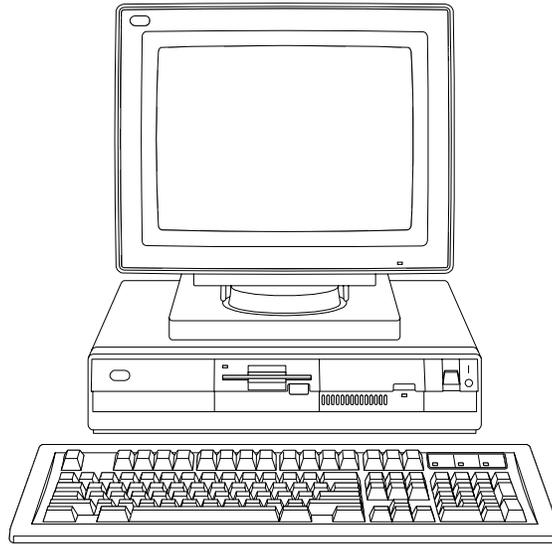


# Implementing the Tennessee Education Network



Doug Wright  
Manager

Bettye V. Burns, Ed.D.  
Associate Legislative Analyst

Ethel Detch, Director  
Office of Education Accountability  
500 Deaderick St., Suite 1360  
Nashville, Tennessee 37243-0268  
615/532-1111

**W. R. Snodgrass**  
**Comptroller of the Treasury**

**July 1995**

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# Executive Summary

The General Assembly appropriated over \$98 million for educational technology for fiscal years 1994, 1995, and 1996. These large technology expenditures are among the most significant special initiatives in Tennessee's education history. This report summarizes the implementation of the Tennessee Education Network and analyzes issues surrounding the role of the State Department of Education and the State Board of Education in that implementation. The report concludes:

**The Tennessee Department of Education overall has made reasonable progress implementing the TEN and 21st Century Classrooms.** As of April 1995, the department has distributed funding to 3,710 21st Century Classrooms of 4,142 funded by the General Assembly; 3,771 teachers have also received basic training in using their computer equipment. The department, in conjunction with the State Board of Regents, appears to be making progress in implementing the statewide network that will link schools and allow them to access the Internet. The department is also apparently progressing towards full implementation of the student information system required by *Tennessee Code Annotated* §49-1-209. The department awarded 31 technology innovation grants to school systems in September 1994.

The Office of Educational Accountability sent a survey to 700 teachers who had received 21st Century Classroom training. (See Appendix B.) The 318 teachers responding to the survey on average rated the program overall 1.8 on a scale of 4 (1=Excellent, 2=Good, 3=Fair, 4=Poor). Only eight percent of the 318 teachers responding to the survey indicated that their 21st Century Classroom was not in operation. Teachers rated their hardware training an average of 2.1 and their software training an average of 2.2. Responding teachers rated the overall degree of support provided by the department at 2.2. (See pages 5-13.)

**The state Department of Education and the State Board of Education should work together to develop a technology policy.** Currently neither the department nor the board has a detailed technology policy indicating what will be achieved with technology and how it will be measured. Reports from both the Southern Regional Education Board (SREB) and Ernst & Young consultants support setting clear goals and objectives for technology, and measuring whether these are attained. Implementing technology without clear and measurable educational goals may result in millions of dollars spent without quantifiable results.

The board had not adopted a final technology policy as of July 1995. The board approved the Tennessee Education Network Implementation Plan on July 30, 1993. According to one board staff member, the board was not consulted before the creation of the TEN project. The board has created an Education Technology Advisory Group composed of members of the board and technology experts from the private sector. Board staff indicate that as the approved plan has been initiated, the Board and the advisory group have been working to establish a more comprehensive technology policy and plan. A draft technology policy provided to the Office of Education Accountability in response to the draft of this report is dated June 7, 1995. (See Appendix E.)

The 1995 Master Plan for Tennessee's schools also does not specifically state educational objectives and goals for technology. The plan indicates that the goal for technology is to improve student learning. The board added two additional progress indicators to the 1994 plan's measures: teacher feedback and student performance. Student performance is the ultimate measure of how technology has improved learning. However, there is no indication of how these will be measured. (See pages 13-15.)

***Department of Education comment:***

Early in the implementation of the 21st Century Classroom program, as a result of the Education Improvement Act and 21st Century Challenge, several key result areas were identified. This past year the Office of Education Technology has worked with the State Board of Education's Technology Advisory Group to develop a long-range plan for education technology. More work will be done in the coming year to refine this plan.

**The Board of Education and the Department of Education should evaluate the impact of Tennessee's technology program on classrooms and student learning. The board and the department do not have formal detailed plans for assessing the program.** The board and the department need to identify the most effective practices in classrooms, the effect of technology on student outcomes, and if state curriculum/educational goals are being met. If the program is not evaluated, the state will not have information as to which technology applications produce the greatest impact on learning. Without this information, the state cannot determine how to apply future technology funding. In addition, the state will not know technology's contributions to meeting state curriculum, learning, and student progress goals. If technology improves learning, fairness may dictate that the state ensure access to these resources to all students. If technology does not improve learning, policy makers should know this before spending additional tax dollars.

Department staff indicated in September and October 1994 that there were no plans to evaluate the program, because of staff restrictions and lack of suitable measures for evaluating the program. Board and department staff indicated in December 1994 that the state could use TCAP scores, promotion rates, and attendance rates as well as information from the Tennessee Value Added Assessment System (TVAAS) to evaluate the program's effect on student learning. Presently, the Tennessee Value Added Assessment System (TVAAS) does not address resource differences between teachers. The TVAAS was designed to measure academic growth of students over time. It does not claim to be able to measure the specific reasons for differences in learning or achievement within particular groups of students.

Overall, research indicates that learning technology can improve student performance. In general, studies have found that students can learn more effectively from computers and that computer-based education has generally positive effects on students. However, research findings clearly conclude that performance varies. In addition, some have criticized the methods used to arrive at the conclusions in these studies.

The department and the State Board of Education have indicated that they will use existing measures to evaluate the impact of technology on learning. However, evaluating the effect of technology by comparing 21st Century Classrooms with regular classrooms may not accurately and completely measure the impact of technology on student learning.

Researchers warn against using traditional achievement measures as indicators of the impact of technology on learning, because they do not measure or control for conditions during the implementation of technology. Further, current techniques may more effectively test basic skills or knowledge than more complex thinking and problem-solving skills. Various education researchers and practitioners have proposed new approaches to measuring the impact of technology on learning to remedy the problems associated with comparison studies and traditional measures. (See pages 16-21.)

***Department of Education comment:***

When the 21st Century Classroom began in 1993, [the department's] major effort was to make sure it got off to a good start. [The department's] primary objective was for teachers to obtain competency in the basic skills and have enough time to incorporate the new technology into their teaching style. Since the program was relatively new, it would have been premature to evaluate it at such an early date. However, the time has now come to try to assess our efforts. In doing this, not only will [the department] have to use conventional testing methods, but will certainly have to develop fresh techniques for measuring the impact of the new technology on learning.

**The board and the department should evaluate educational software and its compatibility with state curriculum.** Neither the board nor the Department of Education had specific plans to evaluate or approve software or other computer media or their various impacts on the classroom, although computer software purchased by schools can significantly change classroom routines.

Staff of the board and the department indicate that it would be an overwhelming and possibly impossible task for the state to evaluate all of the thousands of different software programs available. However, if it is overwhelming for the state, it is not clear how some school systems, particularly those with fewer resources, will be able to handle this task. Although the department provides teachers with a software evaluation checklist, it may be unreasonable to expect teachers to individually evaluate software programs.

Even though Tennessee has adopted the concept of school based decision making, it would seem efficient and helpful to provide a list of suggested software from which systems could choose. (See pages 21-22.)

***Department of Education comment:***

This is an important concern for our teachers and [the department] is currently studying how to remedy it. The basic problem is how to deal intelligently with an overwhelming number of software products. There are several ways to approach this issue. One suggestion is to put the burden on the software vendor. In order to be placed on the recommended list, a vendor will be required to show in detail that his product meets the criteria of the Tennessee curriculum. Another suggestion is to set up a database on the Internet in which teachers could list software which they feel is of particular benefit for their grade level.

**The Department of Education should increase coordination and communication among the staff implementing technology, other divisions in the department, and the Board of Education.** Department staff in charge of the Division of Curriculum and Instruction and the Division of Accountability as of fall 1994 indicated that they had no involvement with

the programs of the Office of Education Technology; that office is responsible for implementing the components of the 21st Century program. According to a Board of Education staff member, the board was not consulted before the creation of the TEN project. The board did approve the TEN implementation plan, and has requested and received status reports on the implementation of TEN at each board meeting.

The stated goal of the department as well as the State Board of Education is to improve student learning through technology. The department and the board also have a stated goal of implementing technology into the curriculum. However, it seems that accomplishing these goals would require the involvement of the divisions of the department that are responsible for developing and evaluating schools' curriculum and determining whether schools are achieving educational goals.

The Division of Curriculum and Instruction has been responsible for approving the design and development of curriculum materials used in schools. The division also has evaluated and approved programs, and conducted workshops for teachers in mathematics and science. Curriculum specialists from the division also provided technical assistance and in-service training to local school personnel. The division also has operated several technology programs, including the Elementary Computer Project and the Secondary Technology-Based Instructional Project.

The Division of Accountability has been responsible for the school approval process, reviewing school system compliance with accountability standards, issuing annual reports on school and school system progress in meeting performance goals, and student assessment.

The department recently reorganized all divisions under two Assistant Commissioners. One Assistant Commissioner will be in charge of curriculum and instruction, special education, vocational education, and coordinating teacher training activities. The other Assistant Commissioner is in charge of finance and administration, accountability, and education technology. Because the Office of Education Technology will still be in a separate division from curriculum and instruction, there will continue to be a need for coordination and communication between these divisions. (See pages 22-23.)

***Department of Education comment:***

Certainly [the Office of Education Technology] should coordinate our activities with the other divisions to insure that curriculum and technology are suitably integrated. The Office of Education Technology has made and will continue to make every effort to communicate properly with the other divisions, and we will endeavor to strengthen these relationships in the future.

**The Department of Education should continue to work toward providing training that will enable teachers to integrate technology with the state-approved curriculum.** The stated goal of the 21st Century Classrooms project is to teach students through the use of technology. Therefore, teachers need to learn how they can teach the state curriculum with technology. Educational software comes in many forms, the usefulness of which may vary according to curriculum needs and the needs of classroom students. Therefore, teachers need to learn how to maximize the effectiveness of their equipment and their software. Teachers also need information about which software is available, when it is most effective, and how it will help them teach specific curriculum components.

Teachers express a need for training in integrating technology with curriculum. Teachers responding to a survey by the Office of Education Accountability on average rated their technology training an average of 2.4 on a scale of 1 to 4 (1=Excellent, 2=Good, 3=Fair, 4=Poor) when asked how well their 21st Century Classroom training prepared them to use computer hardware and instructional software to meet state curriculum goals for their classroom. Fourteen percent of the teachers rated their training excellent, 44 percent good, 28 percent fair, and 14 percent poor. Out of 700 21st Century Classroom teachers surveyed, 318 responded.

Teacher responses also indicate that many teachers desire additional training in integrating technology and curriculum. Eighty-five percent of the teachers responding indicated that they would like additional training. Seventy-seven percent of those teachers indicated they want training to integrate the use of technology with teaching the state's curriculum.

Feedback from teachers has caused the Department of Education to improve its training in this area. For instance, the department prepared and distributed a package of integration activities for 21st Century Classroom teachers in September 1994. Trainers have also been stressing integration more during teacher training sessions.

Written materials provided to teachers contain little specific guidance or information about specific programs or types of programs and their relative effectiveness. Teachers may need freedom to creatively use technology in their classrooms. However, the department should use its resources to the extent possible to enable teachers to effectively accomplish the overall education goals of the state. (See pages 23-25.)

***Department of Education comment:***

[The department] is very much aware of the need to do this. We have revised the curriculum emphasizing integration activities. In addition, we are offering special workshops showing teachers how to integrate subjects effectively. Efforts are underway to develop additional training programs in partnership with higher education.

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# Introduction

The General Assembly appropriated over \$98 million for educational technology for fiscal years 1994, 1995, and 1996, including \$76.9 million earmarked for instructional technology to be used in Tennessee's classrooms. The \$98 million total includes:

- \$73.9 million for 4,150 21st Century Classrooms
- \$7 million for Internet connections for each school district office and school library
- \$3 million in grants for innovative instructional technology initiatives
- \$3 million for technology development partnerships

Another \$11.2 million of the \$98 million total appropriation is to be used to fund the state's student management information system required by *Tennessee Code Annotated* §49-1-209.

These large technology expenditures are among the most significant special initiatives in Tennessee's education history. This investment deserves analysis because initially less than 10 percent of Tennessee's classrooms will be equipped with this technology. The Tennessee Education Network Implementation Plan states: "The goals of the 21st Century Classroom Project include bringing appropriate instructional technology to every classroom in Tennessee by the end of the decade." However, it is questionable whether the state can afford to equip all classrooms with technology. Therefore, it is important to understand the issues surrounding technology in education.

These issues include the need to integrate technology into the curriculum, the need to determine whether technology is effectively used in Tennessee's classrooms, and the need to determine the most effective and efficient use of these resources. This report analyzes these issues as well as the role of the Department of Education and the State Board of Education in the implementation of technology. The implementation of technology in Tennessee's schools is presented in terms of current progress and future needs to ensure success and the wise use of the state's resources.

## Methodology

The analysis and conclusions in this report are based on several interviews, including interviews with staff of the State Department of Education, the State Board of Education, and the Tennessee Education Association. (See Appendix A.) The Office of Education Accountability also surveyed 700 randomly selected teachers out of the 2,914 teachers trained to be 21st Century Classroom teachers as of November 1994—318 responded. (See Appendix B.) Materials reviewed include: memos, reports, program summaries, and other literature from the Department of Education; meeting minutes and records from the State Board of Education; the Master Plan for Tennessee Schools 1994 and 1995; reports from the Southern Regional Education Board; accountability audits of the Tennessee Education Network and 21st Century Classroom programs in school districts (State Department of Education); numerous articles and material concerning the effectiveness and implementation of technology in schools; the Tennessee Public Acts and the *Tennessee Code Annotated*. Staff also visited several 21st Century classrooms and attended one day of 21st Century Classroom training.

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# Technology in Education

The use of computers in schools has increased greatly in the last decade. Schools in North America spent almost \$2.5 billion on technology in the 1993-94 school year. The ratio of students to computers in schools dropped from 125:1 in 1984 to 14:1 in 1994.<sup>1</sup>

In essence, technology greatly increases teachers' and students' abilities to access vast amounts of information and learning resources. Technology in education includes use of computers, large-screen televisions, CD-ROM players, and laser discs along with traditional teaching tools to improve student learning. Technology applications include word processing software and databases to analyze information.

Technology can also be used to make multimedia presentations to demonstrate concepts in nature, history, science, or other subjects. (Multimedia is "any combination of text, video, graphics, sound, audio and animation."<sup>2</sup>) Technology also encompasses computer networks within and between schools to allow interaction among students who may be separated by thousands of miles.<sup>3</sup>

## Rationales for Using Technology in Education

Some of the rationales for using technology in education include:

1. *The Social Rationale*—Policy makers want to be sure that all children are aware and unafraid of how computers work. Children should be prepared to understand computers and be aware of their role in society because computers are pervasive in industrialized countries.
2. *The Vocational Rationale*—There will be employment opportunities for individuals who have the proper computer skills. Therefore, it is an important competency to develop.
3. *The Pedagogic Rationale*—Students can learn from computers. There are advantages over other traditional methods in using computers to learn.
4. *The Catalytic Rationale*—Computers are catalysts to change schools for the better. They can facilitate change, are symbols of progress, and can encourage learning.<sup>4</sup>

In Tennessee and in education generally, the emphasis for technology in schools appears to be driven by the last two of these rationales. Department of Education Staff stress the desire to use the computers and technology in the Tennessee Education Network (TEN) to enhance and encourage student learning rather than to teach students about computers.

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<sup>1</sup> Schurman, Kyle, "Today's Schools: Three R's ... And One (Technology)," *Family Computing, PC Novice*, (September 1994), pp. 28-32.

<sup>2</sup> Pisapia, J. & Perlman, S. (1992), *Learning Technologies in the Classroom: A Survey of Results*, Virginia Commonwealth University, Richmond, VA, 1993, p. 10.

<sup>3</sup> Ibid.

<sup>4</sup> Hawkridge, D. (1990), "Who Needs Computers in Schools, and Why?," *Computers in Education*, 15 (1-3) 1-6. Cited in Metropolitan Educational Research Consortium (MERC), *Technology: Review of the Literature*, Virginia Commonwealth University, Richmond, VA. 1993, p. 3.

## Why Use Technology in Education?

The National Foundation for the Improvement of Education has proposed several benefits and curriculum impacts of using technology in education:

1. Technology puts vast amounts of information at students' fingertips.
2. Technology allows for greater breadth of study. Throughout a school year, a student, with guidance, can cover a wide breadth of information and begin to see relationships between seemingly unrelated subjects.
3. Technology offers students a chance to delve deeply into subjects. Greater accessibility to information gives students the opportunity to gather, analyze, and synthesize data in new ways. Students can manipulate data to identify those portions that are relevant to their needs. They can integrate data from one subject area to another and use the information to enhance their understanding.
4. Technology provides a mode for developing higher-order thinking skills and problem solving that should be reflected in the curriculum design. Using technology, students can organize facts to define and solve problems or access data bases on a range of public policy issues such as welfare, employment, or education.
5. Technology compels that curriculum be more flexible. Technology provides teachers a tool to create their own teaching materials, to go beyond required textbooks and use alternative resources, and to reorganize information in new ways. Students can also manipulate and reorder what they learn, giving them greater control over their learning.
6. Technology links curriculum with realistic experiences both inside and outside the school. Using telecommunications and computer networks, students can work together in cooperative learning situations to help solve real problems, tying their education to real life situations and giving them invaluable learning experiences.<sup>5</sup>

Other advantages of using technology cited include enhancing the ability of teachers to attempt more complex projects with their students, enabling teachers to introduce more advanced skills at an earlier age, and expanding what students can accomplish on a given assignment.<sup>6</sup>

In spite of possible positive effects of technology in education, critics point to a number of potential pitfalls. Reasons suggested for technology's past failure include inadequate computer access, lack of teacher interest, insufficient quality software, small technology budgets, and few indicators to show the effectiveness of using technology.<sup>7</sup> The U. S. Congress' Office of Technology Assessment has cited the lack of adequate and appropriate training as one of the most significant factors.<sup>8</sup>

Educators also point to a history of technology experts promising more than they could deliver. Some critics suggest that evidence of effectiveness is scarce and existing

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<sup>5</sup> Taken from "Images in Action" a publication of NFIE's Learning Tomorrow Program, (The National Foundation For The Improvement of Education, National Education Association, Washington, D.C.).

<sup>6</sup> Means, Barbara, and Olson, Kerry, "The Link Between Technology and Authentic Learning," *Educational Leadership*, April, 1994, p. 18.

<sup>7</sup> Scrogan, Len, "The OTA Report: Teacher, Training, and Technology," *Classroom Computer Learning*, January 1989, p. 80.

<sup>8</sup> Office of Technology Assessment, *Power On!: New Tools for Teaching and Learning*, U.S. Congress, 1988, pp. 14, 16.

studies provide little guidance for educators to decide how to use technology in instruction.<sup>9</sup> As noted by one report:

For these and other reasons, some observers fear that a public and professional backlash fueled by some advocates' unsubstantiated claims will gather steam. They claim there is little evidence that the computer has made major contributions to learning in the classroom other than to help learners know how to use it.<sup>10</sup>

## Types of Instruction using Technology

Education literature notes several types of teaching with technology. However, there are many variations in terminology. In addition, the flexibility of teaching with technology naturally leads to overlap between types. Some commonly cited terms are:

1. **Computer-Assisted Instruction (CAI)** In CAI the computer takes over some elements of teaching. The student uses the computer to respond to questions pertaining to computer-presented lessons. The teacher controls classroom activities and the computer supplements the teacher's instruction.<sup>11</sup> CAI is well suited to teaching basic skills in specific subjects (e.g., math, spelling). It usually involves drill-and-practice exercises or tutorial instruction. Drill-and-practice asks students questions on material and provides feedback to their responses. Tutorial instruction teaches new material that students can interact with on the computer.<sup>12</sup> The acronym (CAI) is also interpreted as: computer-aided instruction; computer-augmented instruction; and computer-administered instruction.<sup>13</sup> CAI is sometimes used to refer to all educational software.<sup>14</sup>
2. **Computer-Managed Instruction (CMI)** CMI replaces all or part of the teacher's role. It standardizes and routinizes instruction and makes teachers and students accountable for achieving defined and measurable objectives. CMI individualizes learning by recognizing simple skill differences among students taught by the software.<sup>15</sup> The computer evaluates student performance, guides students to instructional resources, and records student progress.<sup>16</sup>
3. **Integrated Learning Systems (ILS)** Integrated Learning Systems use either CMI or CAI software to manage learning in core subjects such as math, science, reading, and writing. An ILS usually consists of computers connected to a central computer. An ILS usually has record-keeping and reporting abilities that assign students to specific lessons according to their progress.<sup>17</sup>

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<sup>9</sup> Association for Supervision and Curriculum Development, *Technology In Today s Schools*, Edwards Brothers Press, 1990, p. vii.

<sup>10</sup> Metropolitan Educational Research Consortium (MERC), *Technology: Review of the Literature*, Virginia Commonwealth University, Richmond, VA, 1993, p. 1.

<sup>11</sup> Pisapia, J. & Perlman, S., pp.7-8.

<sup>12</sup> Metropolitan Educational Research Consortium (MERC), p. 37

<sup>13</sup> Bangert-Drowns, R. L., Kulik, J. A., & Kulik, C. L. C., "Effectiveness of Computer-Based Education In Elementary Schools," *Computers in Human Behavior*, Vol. 1, (1985), p. 71.

<sup>14</sup> Pisapia, J. & Perlman, S., p. 8.

<sup>15</sup> Budin (1991). Cited in Metropolitan Educational Research Consortium (MERC), p. 36.

<sup>16</sup> Pisapia, J. & Perlman, S., p. 9.

<sup>17</sup> Ibid, p. 9.

4. **Computer-Enriched Instruction (CEI)** CEI does not replace regular course elements. It serves to improve the teaching of higher order skills through simulation, problem-solving, and student productivity applications such as word processing and databases. CEI software often allows students to manipulate information and see the results. The computer generates data at the student's request to illustrate relationships in models of social or physical reality, executes programs developed by the student, or provides general enrichment in relatively unstructured exercises primarily designed to stimulate and motivate students.<sup>18</sup>

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## The Tennessee Education Network

The Department of Education contracted with Ernst and Young consultants in 1990 to assist in establishing an educational technology plan for the state. The initiative resulting from that plan is called the Tennessee Education Network (TEN). TEN has four major components:

- 21st Century Classrooms;
- a technology training program for teachers;
- a telecommunications network to connect the department, schools, and school systems; and
- a statewide management information system.

The TEN initiative is supervised at the state level by the Office of Education Technology in the Department of Education. This office was created in fiscal year 1993 through the merger of two department offices, the Computer Education Office in the Division of General Education and the Office of Data Management in the Division of Finance and Administration.

Technology implementation at the local level is conducted by 212 technology coordinators. The duties of the technology coordinators include developing technology plans required by the department, implementing technology in schools, understanding K-12 curriculum and recommending appropriate technology for each classroom, developing and maintaining a hardware and software inventory, training school system personnel, purchasing hardware and software, and developing and maintaining computer resources. These positions are funded at a salary based on the average teacher's salary in each school system. The state pays 50 percent of the cost, equalized in the same manner as other Basic Education Program (BEP) components. The technology coordinators were funded outside the BEP, but are now funded under the BEP.

The Tennessee Department of Education overall has made reasonable progress implementing the TEN and 21st Century Classrooms. As of April 1995, the department has distributed funding to almost 3,710 21st Century Classrooms out of 4,142 funded by the General Assembly; 3,771 teachers have also received basic training in using their computer equipment. The department, in conjunction with the State Board of Regents,

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<sup>18</sup> Ibid.

appears to be making progress in implementing the statewide network that will link schools and allow them to access the Internet. The department is also apparently progressing towards full implementation of the student information system. The department awarded 31 technology innovation grants to school systems in September 1994.

The Office of Educational Accountability sent a survey to 700 teachers who had received 21st Century Classroom training. (See Appendix B.) The 318 teachers responding to the survey on average rated the program overall 1.8 on a scale of 4 (1=Excellent, 2=Good, 3=Fair, 4=Poor). Only eight percent of the 318 teachers responding to the survey indicated that their 21st Century Classroom was not in operation. Teachers rated their hardware training an average of 2.1 and their software training an average of 2.2. Responding teachers rated the overall degree of support provided by the department at 2.2.

## **21st Century Classrooms**

The 21st Century Classrooms program is perhaps the most important component of the TEN project, because it directly affects students, teachers, and curriculum in the classroom. The purpose of 21st Century Classrooms is to use computer technology to enhance student learning. A goal of the project is to bring instructional technology into every Tennessee classroom by the year 2000. Rather than teaching students how to use computers, the objective is to integrate technology into classroom instruction. In other words, 21st Century Classrooms are designed to teach students *with* technology rather than *about* technology. Students can work individually or in small groups using specialized educational computer software on individual computer workstations to learn specific subjects such as reading, writing, or math. In addition, teachers can present movies or pictures related to the subject they are teaching on large screen televisions.

### ***Allocation of funding for 21st Century Classrooms***

The funding for each 21st Century Classroom is determined by the state. The General Assembly made special 21st Century Classroom appropriations of \$53.9 million in fiscal year 1994, and \$10 million for each of fiscal years 1995 and 1996. The special appropriation technology money is allocated to school districts based on average daily membership, with a minimum of one 21st Century classroom per school district. The Tennessee Department of Education developed a cost model for 21st Century Classrooms based on the state's multivendor contract. Based on this model, school systems are required to spend \$20,000 for each 21st Century Classroom, including \$18,000 for equipment and \$2,000 for software. Appropriations are allocated based on \$20,000 per classroom. As a classroom expense, the funding is split 75 percent state share and 25 percent local share, equalized based on local funding capacity. (See Appendix C for 21st Century Classroom funding allocations by school system for fiscal year 1996.)

The state's BEP formula allocates \$20 million for technology at full funding. This money has been allocated to 21st Century Classrooms based on a minimum of \$50,000 per school system plus an amount based on the school system's average daily membership. As a BEP classroom expense, the funding is split 75 percent state share and 25 percent local share, equalized based on local funding capacity.

The Basic Education Program (BEP) Review Committee changed the allocation method to an Average Daily Membership basis to allocate classrooms proportional to school systems' student populations beginning with the 1995-96 school year. In fiscal year 1996, the BEP technology money is allocated based on average daily membership only. The former method of allocating BEP funds for 21st Century Classrooms disproportionately allocated 21st Century Classrooms to smaller schools. The initial BEP funding method was designed to ensure that every school system would have at least two 21st Century Classrooms. However, the allocations ranged from \$15.85 per average daily membership (ADM) in Memphis to over \$190 per ADM in the smallest system, Bells.<sup>19</sup> Therefore, when full BEP funding is reached, some small school systems could eventually have all of their classrooms funded as 21st Century Classrooms while larger systems could have only a small percentage funded.

### ***Equipment for 21st Century Classrooms***

The state also has specified hardware types and specifications for a 21st Century Classroom. Each classroom is to consist of a large screen television, laser disc player, CD-ROM drive, printer, modem, and two student computer workstations. (See Exhibit 1.) Each 21st Century Classroom is required to have one teacher computer workstation and at least two student workstations. School systems must submit an implementation plan for their 21st Century Classrooms and specify teachers who will be 21st Century Classroom teachers. School systems must also prepare a five-year technology plan that must be updated annually.

The state does not specify software to be purchased by school systems, but has joined the Educational Products Information Exchange (EPIE) Consortium of States, a group dedicated to improving software selection. EPIE provides computer CD-ROM disks that contain information on instructional and educational software by type of computer (e.g., IBM compatible or Macintosh), grade level, or subject area. The disks also contain product reviews and prices. These disks are provided to all school systems to assist in software selections.

#### *Status of Implementation:*

As of April 1995 the department has received 3,738 classroom technology plans from 138 school systems. The department has distributed funding to implement 3,710 classrooms, of a total of 4,142 classrooms funded by the General Assembly.

### **Teacher Technology Training**

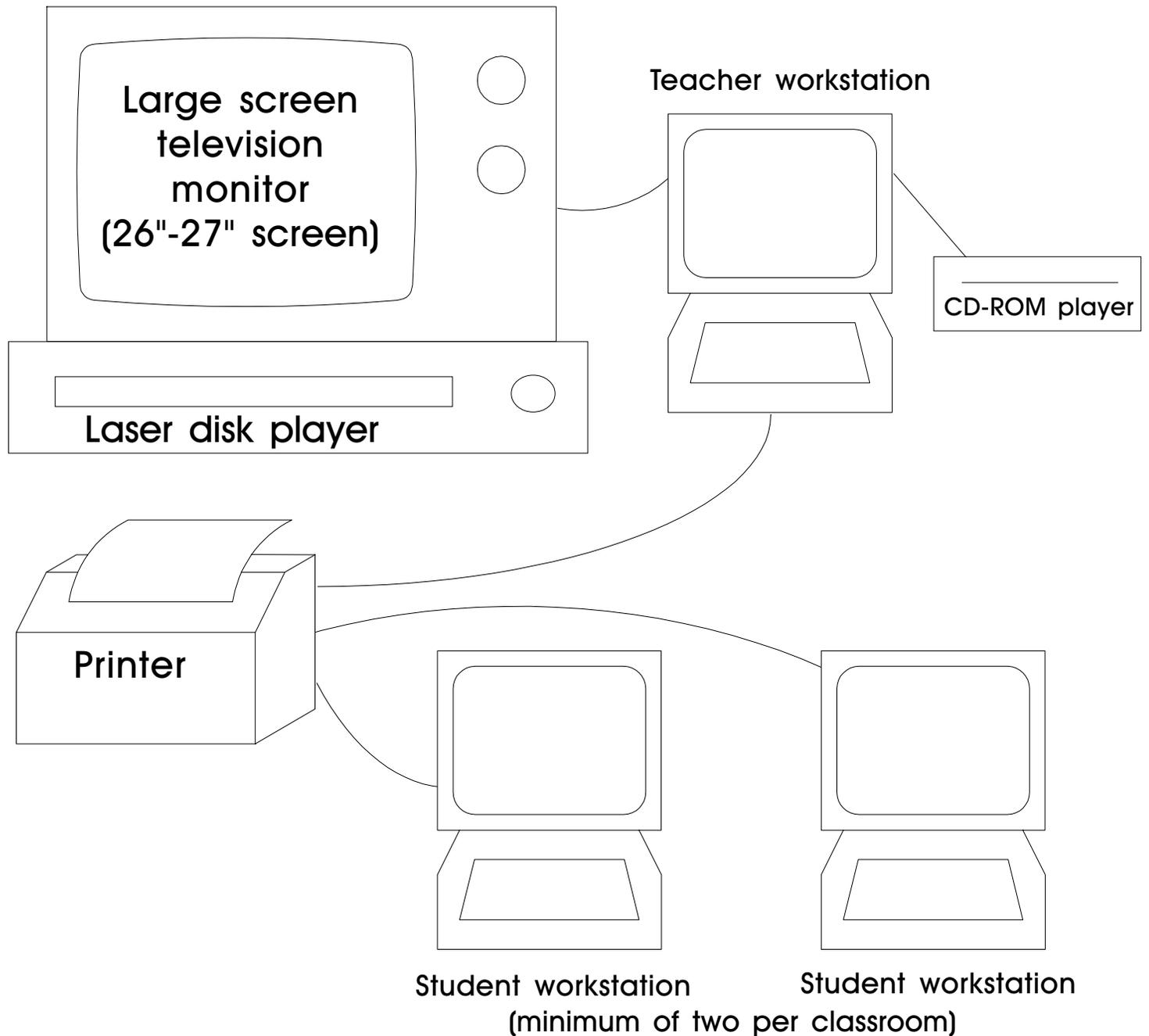
Initially, 21st Century Classroom teachers are required to attend 30 hours of training. Training is provided by the state at three regional training centers in Jackson, Nashville, and Knoxville. Teachers are also able to review computer hardware and software at the facilities. The department has given school systems the option of obtaining training at local sites if they submit a training plan and it is approved by the department. If a school system chooses to do its own training, the state provides \$225 training funding

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<sup>19</sup> This school system consists of one school.

# Exhibit 1

## 21st Century Classroom



per teacher, equalized at Basic Education Program classroom equalization rates.<sup>20</sup> Schools may obtain training at state higher education institutions certified by the department. Any school, whether UT or Board of Regents, is free to get certified to do this training. According to the department, the University of Tennessee at Chattanooga and Middle Tennessee State University are the only two state universities that have obtained certification to do 21st Century Classroom teacher training. Bryan College, a private institution in Dayton, Tennessee, has also been certified to provide 21st Century training.

*Status of Implementation:*

As of April 1995, 3,771 of 4,142 21st Century teachers had received training. Another 170 teachers have been scheduled for training, and 201 teachers still need to be scheduled. The department has also trained all of the technology coordinators funded by the state. The Board of Education has approved instructional technology standards for the licensing of new teachers. New candidates for teacher licensure will be required to meet these standards by September 1, 1996. The department is working with representatives from higher education to develop training for new teacher candidates by that deadline.

## **Library-Internet Telecommunications Project**

The Tennessee Information Systems Council and the Tennessee Board of Education earmarked \$7 million in technology appropriations for a statewide telecommunications/computer network. The project is to provide Internet access for instructional purposes, and to allow school systems to be connected to each other and to the Tennessee Department of Education. Schools will also be able to use the network to transmit data to the state mainframe computer. The network is being implemented jointly by the Tennessee Department of Education, the State Board of Regents, the Office of Information Resources in the Department of Finance and Administration, and the school systems. According to staff, the department chose to work with the Board of Regents because the number and geographic distribution of institutions in their existing network makes it possible for a majority of schools to connect to the Internet with a local call.

Schools are connected through a statewide network called TEN/TECNet that uses 14 Board of Regents school sites across the state as connecting points. These “node sites” provide access to the network through local dial modem pools as well as direct connection to school system central offices. The modem pools allow local schools to access the network by dialing a local phone number. Schools that are not directly connected to the network or able to use local access numbers can access the network by calling an “800” number that connects to a Board of Regents’ site in Nashville.

One goal of the library Internet project is to provide workstations and training for 1,541 school librarians and media specialists and the 212 technology coordinators. The training, developed by the Tennessee Board of Regents and the Department of Education, is being conducted between September 1994 and June 1995 at Tennessee Board of Regents institutions.

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<sup>20</sup> The state pays a statewide average of 75 percent of the cost of classroom components such as technology. However, the actual percentage paid by the state for a given county is higher or lower than this average because the percentage is adjusted to reflect the county’s ability to generate revenue compared to all other counties. This process is known as equalization.

### *Status of Implementation:*

The department has executed a contract with the Board of Regents to assist in implementing the network. The department has implemented “800” dial-in service to the network, and started providing network training to librarians in October 1994. The department has installed 10 local dial-in modem pools, resulting in 75 percent of schools in the state having local-call access to the network. The department has approved 152 Technology Coordinator Internet workstations representing 116 school systems, 1,313 library Internet workstations representing 127 school systems, and two library Internet workstations representing two special school systems.

The department requested an improvement of \$6.9 million<sup>21</sup> to the fiscal year 1996 budget to provide direct connections to the network for all school systems. According to department staff, this would eliminate over \$2 million in costs associated with “800” service for rural schools that cannot access the network with a local call. It would also provide better data transmission capability and remove limitations on the number of users who could access the network simultaneously. According to department staff, this improvement was turned down by the administration.

## **Statewide Management Information System**

The Education Improvement Act approved by the General Assembly in 1992 authorized the state Department of Education to develop an administrative educational information system:

The Commissioner of Education is authorized to prescribe a management information system through which local school systems maintain, record, and report information to the department and information for internal school and system management. Such system shall be established by the Commissioner in accordance with the standards and policies and procedures established by the Information Systems Council. (*Tennessee Code Annotated* §49-1-209)

The information system will provide the department, local education agencies, and other state agencies current and accurate data to help meet the requirements of the Education Improvement Act. The data provided by the system will allow school systems to determine student progress, manage their systems, and reduce paperwork by allowing direct electronic reporting of information to the department.

The department has identified 13 areas as potential components of the information system: student management, financial management, personnel/payroll, pupil transportation, food service, facilities and supplies, library management, performance management, textbook inventory, State Board of Education rules, project management, office automation, and telecommunications/data collection. The first seven of these items have been identified as the first components to be implemented, in order of their listing.

The system will contain individual student information on:

- Attendance
- Student classes on 20th day of school year
- Class credits and grade point averages for grades 9-12

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<sup>21</sup> \$3,337,491 one-time cost; \$3,588,980 recurring cost.

- Suspensions and expulsions
- Promotion and graduation
- Special education options
- TCAP scores
- Program participation (e.g., Chapter 1, vocational education)

The first component of the system the department will implement is student management information. Many school districts in the state were already using one of three commercial student information system software packages. Some larger school districts were using systems they had developed on their own. Rather than require districts to change systems, the department decided to allow these vendors and school districts to change their software to meet department specifications. School districts without a system will be able to purchase one of the certified software packages through a statewide contract.

Each school district is required by the department to submit an implementation plan before state funding is released. Each school district must also test a data transmission plan with the department during the 1994-95 school year.

*Status of Implementation:*

As of April 1995, two of the three commercial software packages has been certified by the department as meeting their specifications. According to the department, one of these programs is scheduled for final certification by June 30, 1995. As of April 1995, the department has received 128 student management system implementation plans from the 139 school systems in the state, and approved 126 of those plans.

## **Educational Technology Innovation Grants**

The state Board of Education and the Tennessee Information Systems Council allocated one-time 1994-95 funding of \$3 million for innovative instructional projects. Since then the department has set aside \$400,000 of this money to the state's special schools<sup>22</sup> for educational technology. Innovative Instructional Project grants of up to \$100,000 were awarded to school systems for creative projects that incorporate instructional technology into the learning process. (See Appendix D.) Projects approved for funding were required to demonstrate original and innovative approaches to learning using technology. However, school systems could propose adapting a successful program to meet their specific needs. The grants were awarded based on evaluation by a team organized by the department. School systems receiving an award are required to provide matching funds based on their 1994-95 classroom equalization rate to make up the total awarded.

*Status of Implementation:*

The Department of Education issued a request for proposals to school systems in May 1994. Competitive grants were awarded to school systems based on evaluation by a team organized by the department.

The department awarded 31 technology innovation grants to school systems in September 1994. These grants ranged from \$28,250 (\$22,966 state share) to provide on-

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<sup>22</sup> Alvin C. York Institute, Tennessee School for the Blind, Tennessee School for the Deaf, Tennessee Preparatory School, West Tennessee School for the Deaf.

line access to library materials to \$610,000 (\$100,000 state share) to install a county-wide instruction server to communicate with elementary, middle, and high schools, as well as adults. A complete list of systems receiving these can be found in Appendix D.

## **Technology Development Partnerships**

The department has allocated \$3 million in technology appropriations for Technology Development Partnerships. Their purpose is to form partnerships between the state and software developers to develop educational software, Tennessee-specific multimedia products, distance learning projects, and other educational technology projects. Project developers must be sponsored by a major university within the state. A portion of the funding for this project would also be used to form a committee of subject area curriculum specialists to evaluate educational software recommended by Technology Coordinators.

### *Status of Implementation:*

As of April 1995, the department had not awarded any technology development partnerships. According to the Director of the Office of Education Technology, the reason for no awards is that available personnel were busy implementing other components of TEN. Because of administration budget cuts, the department is now considering using this money for other technology purposes, especially for maintaining schools' connections to the Internet.

## **Technology Audit Results**

The department performs technology audits of school systems to ensure that they have complied with the department's "21st Century Classroom Guidelines." As of May 1995, written reports on 64 of these audits had been completed and submitted in writing to the Office of Education Accountability. These audits also include a review of the school system's accounting system to ensure that they have adequately accounted for program funds. Overall, the department found that school systems have complied with the laws and guidelines of the program. However, the department found 20 school systems that had not complied with one or more provisions of the program. These violations included:

- One school system's 21st Century teacher had an adequately equipped classroom but had not attended state training as required by the department.
- Ten school systems violated *Tennessee Code Annotated* §49-2-203, which requires that all expenditures for equipment exceeding \$2,000 must be made through competitive bids solicited through newspaper advertisements or by use of a comprehensive vendor list. In one of these cases, the equipment was purchased from a teacher employed by the school system, in violation of *T.C.A.* §49-6-2003, which prohibits any teacher or other school officer from having a direct or indirect monetary interest in the sale of equipment to state public schools.
- Two school systems violated the program's requirement that personal computers used in the program be FCC Class B Certified. This certification ensures that computers can operate in close proximity with other electronic devices.
- One system could not be audited because it had not implemented its 21st Century Classroom program.

- One school system had not purchased the minimum equipment or spent the minimum amount per classroom required by program guidelines.
- Four school systems used specific brand names rather than generic descriptions in hardware bid descriptions. In one of these cases, the school system bid items as a bundle rather than as individual items, which could limit the number of bidders compared to individual item bids.
- One school purchased computer and printer consumable supplies (disks, ink cartridges, and toner) without department approval. The department does not allow purchase of consumables with 21st Century Classroom money.
- One school did not reasonably allocate the cost of hardware and software shared between instructional and non-instructional uses, as required by department policy.

As of May 1995, all of these problems had been resolved.

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## Key Implementation Issues

Effectively implementing technology over the long term appears to require the Department of Education and the State Board of Education to: (1) develop a technology policy that sets educational goals and objectives for technology; (2) prepare a detailed plan for measuring technology's effect on student learning; (3) evaluate software and its compatibility with state curriculum; (4) coordinate activities between those implementing technology and other divisions of the Tennessee Department of Education responsible for evaluating curriculum and measuring results; and (5) further train teachers to integrate technology into their classrooms and to meet specific curricular objectives.

### Need for a Technology Policy

The state Department of Education and the State Board of Education should work together to develop a technology policy to ensure that Tennessee's educational technology efforts are linked to attaining state curriculum and educational goals and objectives. Currently neither the department nor the board has a detailed technology policy indicating what will be achieved with technology and how it will be measured. Implementing technology without clear and measurable educational goals may result in millions of dollars spent without quantifiable results.

The Southern Regional Education Board (SREB) has published a guide to key elements of a state educational technology program. The SREB guide supports setting clear goals and objectives for technology, and measuring whether these are attained, suggesting: "Technology is most effective when it is used to fulfill an educational need or objective."<sup>23</sup> Among the factors the report suggests states should consider in their technology plan is whether the plan: coincides with state educational goals and mandates; addresses state accountability requirements; states means for using technology for student achievement and reports of progress; and shows a link between educational objectives and technology.<sup>24</sup> The SREB report states:

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<sup>23</sup> Jones, Sue, *The Key Elements of Effective State Planning for Educational Technology*, Southern Regional Education Board, p. 6.

<sup>24</sup> *Ibid*, p. 17.

One important task in the planning process is to clearly define your goals and objectives for educational technology. What you plan to accomplish will be limited by such factors as funding and human resources. You should consider these and other constraints when establish-ing [sic] your goals and objectives. Unrealistic promises can lead to doubts and a loss of support among your staff, teachers in the state, the legislature, and the voting public. If clearly defined, your goals and objectives will drive your remaining planning decisions.<sup>25</sup>

Closely tied to your goals and objectives will be the evaluation criteria used to measure whether established goals and objectives have been met. For this reason, it is important to begin planning for the evaluation process while you are defining your goals and objectives. Of primary consideration is how you will know that you have reached your objectives. The use of an independent third party can help lend credibility to the evaluation process.<sup>26</sup>

A technology plan prepared for the state Department of Education by Ernst and Young consultants also provides several recommendations related to curriculum integration and evaluation that do not appear to be a part of the current technology program:<sup>27</sup>

The Tennessee Department of Education should maintain a series of “Technology Targets,” or frameworks which describe the target configuration(s), usage and benefits for Tennessee classrooms by subject area or classroom type. These targets should provide guidance for school technology users. However, technology use should not be restricted to the targets. Innovation and creativity with instructional technology should be encouraged. (Recommendation IV.D.2, P.7)

Individuals charged with the responsibility for administering the Career Ladder Program should begin developing evaluation models which will accommodate the changing classroom and use of technology. (Recommendation V.A.1, P.13)

In formulating the objectives for the state curriculum guides for the various subject areas, the curriculum and instruction personnel should be cognizant of the recommendations for inclusion of technology that is discipline specific. Examples of these uses should be included in future curriculum guides with examples given for teacher use. This should not be limited to the math and science disciplines listed above. (Recommendation V.E.1, P.14)

The board had not published a final technology policy as of July 1995. The board approved the Tennessee Education Network Implementation Plan on July 30, 1993. According to one board staff member, the board was not consulted before the creation of the TEN project. The board has created an Education Technology Advisory Group composed of members of the board and technology experts from the private sector. Board staff indicate that as the approved plan has been initiated, the Board and the advisory

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<sup>25</sup> Ibid, p. 6.

<sup>26</sup> Ibid.

<sup>27</sup> *Long-Range Systems Plan: Strategic Plan for the 21st Century Classroom*, Ernst & Young, Tennessee Department of Education, 1991.

group have been working to establish a more comprehensive technology policy and plan. The draft technology policy provided to the Office of Education Accountability in response to the draft of this report is dated June 7, 1995. (See Appendix E.)

The Executive Director of the Board of Education and the chair of the board's Technology Advisory Group indicated that the ideas in their February 1994 draft technology policy were incorporated into the Master Plan for Education. The Master Plan for Tennessee Schools 1994 has eight key result areas for education. Technology is one of these key result areas. The technology content in the Master Plan is only two pages. The goal for education stated in this document is as follows:

Goal: State-of-the-art technology will be an integral part of instruction and learning in all schools. Technology will be used to provide professional development, manage schools and school systems, and link all school systems in a statewide information network.

However, the master plan indicates only three progress indicators for technology in the classroom. These progress indicators do not appear to directly link ways the board will ensure that technology will improve learning in the classroom. These indicators are: (1) the number of classrooms with technology, (2) the number of teachers trained in the use of instructional technology, and (3) the number of school systems successfully using the Tennessee Education Network.<sup>28</sup>

The 1995 Master Plan for Tennessee's schools also does not specifically state educational objectives and goals for technology. The plan indicates that the goal for technology is to improve student learning. The board added two additional progress indicators to the 1994 plan's measures: teacher feedback and student performance. Student performance is the ultimate measure of how technology has improved learning. However, there is no indication of how this will be measured.

Implementing technology in Tennessee's schools will require more than generalities about the future and transforming schools through technological hardware. Successful implementation will require the board and the department to set specific educational goals for technology. It will require a reassessment of how students can best learn, how curricula must be adapted for technology, and how technology will affect the classroom.

***Department of Education comment:***

Early in the implementation of the 21st Century Classroom program, as a result of the Education Improvement Act and 21st Century Challenge, several key result areas were identified. This past year the Office of Education Technology has worked with the State Board of Education's Technology Advisory Group to develop a long-range plan for education technology. More work will be done in the coming year to refine this plan.

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<sup>28</sup> According to board staff, TEN was used around the time that this document was prepared to refer to the statewide information network rather than to the entire technology program. However, all documents provided by the Department of Education identify TEN as encompassing four components: 21st Century Classrooms, teacher technology training, a statewide management information system, and a telecommunications network.

## **Need for Plan to Evaluate Program**

The Board of Education and the Department of Education should evaluate the impact of Tennessee's technology program on classrooms and student learning. The board and the department do not have formal detailed plans for assessing the program. The board and the department need to identify the most effective practices in classrooms, the effect of technology on student outcomes, and if state curriculum/educational goals are being met. If the program is not evaluated, the state will not have information as to which technology applications produce the greatest impact on learning. Without this information, the state cannot determine how to apply future technology funding. In addition, the state will not know technology's contributions to meeting state curriculum, learning, and student progress goals. If technology improves learning, fairness may dictate that the state ensure access to these resources to all students. If technology does not improve learning, policy makers should know this before spending additional tax dollars.

The Board of Education's February 1994 draft technology policy, never formally adopted, contains the following strategy for evaluating the 21st Century classroom program:

- E. Recognize that not all teachers are equally prepared to integrate technology into the classroom. Independent evaluation of 21st century classrooms shall be initiated.
  - 1. Determine exceptional 21st century classrooms and identify what makes them exceptional. Spotlight and showcase these examples to replicate where possible.
  - 2. Determine inadequate use of 21st century technology. Provide additional training and support where feasible. Relocate equipment or teacher where technology and teaching style are incompatible.
  - 3. Institute studies to determine the effects of 21st century classroom technology on TCAP scores and value added assessment.

The board's June 7, 1995, draft technology plan does not contain provisions for independent evaluation of the program or studies to determine the effects of technology on TCAP scores and value added assessment. That draft does include provisions for developing criteria for evaluating impact on student learning, developing criteria and a process for evaluating quality of student learning opportunities, and showcasing exemplary classroom technology programs.

Department staff indicated in September and October 1994 that there were no plans to evaluate the program, because of staff restrictions and lack of suitable measures for evaluating the program. One State Board of Education staff member interviewed indicated that the TEN program should have started with what was to be accomplished with the technology, then determined what technology was needed—however, the program did just the opposite.

Board and department staff indicated in December 1994 that the state could use TCAP scores, promotion rates, and attendance rates as well as information from the Tennessee Value Added Assessment System (TVAAS) to evaluate the program's effect on student learning. Both board and department staff indicated that Dr. William Sanders, the developer of TVAAS, had been preliminarily contacted to determine whether he could

separate out data to compare the 21st Century Classrooms with the regular classrooms. According to these staff, Dr. Sanders said that he could do this.

Presently, the Tennessee Value Added Assessment System (TVAAS) does not address resource differences between teachers. The TVAAS was designed to measure academic growth of students over time. It does not claim to be able to measure the specific reasons for differences in learning or achievement within particular groups of students. According to an overview of the TVAAS published by the University of Tennessee:

TVAAS was conceived as a method of estimating the academic growth of each student over his or her school career in each subject. It does not suggest or prescribe a particular method for encouraging this growth. How you help your students learn is your decision.<sup>29</sup>

### ***Need to Determine Success of Program for Future Allocation of Money***

The state will need information to make decisions concerning allocation of tax dollars for technology. According to the Tennessee Education Network Implementation Plan, “The Goals of the 21st Century Classroom Project include bringing appropriate instructional technology to every classroom in Tennessee by the end of the decade.” However, it is unlikely the state will have adequate funds to equip all classrooms with 21st Century technology. While the state has invested almost \$64 million for 4,142 21st Century Classrooms (\$15,451 per classroom) in fiscal years 1994 and 1995, these classrooms represent less than nine percent of the state’s 47,377 classrooms. The original long-range 21st Century Classroom plan prepared for the state by its consultant estimated the cost of implementing technology over 10 years could cost over \$1 billion. It would cost the state over \$668 million to equip the rest of the state’s classrooms at present expenditures per 21st Century Classroom.

According to the Chair of the State Board of Education’s Technology Advisory Group, the board’s goal is to decrease the cost per classroom to half of the present cost. This could be accomplished in part through networking computers within schools to allow them to share software. However, even if this is accomplished, over \$300 million would be needed to equip state classrooms with technology.

If the state cannot afford to equip all classrooms with technology, clearly money should be allocated where it will be most effective. Quality information concerning how technology is succeeding or failing will facilitate this process.

### ***Technology’s Impact on Student Performance***

Overall, research indicates that learning technology can improve student performance. In general, studies have found that students can learn more effectively from computers and that computer-based education has generally positive effects on students. However, research findings clearly conclude that performance varies. In addition, some have criticized the methods used to arrive at the conclusions in these studies.

The Metropolitan Educational Research Consortium (MERC) at Virginia Commonwealth University recently analyzed and summarized 184 studies of the impact of

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<sup>29</sup> Sanders, William L., and Horn, Sandra, *An Overview of the Tennessee Value-Added Assessment System (TVAAS) with Answers to Frequently Asked Questions*, University of Tennessee, p. 7.

technology on learning. Their review found that research overall indicates that learning technologies significantly enhance student performance.<sup>30</sup> However, the analysis also found substantial fluctuations in results. According to the researchers, 32 percent of the studies indicated that technology had an insignificant effect on learning, 19 percent showed it had a moderate effect, and 49 percent indicated a substantial effect on student learning.<sup>31</sup> The findings clearly suggest that technology has an important but not independent impact on learning.<sup>32</sup>

The MERC study also found variations in effectiveness by technology teaching method, grade level, and subject. For instance, Computer Assisted Instruction (CAI) and Integrated Learning Systems (ILS) applications were found to be most effective for teaching mathematics and language arts.<sup>33</sup> Younger students were found to benefit more than older ones from the highly structured materials (small steps and immediate feedback) in drill and practice, tutorial, and managed instruction.<sup>34</sup> (For descriptions of various methods, see pages 4-5.)

Studies to determine the impact of computers on learning have been criticized on several grounds. One criticism is the extreme difficulty of controlling for variables other than the technology itself, making it difficult to assess the impact of the technology alone. For instance, instructional methods, teacher and student characteristics, the curriculum and the context in which it is taught, and other environmental variables will interact to produce a particular outcome.<sup>35</sup> It has been suggested that students may learn more through technology because of the improved instructional methods and materials brought by technology rather than the equipment.<sup>36</sup>

Studies similar to the MERC study also have been criticized because they statistically combine the results of many studies to obtain an overall result. This is often done because of the small sample sizes or other perceived weaknesses in individual studies. Therefore, the combined result may gloss over some of the weaknesses of the individual studies.<sup>37</sup>

### ***Traditional Evaluation Models May Not Work***

The department and the State Board of Education have indicated that they will use existing measures to evaluate the impact of technology on learning. However, these scores may not indicate the circumstances in which technology works best. Traditional evaluation methods may not adequately evaluate the impact of technology or control for conditions occurring during implementation of learning technology. In short, evaluating the effect of technology by comparing 21st Century Classrooms with regular classrooms may not accurately and completely measure the impact of technology on student learning.

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<sup>30</sup> Pisapia, J. & Perlman, S., pp. 16, 24.

<sup>31</sup> Ibid.

<sup>32</sup> Metropolitan Educational Research Consortium (MERC), p. 11.

<sup>33</sup> Ibid, p. 24.

<sup>34</sup> Pisapia, J. & Perlman, S., p. 19.

<sup>35</sup> Means, Barbara, editor, *Using Technology to Support Education Reform*, Office of Educational Research and Improvement, U. S. Department of Education, September 1993, p. 75.

<sup>36</sup> Pisapia, J. & Perlman, S., p. 24.

<sup>37</sup> Bork, Alfred. "Is Technology-Based Learning Effective?," *Contemporary Education*, Vol. 63, No. 1, Fall, 1991, p. 10-11.

Comparing student performance after being taught with or without learning technologies involves several problems. One serious problem is the difficulty of creating a comparable control group. Differences other than the use of computers in most comparison studies may distort the results of these types of studies.<sup>38</sup> For instance, in a simple comparison it is not clear how the effect of technology will be separated from the impact of individual teachers. One might suspect that teachers who volunteer or are selected for 21st Century Classrooms as a group are among the best teachers in the state. Those volunteering for 21st Century Classrooms are certainly more interested in using technology to teach students.

Teachers may also use technology in a variety of ways. Some teachers may use technology mainly to enhance traditional lecture presentations by presenting pictures or videos to support their presentation. Other teachers may have students working individually on interactive computer programs that teach a fixed set of skills or information. Still other teachers may have students working together in small groups on the computer with a program that requires them to collaborate, evaluate information, and arrive at group decisions.

It has been suggested that comparison studies “can be valuable and reliable guidelines for policy decisions when the effect of the learning technology is isolated as much as possible, when it is supplemented by evaluations focusing on the process and learning situations, and when the results are used as interpretative trends.”<sup>39</sup>

### **Traditional Achievement Measures**

Researchers warn against using traditional achievement measures as indicators of the impact of technology on learning, because they do not measure or control for conditions during implementation. These conditions include: (1) implementation of technology over several years; (2) computers used in many ways for different purposes; (3) extensive use of learning technologies too new to be supported by systematic research about their effectiveness; and (4) schools with poorly defined learning objectives for technology.<sup>40</sup> The use of standardized tests to compare the effects of technology versus other means has been criticized because the test will show more positive results for the teaching method most similar to the test.<sup>41</sup>

Further, current techniques may more effectively test basic skills or knowledge than more complex thinking and problem-solving skills.<sup>42</sup> The International Society of Technology Education (ISTE) has declared that new assessment technologies must be developed to complement and eventually replace conventional tests. These new assessments must reflect new curricula, ways of learning, and environments.<sup>43</sup>

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<sup>38</sup> Clark, R. E., “Evidence for Confounding in Computer-based Instruction Studies: Analyzing the Meta-analyses,” *Educational Communications and Technology Journal* 33(4). Cited in Metropolitan Educational Research Consortium (MERC), p. 66.

<sup>39</sup> Pisapia, J. & Perlman, S., p. 11.

<sup>40</sup> Wilder, G., and Fowles, M., “Assessing the Outcomes of Computer-based Instruction: The Experience of Maryland,” *T.H.E. Journal*, 1992. pp. 82-84. Cited in Metropolitan Educational Research Consortium (MERC), p. 67.

<sup>41</sup> Means, Barbara, editor, *Using Technology to Support Education Reform*, p. 75.

<sup>42</sup> Office of Technology Assessment, *Power On!: New Tools for Teaching and Learning*, U.S. Congress 1988. Cited in Metropolitan Educational Research Consortium (MERC), p. 67.

<sup>43</sup> Metropolitan Educational Research Consortium (MERC), p.67.

## ***New Approaches to Assessment***

Various education researchers and practitioners have proposed new approaches to measuring the impact of technology on learning to remedy the problems associated with comparison studies and traditional measures. One approach called “contextualized research” seeks to provide “detailed descriptions of specific implementations”: “This approach to studying the effects of technology-based innovations focuses on understanding the relationships among various elements in the project, and the variables that contribute to specific outcomes, rather than to declare the innovation as more or less effective than some other approach.”<sup>44</sup> Conceptualized research examines how technological changes in the classroom interact with variables such as classroom environment and individual student attributes to produce changes in learning.<sup>45</sup>

A related means of examining technology’s impact has been called “compelling examples.”<sup>46</sup> This approach attempts to describe the unique contributions of technology in the classroom. For instance, computers may enhance learning in some cases because of their interactive capabilities. One problem with compelling examples is that they are less quantitative than traditional measures of educational success. This requires that leaders and educators determine the kinds of examples that prove to them the effectiveness of technology on learning.<sup>47</sup>

## ***The Maryland Education Project***

The Maryland Education Project is one effort to evaluate the impact of technology using new assessment approaches. The Maryland Education Project is a joint effort between the Potomac Edison Company, the Maryland Department of Education, six school systems, and seven universities in Maryland. The project is “an effort to integrate computers into the learning processes of all disciplines represented in the Maryland public schools, grades K through 12.” The project has been phased in, beginning with elementary schools, since 1987-88. Local schools and school districts decide how computers are used and the grade level of their use.<sup>48</sup>

The Assessment Measures Task Force formed by the project decided against a standard evaluation for the entire project. This decision was based on the fact that each school or district is in control of how technology is used. Therefore, the task force involved school administrators and teachers in developing an evaluation process. The process task force provided general guidelines for teachers to collect student work samples “that appeared to demonstrate the unique contributions of the computer to the learning process.”<sup>49</sup> These work samples include a “context,” including hardware and software used, class and subject area, assignment producing the sample, ability level of students, the learning effect demonstrated by the work sample, and how well the sample would apply to other classes.<sup>50</sup>

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<sup>44</sup> Means, Barbara, editor. *Using Technology to Support Education Reform*, p. 76.

<sup>45</sup> Ibid, pp. 76, 78.

<sup>46</sup> Bork, Alfred, p.12.

<sup>47</sup> Ibid, pp. 12-13.

<sup>48</sup> Fowles, Mary E. and Wilder, Gita, *Maryland Education Project: Assessment Measures Task Force Report*, Educational Testing Service, Spring 1991, pp.1-2.

<sup>49</sup> Ibid, p.2.

<sup>50</sup> Ibid, p.3.

After work samples were collected, they were grouped into categories:

As the teachers discussed how computers had enhanced teaching and learning in their own classrooms they began to recognize that the ways in which computers clearly made a difference in the way students learn and the way teachers teach clustered into a limited number of categories. These categories, called “domains” for the purposes of this project, were further discussed and refined by the Task Force in a subsequent meeting....As they discussed the effects of using computers in their classrooms, the teachers agreed to focus on areas (domains) in which the computer appeared to be making a real difference in instruction, rather than offering an alternative medium for “usual” classroom activities.<sup>51</sup>

An approach similar to Maryland’s may allow Tennessee to determine the positive contributions of technology to learning and provide guidance for future allocation of state funding for education technology.

***Department of Education Comment:***

When the 21st Century Classroom began in 1993, [the department’s] major effort was to make sure it got off to a good start. [The department’s] primary objective was for teachers to obtain competency in the basic skills and have enough time to incorporate the new technology into their teaching style. Since the program was relatively new, it would have been premature to evaluate it at such an early date. However, the time has now come to try to assess our efforts. In doing this, not only will [the department] have to use conventional testing methods, but will certainly have to develop fresh techniques for measuring the impact of the new technology on learning.

**Need for Software Evaluation**

The board and the department should consider evaluating software and its compatibility with state curriculum. Neither the board nor the Department of Education have specific plans to evaluate or approve software or other computer media or their various impacts on the classroom, although computer software purchased by schools can significantly change classroom routines. In 21st Century classrooms, software alone can also become a major portion of the curriculum, if not the entire curriculum. One laser disc or CD-ROM can contain many books that may be used by a teacher in the classroom. For instance, several CD-ROMs widely available contain entire encyclopedias. However, the board’s position has been not to dictate to school systems specific laser discs, CD-ROMs, or software to purchase.

Staff of the board and the department indicate that it would be an overwhelming and perhaps impossible task for the state to evaluate the thousands of different software programs available. However, if it is overwhelming for the state, it is not clear how some school systems, particularly those with fewer resources, will be able to handle this task. Although the department provides teachers with a software evaluation checklist, it may be unreasonable to expect teachers to individually evaluate software programs. It is doubtful that most teachers have the time or resources to make comparisons among all of their software options. Teachers may be able to determine whether a specific program appears

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<sup>51</sup> Ibid, p.3.

to meet their needs. However, there may be other programs that have been proven more effective or that are more cost-effective over a wider range of skills.

The state has an approval process to assure that textbooks meet state curriculum standards. The state Textbook Commission, created by *Tennessee Code Annotated* §49-6-2201, recommends textbooks to the Board of Education for approval. The commission contracts with approximately 30 teachers in the subject areas of the textbooks to be reviewed each year. Teachers review textbooks against Department of Education curriculum frameworks and current research in each subject.

The commission also sets the retail price for approved textbooks. The commission consists of 10 members—seven educators and one layperson from each grand division of the state. The Commissioner of Education is the ex officio Secretary of the Commission.

The commission has cited several benefits from reviewing textbooks. One benefit is that school systems are also guaranteed that adopted titles have been reviewed against the curriculum frameworks approved by the State Board of Education. The reviews are provided to school systems to assist them in selecting books that best meet their needs. According to the commission, another benefit is that the state's contract with textbook publishers guarantees local school systems that adopted books will be available at the lowest price in the nation for six years. The commission estimates that the state contract saves about \$5 million per year in local textbook purchases. Overall, the commission has concluded that the process provides order while giving local committees flexibility in selecting textbooks.<sup>52</sup>

Even though Tennessee has adopted the concept of school based decision making, it would seem efficient and helpful to provide a list of suggested software from which systems could choose.

***Department of Education comment:***

This is an important concern for our teachers and [the department] is currently studying how to remedy it. The basic problem is how to deal intelligently with an overwhelming number of software products. There are several ways to approach this issue. One suggestion is to put the burden on the software vendor. In order to be placed on the recommended list, a vendor will be required to show in detail that his product meets the criteria of the Tennessee curriculum. Another suggestion is to set up a database on the Internet in which teachers could list software which they feel is of particular benefit for their grade level.

**The Department Should Improve Coordination among Staff Implementing Technology, Other Divisions of the Department and the Board of Education**

Department staff in charge of the Division of Curriculum and Instruction and the Division of Accountability as of fall 1994 indicated that they had no involvement with the programs of the Office of Education Technology; that office is responsible for implementing the components of the 21st Century program. According to a Board of Education staff member, the board was not consulted before the creation of the TEN

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<sup>52</sup> Written response to questions from the Division of State Audit, Comptroller's Office; prepared for the Joint Government Operations Committee for Sunset public hearing, July 13, 1994.

project. The board did approve the TEN implementation plan, and has requested and received status reports on the implementation of TEN at each board meeting.

The stated goal of the department as well as the State Board of Education is to improve student learning through technology. Both the department and the board have the goal of implementing technology into the curriculum. However, it seems that accomplishing these goals would require the involvement of the divisions of the department that are responsible for developing and evaluating schools' curriculum and determining whether schools are achieving educational goals.

The Division of Curriculum and Instruction has been responsible for approving the design and development of curriculum materials used in schools. The division also has evaluated and approved programs, and conducted workshops for teachers in mathematics and science. Curriculum specialists from the division also provided technical assistance and in-service training to local school personnel.

The division also has operated several technology programs, including the Elementary Computer Project and the Secondary Technology-Based Instructional Project. The Elementary Computer Project has consisted of five local education agencies in a project to identify and define materials and procedures that enhance the teaching of writing in the primary grades by using computer-based instruction. The Secondary Technology-Based Instructional Project has consisted of 20 high schools in a project to maximize the use of technology to prepare students for success in higher education and the work place.

The Division of Accountability has been responsible for the school approval process, reviewing school system compliance with accountability standards, issuing annual reports on school and school system progress in meeting performance goals, and student assessment.

The department recently reorganized all divisions under two Assistant Commissioners. One Assistant Commissioner will be in charge of curriculum and instruction, special education, vocational education, and coordinating teacher training activities. The other Assistant Commissioner is in charge of finance and administration, accountability, and education technology. Because education technology will still be in a separate division from curriculum and instruction, there will continue to be a need for coordination and communication between these divisions.

***Department of Education comment:***

Certainly [the Office of Education Technology] should coordinate our activities with the other divisions to insure that curriculum and technology are suitably integrated. The Office of Education Technology has made and will continue to make every effort to communicate properly with the other divisions, and we will endeavor to strengthen these relationships in the future.

**The Department Should Continue to Integrate Technology with Curriculum**

The Department of Education should continue to develop training that will enable teachers to integrate technology with the state-approved curriculum. The stated goal of the 21st Century Classrooms project is to teach students through the use of technology.

Therefore, teachers need to learn how they can teach the state curriculum with technology. They also need to learn as many of the technology options available to them as possible. Educational software comes in many forms, the usefulness of which may vary according to curriculum needs and the needs of classroom students. Therefore, teachers need to learn how to maximize the effectiveness of their equipment and their software. Teachers also need information about which software is available, when it is most effective, and how it will help them teach specific curriculum components. The United States Office of Technology Assessment has observed that technology's success in schools depends upon teacher training, information on available technologies, when teachers should use them, and why they make a difference.<sup>53</sup>

Teachers express a need for training in integrating technology with curriculum. Teachers responding to a survey by the Office of Education Accountability on average rated their technology training an average of 2.4 on a scale of 1 to 4 (1=Excellent, 2=Good, 3=Fair, 4=Poor) when asked how well their 21st Century Classroom training prepared them to use computer hardware and instructional software to meet state curriculum goals for their classroom. Fourteen percent of the teachers rated their training excellent, 44 percent good, 28 percent fair, and 14 percent poor. Out of 700 21st Century Classroom teachers surveyed, 318 responded.

Teacher responses also indicate that many teachers desire additional training in integrating technology and curriculum. Eighty-five percent of the teachers responding indicated that they would like additional training. Seventy-seven percent of those teachers indicated they want training to integrate the use of technology with teaching the state's curriculum.

Because of the feedback from teachers, the Department of Education has improved its training in this area. For instance, the department prepared and distributed a package of integration activities for 21st Century Classroom teachers in September 1994. Trainers have also been stressing integration during teacher training sessions. For example:

- Teachers are allowed time during their training to view and evaluate software packages for their classroom from the department's software database library. Software in the database is categorized as primary level, intermediate level, and middle school level.
- During their training, teachers are taught the basic categories of instructional software (e.g., drill and practice, simulation), types of software (e.g., database, word processing, spreadsheet), and examples of programs.
- Teachers are provided guidelines for evaluating instructional software, and a checklist to help teachers review software documentation, preview new programs, integrate software into their lesson planning, and evaluate the effectiveness of software in achieving their learning objectives.
- The department has created a packet of activities called "Integration Activities for 21st Century Classroom Teachers." This material consists of reproduced activities from various sources including some Tennessee teachers. However, according to department staff, this material is only distributed to teachers—it is not part of the training activities.

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<sup>53</sup> Scrogan, Len, p. 80.

- Some limited written information is provided to teachers concerning various types of “optical technology” such as CD-ROM and laser disc, and some of the uses and advantages of these tools.
- The state has joined the Educational Products Information Exchange (EPIE) Consortium of States, a group dedicated to improving software selection. The group provides computer CD-ROM disks that contain information on instructional and educational software by type of computer (e.g., IBM compatible or Macintosh), grade level, or subject area. The disks also contain product reviews and prices. These disks are provided to all school systems to assist in software selections.

Written materials provided to teachers contain little specific guidance or information about specific programs or types of programs and their relative effectiveness. For instance, a teacher may need to know:

- Research findings concerning what types of software or ways of presenting material appear to be most effective for teaching specific subjects, skills, or grade levels.
- Which types of software are best for teaching specific elements in the state’s curriculum guide.
- How to decide whether it is more effective to have students work together on computers or alone, and whether this varies by the subject or skill they want to teach.
- Are there areas where non-technological teaching methods are more effective? How can the teacher devise the proper mix of technological and non-technological classroom activities?

Teachers may need freedom to use technology in their classrooms creatively. However, the department should use its resources to the extent possible to enable teachers to effectively accomplish the overall education goals of the state.

***Department of Education comment:***

[The department] is very much aware of the need to do this. We have revised the curriculum emphasizing integration activities. In addition, we are offering special workshops showing teachers how to integrate subjects effectively. Efforts are underway to develop additional training programs in partnership with higher education.



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# Administrative Alternatives

The Department of Education and the Board of Education may wish to consider some or all of the following alternatives for technology implementation.

- The Board of Education should work with the Department of Education to develop a detailed technology policy indicating what should be achieved with technology, how it will be measured, and how they will ensure that Tennessee’s educational technology efforts are linked to attaining state curriculum and educational goals and objectives.
- The Board of Education and the Department of Education should develop a plan for evaluating the impact of technology on schools and student learning. The plan should outline specific strategies for identifying the most effective uses of technology in classrooms, the contributions of technology to student learning, and technology’s impact on state curriculum and educational goals.
- The Board of Education and the Department of Education should develop a process for evaluating software in use in Tennessee classrooms. The process should identify both effective and ineffective programs, how programs are effective, the situations where they are most effective (e.g., grade levels, subjects) and how the programs relate to state curriculum goals.
- The Department should improve coordination between staff implementing technology, other divisions of the department and the Board of Education. Implementing technology into the curriculum would appear to require the involvement of those responsible for developing and evaluating schools’ curriculum and determining whether schools are achieving educational goals.

## Appendix A Persons Contacted

James Abernathy  
Acting Assistant Commissioner  
Tennessee Department of Education

Tom Cannon  
Assistant Commissioner  
Tennessee Department of Education

Gary Cox  
Auditor  
Tennessee Department of Education

James DeMoss  
Executive Assistant  
State Board of Education

Karan Duke  
Consultant  
Seltmann, Cobb, and Bryant

Deborah Gilliam  
Director of Research and Information Services  
Tennessee Department of Education

Donna Harris  
Director of Information Systems  
Tennessee Department of Education

Mary Jo Howland  
21st Century Classroom Technology Centers  
Supervisor  
Tennessee Department of Education

Claire Kahane  
Director of 21st Century Classroom Program  
Tennessee Department of Education

Vic Mangrum  
Director, Office of Education Technology  
Tennessee Department of Education

Phyllis Pardue  
TEN Administrative Coordinator  
Tennessee Department of Education

Roger Pelham  
TEN Project Coordinator  
Tennessee Department of Education

Dr. C. Brent Poulton  
Executive Director  
State Board of Education

Fielding Rolston  
Member-State Board of Education  
Chair- Technology Subcommittee

Peggy Smith  
Coordinator, Instruction and Professional  
Development  
Tennessee Education Association

Chris Steppee  
Audit Director  
Tennessee Department of Education

Kathy Woodall  
President  
Tennessee Education Association

## Appendix B

# Survey of 21st Century Classroom Teachers

Name \_\_\_\_\_ Home Phone \_\_\_\_\_  
(Name and phone number will be kept strictly confidential)

1. How many students are in your 21st Century Classroom? \_\_\_\_\_
2. How many 21st Century Classroom program computers are in your 21st Century Classroom? \_\_\_\_\_
3. To what degree did you participate in deciding which instructional computer **software** would be used in your 21st Century Classroom?  
\_\_\_\_ I chose the software by myself  
\_\_\_\_ Others chose the software without my input  
\_\_\_\_ It was a joint decision that I participated in  
\_\_\_\_ Other (please specify) \_\_\_\_\_
4. If you replied that others made the decision, or that it was a joint decision, please identify the position(s) of those who chose your software.  
\_\_\_\_\_
5. Did you have an opportunity to preview the computer **software** chosen for your 21st Century Classroom before a decision was made? \_\_\_\_ Yes \_\_\_\_ No
6. To what degree did you participate in deciding which computer **hardware** would be used in your 21st Century Classroom?  
\_\_\_\_ I chose the hardware by myself  
\_\_\_\_ Others chose the hardware without my input  
\_\_\_\_ It was a joint decision that I participated in  
\_\_\_\_ Other (please specify) \_\_\_\_\_
7. If you replied that others made the decision, or that it was a joint decision, please identify the position(s) of those who chose your hardware.  
\_\_\_\_\_
8. Did you have an opportunity to preview the computer **hardware** chosen for your 21st Century classroom before a decision was made? \_\_\_\_ Yes \_\_\_\_ No
9. Please identify the configuration of your 21st Century Classroom:  
\_\_\_\_ Stand-alone computer units with individual software.  
\_\_\_\_ Computer terminals connected to a central computer server.  
\_\_\_\_ Computers in classroom can be used either as stand-alone units or to access a central computer.  
\_\_\_\_ Other configuration (Please specify). \_\_\_\_\_  
\_\_\_\_ The technology in my classroom is not in operation.  
\_\_\_\_ Don't know.
10. Are the computers in your 21st Century Classroom connected to a printer? \_\_\_\_ Yes \_\_\_\_ No

## Appendix C

### 21st Century Classroom Funding Allocation Fiscal Year 1996

System	New Classrooms	Total	State	Local
Anderson County	5	\$101,125	\$76,101	\$25,024
Clinton City	1	20,225	15,220	5,005
Oak Ridge	4	80,900	60,881	20,019
Bedford County	4	80,900	64,294	16,606
Benton County	2	40,450	33,498	6,952
Bledsoe County	1	20,225	17,654	2,571
Blount County	8	161,800	123,355	38,445
Alcoa City	1	20,225	15,419	4,806
Maryville City	3	60,675	46,258	14,417
Bradley County	6	121,350	84,750	36,600
Cleveland City	2	40,450	28,250	12,200
Campbell County	4	80,900	67,710	13,190
Cannon County	2	40,450	36,309	4,141
Carroll County	0	0	0	0
Hollow Rock-	1	20,225	17,580	2,645
Huntingdon SSD	1	20,225	17,580	2,645
McKenzie SSD	1	20,225	17,580	2,645
South Carroll SSD	1	20,225	17,580	2,645
West Carroll SSD	1	20,225	17,580	2,645
Carter County	4	80,900	64,370	16,530
Elizabethton City	1	20,225	16,092	4,133
Cheatham County	7	141,575	131,076	10,499
Chester County	2	40,450	36,464	3,986
Claiborne County	4	80,900	71,432	9,468
Clay County	1	20,225	17,498	2,727
Cocke County	4	80,900	70,531	10,369
Newport City	1	20,225	17,633	2,592
Coffee County	2	40,450	30,573	9,877
Manchester City	1	20,225	15,287	4,938
Tullahoma City	3	60,675	45,860	14,815
Crockett County	1	20,225	18,320	1,905



# **Appendix E**

## **State Board of Education**

### **Draft Education Technology Long-Range Plan**

#### **Submitted to Office of Education Accountability June 7, 1995**

#### **Introduction**

The Tennessee State Board of Education has adopted a vision of public education excellence. The Board's 1995 Master Plan for Tennessee schools states the vision and defines the goals and strategies necessary to achieve it. Realization of the vision and its related goals requires changes in our schools and in our thinking about how we educate students.

The General Assembly's commitment to a technology initiative in 1992 creates a remarkable opportunity to advance schools toward that vision. This initiative has been guided by a state technology plan prepared by the State Department of Education and adopted both by the State's Information Systems Council and the State Board of Education. While this initiative is well underway, it is best viewed as a start-up initiative. There is a need for a long-range plan to guide future development of the initiative. The Education Technology Long-Range Plan responds to this need.

The Education Technology Long-Range Plan is targeted at six goals:

- Goal I: Student learning will be improved through the use of classroom technology.
- Goal II: Student learning opportunities will be expanded beyond the classroom.
- Goal III: New and experienced teachers will have the necessary professional development to use technology.
- Goal IV: Practitioners and researchers in technology development will work together to improve products and applications.
- Goal V: A management information system will assist management of local school systems, improve communication between school systems and the state, and direct state policy-making and resource deployment.
- Goal VI: Involvement in the development and implementation of (state) technology initiatives will be broad-based and include education, research and technology constituencies.

The plan is organized similarly to the Master Plan. For each goal, the basic strategies to be pursued are specified. In addition, progress indicators are identified for use as the basis for measuring progress.

Success is ultimately dependent upon several organizations following through with specific activities. These activities are also identified (to be done).

In summary, the plan lays out what is needed to be done to fully exploit technology to improve education, the strategies to be pursued and specific activities. It provides direction, a basis for monitoring progress and a basis for determining needed adjustments.

#### ***Goal I: Student learning will be improved through the use of classroom technology.***

Strategies:

1. Integrate technology into instruction and into curriculum development.
2. Use technology to promote active learning.

3. Develop criteria for evaluating impact on student learning.
4. Require school systems to submit a long-range technology plan, including desired results.
5. Involve teachers in planning and evaluation of technology plans, hardware and software.
6. Provide funding for technology in the BEP formula.
7. Ensure that announcement of state technology funds occurs prior to local budget adoption.
8. Provide State Department staff assistance to school systems needing initial technology support.
9. Develop guidelines regarding technology maintenance for local school systems.

Measures:

1. Improved student performance.
2. Percent of 21st Century Classrooms.
3. Teacher feedback about involvement.
4. Local system progress beyond state plan.
5. Number and quality of technology plans.
6. Level of BEP funding for technology.
7. Requests for assistance from SDE.

***Goal II: Student learning opportunities will be expanded beyond the classroom.***

Strategies:

1. Develop statewide networking capabilities for access.
2. Provide guidelines for computer networking in every school.
3. Ensure network training and local accessibility to the statewide network.
4. Involve classroom teachers in planning and evaluation.
5. Develop criteria and process for evaluating quality of learning opportunities available to students.
6. Link networking to classroom instruction.
7. Develop local products that can be shared via networks.

Measures:

1. Number of school systems with access to state network.
2. Number of network training opportunities and number of participants.
3. Teacher feedback on planning and instructional uses of networks.
4. Number of local products shared through networks.

***Goal III: New and experienced teachers will have the necessary professional development to use technology.***

Strategies:

1. Require teacher education institutions to prepare teachers using the instructional technology knowledges and skills in the Board's Teacher Education Policy.
2. Involve classroom teachers in planning and evaluation of professional development for technology, including technology use and software selection.
3. Promote establishment of school system and higher education partnerships and cooperatives for technology training, as well as other contracted arrangements.

4. Encourage the development of Regional Centers for classroom technology training.
5. Include administrators in technology training.
6. Promote the use of distance learning for professional development.
7. Evaluate and continually improve the technology training curriculum and professional development program.
8. Continue the 21st Century Classroom teacher training program.

Measures:

1. Number of teacher education graduates with appropriate technology skills.
2. Numbers of partnerships between higher education and school systems.
3. Number of regional centers, or other arrangements to provide training.
4. Number of trained administrators.
5. Number of teachers trained through 21st Century Classroom programs.

***Goal IV: Practitioners and researchers in technology development will work together to improve products and applications.***

Strategies:

1. Develop and implement Technology Development Partnerships.
2. Overcome barriers created by accreditation standards.
3. Network K-12 classrooms with higher education institutions.
4. Promote and fund classroom technology projects that are clearly innovative.
5. Develop a clearinghouse of exemplary classroom technology programs and showcase them.
6. Encourage local education partnerships with business to provide improved and creative access to information and communication technologies.

Measures:

1. Number of Technology Development Partnerships.
2. Number of innovative programs funded.
3. Clearinghouse use.
4. Number of business/education partnerships that increase technology access.

***Goal V: A management information system will assist management of local school systems, improve communication between school systems and the state, and direct state policy-making and resource deployment.***

Strategies:

1. Ensure the management system is equally beneficial to school systems and the state.
2. Develop and maintain a comprehensive student database.
3. Develop criteria and process for validating and evaluating student data.
4. Use database information at the local level to identify student needs and improve learning.
5. Protect security of databases.
6. Increase funding for the management information system (including funds for items such as file servers, cabling, etc.).
7. Develop a plan to provide each teacher with access to appropriate student and school information.

Measures:

1. Number of school systems with information management system in use.
2. School system and state feedback.
3. Increase in funding to maximize system effectiveness.
4. Number of teachers with access.

***Goal VI: Involvement in the development and implementation of (state) technology initiatives will be broad-based and include education, research and technology constituencies.***

Strategies:

1. Expand the State Board of Education Technology Advisory Group to include educational constituencies affected by technology.
2. Request a periodic progress report and timeline and update from the Education Technology Advisory Group.
3. charge the Educational Technology Advisory Group with evaluation of the long range plan over an extended period of time, and with responsibility to recommend improvements in the form of goals, strategies, assessment criteria and measures.

Measures:

1. Composition of the Education Technology Advisory Group.
2. Frequency and quality of progress reports.
3. Evaluation findings and recommendations.

System Name: Chattanooga Project Total: \$102,681  
Project Name: EFG 21st Century Preparatory School SDE Total: \$ 60,254  
Abstract: This project proposed implementing technology and telecommunications as the focal point of the EFG curriculum delivery system. Using Internet students will develop competencies in the following three domains: Ecological, Futures, and Global. The EFG Internet Hub will allow learners to inquire, search, communicate, and create emerging theories about their world.

System Name: Franklin County Project Total: \$118,298  
Project Name: Research Links: Linking Students to Information SDE Funds: \$100,000

Abstract: This project proposes to automate two jr. high schools and two high schools and link them with rich resources of a university library. Students will learn to use information creatively, become critical thinkers and problem solvers, and equip them to function in a 21st Century Information environment.

System Name: Grainger County Project Total: \$ 99,285  
Project Name: Making Schools Fit Children SDE Total: \$ 88,566  
Abstract: This project is a variation of the nationally acclaimed “Kindergarten Integrated Thematic Experiences” (KITE) which effectively combines child-initiated and teacher directed activities within a planned environment using computer assisted instruction. The multi-sensory program involves the child through oral language and hands-on activities.

System Name: Hamblen County Project Total: \$305,139  
Project Name: The Expression Connection SDE Total: \$100,000  
Abstract: This project will utilize E-mail and telecommunication in the form of a Wide Area Network (WAN) to facilitate the development and advancement of written expression in all technology equipped classrooms in grades 1-12. Students will make connections with students, teachers, administrators and classes at other schools across the System. Variety of activities will promote this.

System Name: Hamilton County Project Total: \$100,000  
Project Name: Broadcast Journalism/Distance LearningProject SDE Total: \$ 58,681

Abstract: This project proposes installing a complete television studio in a local high school with access by all 9-12 students. The studio will have high-end tape and digital editing equipment for use by students and administration for distance learning via the Public Access Channel and as a teaching tool in broadcast journalism. Drama classes, administration and curriculum will utilize.



System Name: Maury County Project Total: \$400,000  
Project Name: Education Access Channel SDE Total: \$100,000  
Abstract: The local cable company will provide the school system with one channel for distance learning programs. Our proposal is to link 6 schools and one portable unit with full video capability for video conferencing so that teachers, students, and administrators can communicate interactively. The Education Access channel will be available to the school system for programming 24 hours/day, 7 days/week.

System Name: Memphis City Project Total: \$99,993  
Project Name: MCS TV: Motivating Communication Skills Through Video SDE Total: \$68,802  
Abstract: Project involves cooperative language arts activities to increase 4th through 6th grade students' written and oral communication skills. Fourteen classes (from seven schools) will develop videos while improving written and oral communications skills. A Video Fair will spark community involvement. A handbook and video package detailing project implementation will be provided for replication.

System Name: Monroe County Project Total: \$610,000  
Project Name: Utilization of Distance Learning Technology SDE Total: \$100,000  
Abstract: Project will install a county wide ILS instruction server which will communicate elementary, middle schools, and high schools (particularly at-risk students) and adults. Over time, this concept would include all K-8 students (Chapter 1 and Special Education).

System Name: Murfreesboro City Project Total: \$211,038  
Project Name: Creativity Through Instructional Technology SDE Total: \$100,000  
Abstract: This project proposes a computer driven, interactive, teaching environment. This approach will provide hands-on instruction using the latest technology to disseminate the whole language approach while correlating music with academics (i.e., science, math, foreign language, history, physical education, and art).

System Name: Oak Ridge Project Total: \$175,000  
Project Name: Oak Ridge Schools Innovation Grant for Elementary Schools SDE Total: \$100,000  
Abstract: This \$175,000 technology project will provide approximately 85 teachers and 1,800 students the opportunity to use desktop video communications and to access Internet for the innovative instruction at the elementary level. Funds will purchase equipment for 20 mobile stations, each consisting of a computer, camera, network connection, large screen projection device and printer.





<b>System</b>	<b>New Classrooms</b>	<b>Total</b>	<b>State</b>	<b>Local</b>
Alamo City	1	20,225	18,320	1,905
Bells City	1	20,225	18,320	1,905
Cumberland County	5	101,125	83,955	17,170
Davidson County	43	869,675	393,590	476,085
Decatur County	1	20,225	15,984	4,241
Dekalb County	2	40,450	33,725	6,725
Dickson County	5	101,125	81,009	20,116
Dyer County	3	60,675	47,409	13,266
Dyersburg City	2	40,450	31,606	8,844
Fayette County	3	60,675	51,048	9,627
Fentress County	1	20,225	14,927	5,298
Franklin County	4	80,900	65,944	14,956
Humboldt City	1	20,225	17,484	2,741
Milan SSD	2	40,450	34,968	5,482
Trenton SSD	1	20,225	17,484	2,741
Bradford SSD	1	20,225	17,484	2,741
Gibson SSD	2	40,450	34,968	5,482
Giles County	3	60,675	46,390	14,285
Grainger County	2	40,450	36,119	4,331
Greene County	5	101,125	81,510	19,615
Greeneville City	2	40,450	32,604	7,846
Grundy County	2	40,450	36,789	3,661
Hamblen County	7	141,575	107,607	33,968
Hamilton County	18	364,050	232,892	131,158
Chattanooga City	14	283,150	181,138	102,012
Hancock County	1	20,225	19,061	1,164
Hardeman County	3	60,675	52,276	8,399
Hardin County	4	80,900	70,654	10,246
Hawkins County	5	101,125	83,896	17,229
Rogersville City	1	20,225	16,779	3,446
Haywood County	2	40,450	31,466	8,984
Henderson County	3	60,675	53,208	7,467
Lexington City	1	20,225	17,736	2,489
Henry County	2	40,450	30,380	10,070
Paris SSD	1	20,225	15,190	5,035
Hickman County	3	60,675	55,070	5,605
Houston County	1	20,225	18,144	2,081
Humphreys County	3	60,675	52,359	8,316
Jackson County	1	20,225	17,258	2,967

<b>System</b>	<b>New Classrooms</b>	<b>Total</b>	<b>State</b>	<b>Local</b>
Jefferson County	4	80,900	65,756	15,144
Johnson County	1	20,225	16,030	4,195
Knox County	41	829,225	555,861	273,364
Lake County	1	20,225	18,005	2,220
Lauderdale County	3	60,675	50,932	9,743
Lawrence County	5	101,125	82,734	18,391
Lewis County	2	40,450	36,855	3,595
Lincoln County	3	60,675	50,811	9,864
Fayetteville City	1	20,225	16,937	3,288
Loudon County	3	60,675	50,291	10,384
Lenoir City	2	40,450	33,528	6,922
Mcminn County	5	101,125	82,374	18,751
Athens City	1	20,225	16,475	3,750
Etowah City	1	20,225	16,475	3,750
McNairy County	3	60,675	51,081	9,594
Macon County	2	40,450	34,075	6,375
Madison County	6	121,350	60,681	60,669
Marion County	2	40,450	32,435	8,015
Richard City SSD	1	20,225	16,217	4,008
Marshall County	4	80,900	66,727	14,173
Maury County	8	161,800	123,241	38,559
Meigs County	1	20,225	17,570	2,655
Monroe County	4	80,900	69,927	10,973
Sweetwater City	1	20,225	17,482	2,743
Montgomery County	19	384,275	326,878	57,397
Moore County	1	20,225	18,204	2,021
Morgan County	2	40,450	35,667	4,783
Obion County	3	60,675	46,680	13,995
Union City	1	20,225	15,560	4,665
Overton County	3	60,675	54,910	5,765
Perry County	1	20,225	17,745	2,480
Pickett County	1	20,225	18,736	1,489
Polk County	1	20,225	15,246	4,979
Putnam County	7	141,575	108,060	33,515
Rhea County	2	40,450	33,368	7,082
Dayton City	1	20,225	16,684	3,541
Roane County	4	80,900	60,126	20,774
Harriman City	1	20,225	15,032	5,193
Robertson County	8	161,800	140,788	21,012

<b>System</b>	<b>New Classrooms</b>	<b>Total</b>	<b>State</b>	<b>Local</b>
Rutherford County	20	404,500	330,384	74,116
Murfreesboro City	4	80,900	66,077	14,823
Scott County	1	20,225	18,082	2,143
Oneida SSD	2	40,450	36,163	4,287
Sequatchie County	1	20,225	16,437	3,788
Sevier County	9	182,025	134,446	47,579
Shelby County	39	788,775	558,254	230,521
Memphis City	79	1,597,775	1,130,822	466,953
Smith County	2	40,450	33,025	7,425
Stewart County	2	40,450	37,190	3,260
Sullivan County	8	161,800	105,300	56,500
Bristol City	3	60,675	39,487	21,188
Kingsport City	5	101,125	65,812	35,313
Sumner County	17	343,825	283,328	60,497
Tipton County	7	141,575	128,259	13,316
Covington City	1	20,225	18,323	1,902
Trousdale County	2	40,450	38,289	2,161
Unicoi County	2	40,450	33,219	7,231
Union County	3	60,675	57,121	3,554
Van Buren County	1	20,225	19,216	1,009
Warren County	5	101,125	83,079	18,046
Washington County	7	141,575	102,567	39,008
Johnson City	4	80,900	58,610	22,290
Wayne County	2	40,450	35,816	4,634
Weakley County	3	60,675	45,259	15,416
White County	3	60,675	52,445	8,230
Williamson County	14	283,150	205,047	78,103
Franklin SSD	1	20,225	14,646	5,579
Wilson County	9	182,025	150,402	31,623
Lebanon City	2	40,450	33,423	7,027
<b>Totals</b>	<b>659</b>	<b>\$13,328,275</b>	<b>\$9,996,198</b>	<b>\$3,332,077</b>

11. If the technology in your classroom is not in operation, what is the reason?  
 The equipment and/or software has not been ordered.  
 The equipment and/or software is defective and does not work.  
 The equipment and software are in place, but I need additional training to use them.  
 The equipment and software have been ordered and received, but they have not been installed.  
 The budget for our 21st Century Classroom has not been approved by the state.  
 Our budget has been approved by the state, but we have not received the state funds.  
 Other (Please specify) \_\_\_\_\_
12. How would you rate the computer **software** selected for your classroom in its ability to improve your classroom teaching?  
 Excellent  Good  Fair  Poor
13. How would you rate the computer **hardware** selected for your classroom in its ability to improve your classroom teaching?  
 Excellent  Good  Fair  Poor
14. In your school district or school, was there a process used in the selection of your computer hardware/software to ensure that the hardware and software chosen would meet state curriculum goals?  
 Yes  No  Don't know
15. How would you rate the instructional software used in your 21st Century classroom relative to its compatibility with the state curriculum for your classroom?  
 Excellent  Good  Fair  Poor
16. Who provided you with 21st Century classroom training?  
 State Department of Education  
 Local school or school district  
 State Board of Regents facility  
 Other (Please specify) \_\_\_\_\_  
 I have not yet received training
17. What was the approximate date of your training (month and year) \_\_\_\_\_
18. How useful would you rate the training provided to you relative to its preparation for using the computer hardware and software actually used in your 21st Century Classroom?  
**Hardware**--  Excellent  Good  Fair  Poor  
**Software**--  Excellent  Good  Fair  Poor
19. How would you rate the training in preparing you to use computer hardware and instructional software to meet state curriculum goals in your 21st Century Classroom?  
 Excellent  Good  Fair  Poor
20. Do you feel that you need additional training to enable you to adequately fulfill your role as a 21st Century Classroom teacher?  Yes  No
21. If your answer to question 20 was yes, in what areas would you like additional training?

- Training in the use of computers and related hardware (Laser disk player, CD-ROM player, etc.)
- Training in the use of computer software, CD-ROM programs, and Laser disks.
- Training in how to integrate the use of technology with teaching the state's curriculum.
- Other training (Please specify) \_\_\_\_\_

22. How would you rate the overall degree of support that the state Department of Education has provided to enable you to be successful as a 21st Century classroom teacher?  
 Excellent  Good  Fair  Poor

23. How would you rate the overall degree of support that your school district has provided to enable you to be successful as a 21st Century classroom teacher?  Excellent  Good  Fair  Poor

24. In your school district, does your Technology Coordinator work full-time in that position?  Yes  No

25. In your opinion, is your Technology Coordinator adequately qualified in computer hardware and software for his/her position?  Yes  No  Not sure

26. Do you feel that your Technology Coordinator has been able to provide you with the degree of support you need to be successful as a 21st Century Classroom teacher?  Yes  No  
 (If yes, please skip to question 28.)

27. If your answer to question 26 was no, do you feel that additional Technology Coordinators are necessary for your school district, better qualified coordinators, or both?  
 Additional Technology Coordinators  
 Better qualified Technology Coordinators  
 Both

28. What is your overall assessment of your experience with the 21st Century Classroom program?  
 Excellent  Good  Fair  Poor

29. Please write any other comments you may have concerning the 21st Century Classroom program below:

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