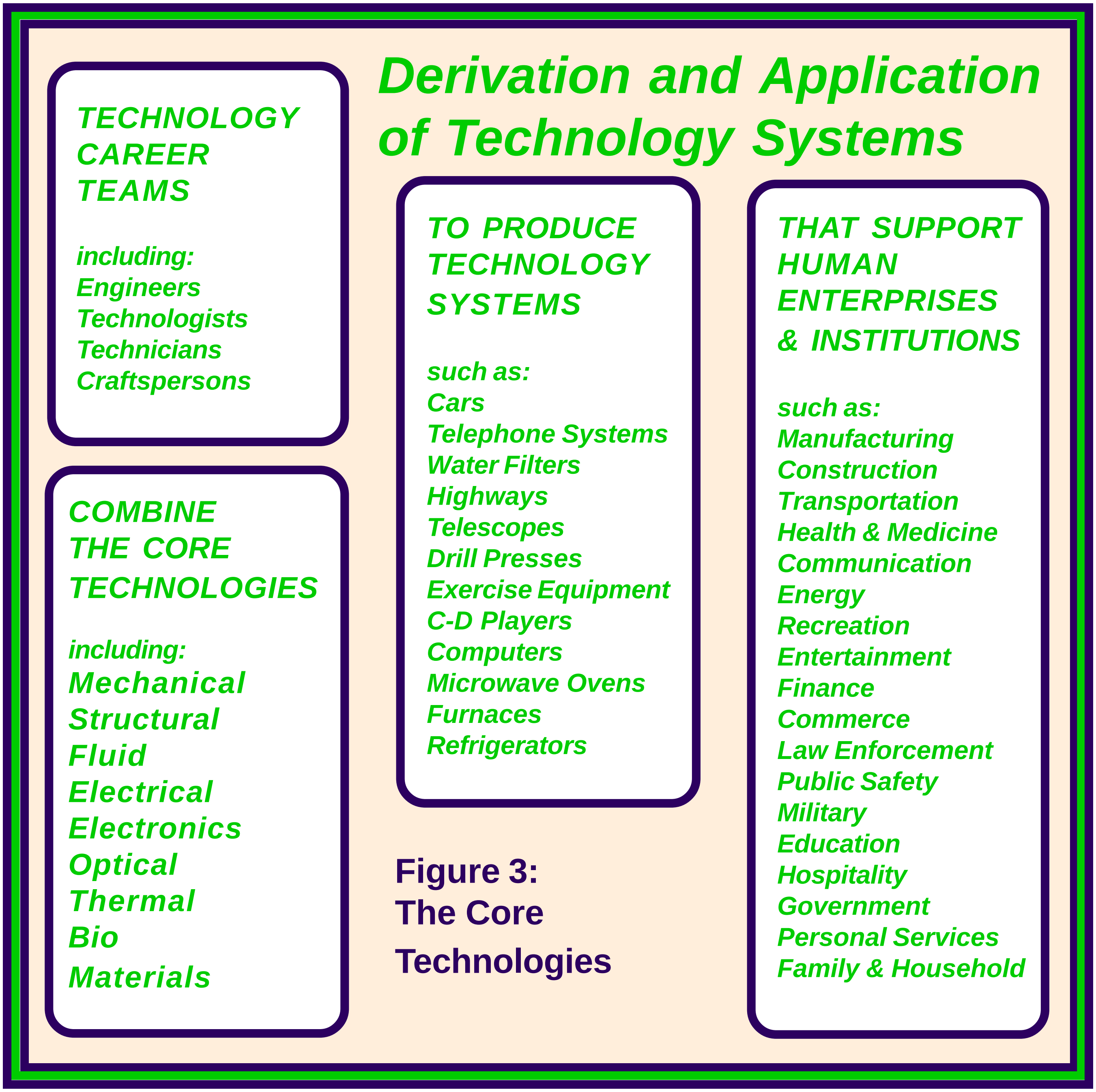
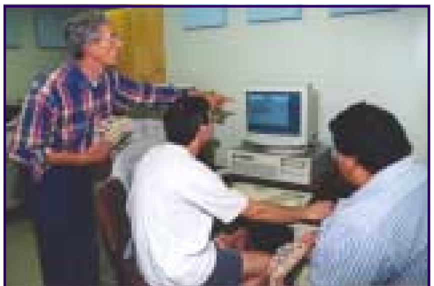


Figure 3: The Core Technologies

and three. Summer Institutes were organized into three, two-week sessions each summer (1999 and 2000) at the University of Maryland Eastern Shore (see Figure 2). Participants received stipends, travel reimbursements, and room and board at the University of Maryland Eastern Shore. Each two-week session involved 30 teachers. Teacher Leaders received 60 (clock) hours of instruction on the core technologies, 43 hours of instruction on teaching/learning strategies, 15 hours of instruction on information systems, and 36 hours of instruction on facilitative leadership. Participants could earn up to six college credits for completing all phases of the project.

Ten days of local in-service training for technology teachers were conducted in each of Maryland's 24 school districts. Each school district established a Local Planning Team to plan and deliver 60 hours of in-service to technology teachers. Local Planning Teams included the local supervisor of technology education and Teacher Leaders participating in the project. TELP has provided in-service professional development and teacher enhancement for more than 300 Maryland Technology Education Teachers.



Structural Technology Bridge Building Activity using design software

The Core Technologies

The core technologies serve as content organizers for technology education in Maryland. The core technologies, which are the building blocks of all technology systems, include: (a) Mechanical Technology; (b) Electrical Technology; (c) Electronic Technology; (d) Structural Technology; (e) Fluid Technology; (f) Optical Technology; (g) Thermal Technology; (h) Biotechnology; and (i) Materials Technology (see Figure 3). Knowledge related to the core technologies provides students with an understanding of: (a) common components; (b) basic systems design; (c) simple controls; (d) system performance evaluation; (e) science concepts applied; (f) mathematics applications to measure, analyze, describe and predict; and (g) safety practices for interacting with technology systems.

The core technologies are unique because they represent a stable content base for the study of technology, one that is not likely to change even as the products of technological innovation evolve rapidly. The core technologies are the informational base required for effective problem solving and design in technology education. They provide unique opportunities to apply mathematics and science concepts in real-world applications and will be valuable to students pursuing further education and careers in technical areas. An understanding of the process through which the basic or core technologies are combined to create technology systems is a major component of technological literacy, which is a goal of technology education in Maryland schools.

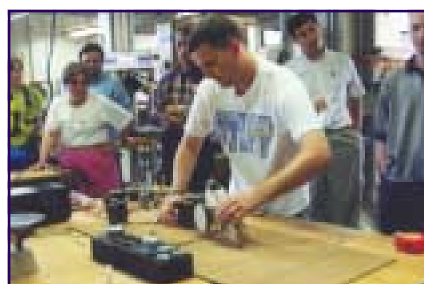
Mechanical Technology Activity using Lego Dacta

Teaching/Learning Strategies

The second innovative and unique feature of this project was instruction on six teaching/learning strategies that enable students to achieve the goals of technology education. They included: (a) Ingenuity Challenge; (b) Modular Technology Activity Package; (c) Topic Investigation; (d) Engineering Design and Development; (e) Product Generation; and (f) Research and Experimentation. These instructional strategies have proven effective in Maryland in enabling students to achieve the goals of technology education. They require students to design, construct, test, evaluate, measure, problem solve, plan, calculate, research, investigate, and report.

Leadership Development

A critical goal of the overall TELP effort was to develop future leaders for the profession. Therefore, each Weekend Institute included leadership development sessions. Topics



Tractor Pull Ingenuity Challenge Activity included planning and facilitating staff development, developing a curriculum process, technology education supervision, and standards-based reform for technology education.

During the two Summer Institutes, Teacher Leaders participated in facilitative leadership training that addressed: (a) sharing an inspired vision; (b) designing pathways to action; (c) focusing on results, processes, and relationships; (d) seeking maximum appropriate involvement; and (e) modeling behaviors that facilitate collaboration. They also worked with selected local supervisors on the curriculum development process, facility design, professional development, and the recruitment and retention of teachers.

Topic investigation research paper

As the project moved through the third year, there was substantial evidence of the leadership abilities gained by TELP participants. This was most apparent in the planning and implementation of local in-service activities. Feedback from observers and participants indicated these high-energy, relevant sessions were being well received by the teachers at the local level. In addition, several local school systems have formed professional organizations as sub-groups under the Maryland state organization's umbrella. Contributions of Teacher Leaders to professional publications have also increased markedly in the past three years. Another indicator of increased interest and commitment to the profession was the attendance of 27 TELP participants at the 2000 ITEA Conference in Salt Lake City and nearly an equal number attending the conference in Atlanta in 2001. This represented the greatest participation ever experienced for Maryland. TELP Teacher Leaders have enrolled in graduate programs and have applied for leadership positions in local school systems at an increased rate. They are running for and winning elected positions in the state and national professional organizations. All of these activities indicate an increased dedication to the profession and a willingness to assume leadership roles in state and local organizations.

Project Evaluation

An important aspect of the project was the role of an experienced external evaluator who coordinated all aspects of project evaluation including gathering formative and summative data. The evaluator's first task was to develop a Change Agent Survey, which was completed by each Teacher Leader during the first Weekend Institute. This survey established baseline data on all Teacher Leaders to determine their level of understanding and current use of the core technologies, teach-

CAD Activity

ing/learning strategies, and leadership potential. Responses on this survey were compared to responses on a similar survey given at the end of the project. The results provided data on the project's effect on teacher knowledge and changes in instructional delivery. Teacher Leaders were also required to evaluate the instruction and content delivery at the conclusion of each Weekend Institute. This formative data was used to improve Weekend Institutes during the school year. The attrition rate for participants was very low considering the three-year time commitment. Seventy-eight of ninety Teacher Leaders were still with the project at the end of the funding period.

Summary

The Technology Education Leadership Project brought together the appropriate instructional resources and personnel in a statewide effort to develop Maryland's technology education leaders for the 21st century. TELP activities have provided teachers with an enhanced technical knowledge base, strengthened instructional practices, and developed leadership skills. Funding from the National Science Foundation has provided the opportunity to work with teachers for the sustained period of time needed to make significant changes in the way they administer and deliver instruction.

Participant responses on the evaluation instruments indicated a high degree of satisfaction with the project. Comments included: "the Weekend Institute was great," "the information was very useful and can be used right away," "excellent interaction between instructors and audience," and "excellent teaching skills demonstrated by the instructors." These responses and similar feedback indicated the project was successful in meeting its goals.

Future plans for TELP include Summer Institutes that will focus on the recently published *Standards for Technological Literacy (STL).* Teacher Leaders will analyze data concerning the correlation of Maryland's Technology Education goals with *STL* and the implementation of *STL* in Maryland, including the development and modification of local and state curriculum documents to become *STL*-based.

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