A Joint Report on Information Technology

presented to the

2007 Session of the General Assembly

January 2007

Submitted by:
Business Education Technology Alliance,
Lt. Governor Bev Perdue
Chairman

School Technology Commission
Representative, Joe Tolson
Chairman

Fred Bartholomew
Vice Chairman

Joint Legislative Oversight Committee on Information Technology,
Senator Vernon Malone
Co-Chairman

Representative Joe Tolson
Co-Chairman

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Submitted by:

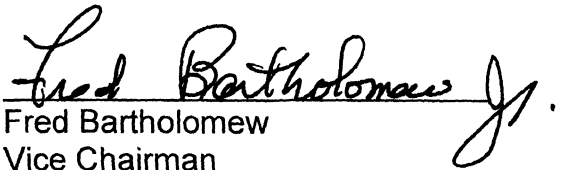*Business Education Technology Alliance, GS115C-102.15*

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Lt. Governor Bev Perdue
Chairman

School Technology Commission, GS115C-102

_____
Representative Joe Tolson
Chairman

_____
Fred Bartholomew
Vice Chairman

Joint Legislative Oversight Committee on Information Technology,

_____
Senator Vernon Malone
Co-Chairman

_____
Representative Joe Tolson
Co-Chairman

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Commission Recommendations

The following recommendations are made jointly by the Business Education Technology Alliance, the School Technology Commission and the Joint Legislative Oversight Committee for Information Technology. They are based on the Four (4) essential elements necessary for *Future Ready Schools in North Carolina* as discussed in the attached report to fully infuse technology into the Public Schools of North Carolina.

Recommendations:

Workforce Preparedness

1. The General Assembly should continue to invest in new and existing innovative education projects and public-private partnership projects that support and are aligned with the State Board of Education's (SBE) *Future-Ready Students* priority and goals.   These initiatives include but are not limited to the Center for 21st Century Skills, New Schools Project, Literacy Coaches, NC Virtual Public School (NCVPS), Learn and Earn Early College Schools, the IMPACT Model, NC Technology Association (NCTA) Demonstration Projects and the Graduation Project.

   These projects serve as models for changing and/or transitioning the teaching and learning in "future ready" schools using 21st Century skills so that students are prepared to compete in a global economy.   They also serve as research and development sites so that other schools can benefit from the lessons learned during the implementation phase of the projects.

2. NC Department of Public Instruction (NCDPI) should align its work with the State Board of Education's (SBE) *Future-Ready Students* priority and goals so all public school students will graduate from high school globally competitive for work and postsecondary education and prepared for life in the 21st Century. NCDPI should make recommendations to the SBE and the General Assembly for changes to any laws, rules or regulations that prohibit the SBE from carrying out its priorities and goals no later than January 15, 2008.

3. The NC Department of Public Instruction (NCDPI) should align the NC State Technology Plan with the State Board of Education's (SBE*) Future-Ready Students* priority and goals so that all public school students will graduate from high school, globally competitive for work and postsecondary education and prepared for life in the 21st Century.   The NC State Technology Plan provides a framework for Local Education Agencies (LEA) as they plan for technology integration into their schools that supports the school's instructional program. It also serves as a mechanism for accountability for spending and budget development.

The Local Education Agency (LEA) technology plans are monitored by the NCDPI for instructional technology and by NC State Information Technology Services for technical infrastructure to ensure minimum standards are met. The alignment with the SBE's priority and goals should be complete so that LEAs can begin making the necessary changes to their plans no later than March 1, 2007.

Educational Technology Readiness

4. The 2007 General Assembly should fully fund ($24,000,000-R) the school connectivity initiative proposed during the last session of the General Assembly to begin connecting all of North Carolina's public schools to a statewide network.   The results of the pilot for which $6 million in non-recurring funds was appropriated in FY 2006-07 should be used to further develop the implementation of this initiative to connect all Local Education Agencies (LEAs) to a statewide network. The goal is to connect all LEA's to the statewide network by 2009-2010.

5. The General Assembly should begin funding to establish 21st century classrooms in alignment with the school connectivity initiative proposed during the 2006-07 session of the General Assembly to begin connecting all of North Carolina's public schools to a statewide network.   The total request in the State Board of Education's Budget for 07-08 is $121.8 million.   The base-line cost to equip these classrooms with digital white board technology, data projectors, computers or other computing devices, document cameras, a technology facilitator and other technical personnel for each school is $7,233 per classroom based on 2006-07 estimated costs.

6. The E-Learning Commission should present a plan to the Education Cabinet for establishing the NCVirtual (NCV) with the Education Cabinet located in the Office of the Governor. The plan should include expanding the statewide network to support all Community Colleges, public and private Universities and Colleges and to support seamless learning for all students.   This plan should be developed no later than June 30, 2007

Policy Framework

7. The Education Cabinet should adopt new priorities and goals for a global economy consistent with those established by the State Board of Education (SBE). These priorities and goals will provide the policy framework so that all education entities are working toward a seamless transition for advanced education for all of North Carolina's citizens. The priorities and goals should be in place no later than June 30, 2007.

8. The Business Education Technology Alliance and the School Technology Commission should work in collaboration to ensure comprehensive implementation of the 4 Essential Elements for *Future Ready Schools in North Carolina* outlined in this Joint Technology Commissions Report, January 2007. The purpose is for each commission to incorporate any changes needed to any laws, rules or regulations in their recommendations to the SBE and the General Assembly that they are required to report annually.

9. The School Technology Commission should review the legislation that guides its work and its charge and make recommendations for any changes needed for any law, rule or policy no later January 15, 2008.

10. The Business Education Technology Alliance should incorporate into its work a plan to support the work of the e-NC Authority as it works to expand affordable broadband connectivity to all households, businesses and communities in the state.   This should be included as part of its annual recommendations to the SBE and the General Assembly.

   The expansion of broadband connectivity to the entire state will further enhance the efforts of the SBE's work to prepare students for a global economy by providing the infrastructure and connectivity necessary to infuse technology into education.   The infrastructure and connectivity will provide access for all citizens to the resources being developed by the Public Schools, the public and private Universities and Colleges, the Community Colleges so that all of North Carolina's citizens are prepared to participate and compete in a global economy.

Business Education Technology Alliance

The Honorable Beverly Eaves Perdue,
Lieutenant Governor and Chairman
20401 Mail Service Center
Raleigh, NC 27699-0401
State Board of Education

The Honorable Linda Garrou
North Carolina State Senate
627 Legislative Office Building
Raleigh, NC 27603-5925
(919) 733-5620
Senate President Pro Tempore

The Honorable Marvin Lucas
NC House of Representatives
Legislative Bldg., Room 1323
Raleigh NC 27601
Speaker of the House

Nicole Darmody, Vice President for NC
University of Phoenix
3800 Arco Corporate Drive
Charlotte, NC 28723
Governor/At Large

Brad Phillips
VP Gov. & Public Relations
Time Warner
101 Innovation Ave.
Morrisville NC 27560
State Board of Education /NCCBI

Donna McLamb
100 Ward Ave
Oxford, NC 27565
No home number
Butner Stem Middle School Granville
County
Speaker of the House/ Principal

George Bakolia
Chief Information Officer
State of North Carolina
PO Box 17209
Raleigh NC 27619-7209
By Statute

The Honorable Vernon Malone
North Carolina State Senate
2113 Legislative Building
Raleigh, NC 27601-2808
(919) 733-5880
Senate President Pro Tempore

The Honorable June St. Clair Atkinson
State Superintendent
Department of Public Instruction
301 North Wilmington St.
Raleigh, NC   27601-2825
Statute

The Honorable Joe Tolson
NC House of Representatives
Chairman of Education Appropriations
402 LOB
Raleigh NC 27603-5925
Speaker of the House of the House

Cindy Fertenbaugh
Electronic Data Systems
Cabarrus County Board of Education
1307 Dennbriar Dr. NW
Concord NC 28027
Governor/At Large

Michael Taylor
President
Stanly Community College
141 College Drive
Albemarle NC 28001
State Board of Education /Community
College Board

Dennis Carter
5319 Sandstone Dr
Fayetteville, NC 28311
H 910-488-9246
Ann Chestnutt Middle School
Cumberland County
Speaker of the House/ Teacher

Kim S. Graham
Greer & Walker, LLP
201 S. Tryon Street, Suite 1500
Charlotte, NC 28202
Direct Dial: 704-353-8237
Fax: 704-377-8663
State Board of Education /NCPTA

Scott S. Smith
Chief Technology Officer
200 South Center Street
Hildebran, North Carolina 28637
828.397.6118 Phone
828.397.6681 Fax
Speaker of the House/ Tech Director

Elsie Brumback
Education Consultant
3112 Camp Ranger Lane
Jamestown, NC 27282
State Board of Education /ITS

Darrin Hartness, Ed.D.
Principal
West Elementary School
500 West Mountain Street
Kings Mountain, NC 28086
p. 704-734-5693
f. 704-734-5618
Senate President Pro Tempore

Dorothy Witherspoon
PO Box 1489
Jefferson, NC 28640
336-982-4310 (H)
336-982-4227 (W)
Governor/NCSBA

John Boling
Interim Director
North Carolina Virtual Public School
NC Virtual Public School
The William and Ida Friday Institute for
Educational Innovation
1890 Main Campus Drive, Raleigh, NC
27606
State Board of Education /NCCBI

Jane Patterson
e-NC
4021 Carya Drive
Raleigh NC 27610
By Statute

Mary Accor, Cleveland County
Commissioner
944 Dixon School Road
Kings Mountain, NC 28086
704.937.7508
State Board of Education /County
Commissioner

Betty Weycker
Winston-Salem/Forsyth County Schools
Post Office Box 2513
Winston-Salem, North Carolina 27102
Senate President Pro Tempore /Tech
Director

Steve Bilzi
6226 Head Road
Wilmington, NC 28409
910-452-7863 (H)
910-799-8200 (W)
Governor/NCSBA

Darleen Johns
President
3801 Wake Forest Road
Raleigh, North Carolina 27609
Phone: 919.781.7575
Fax: 919.872.1440
State Board of Education /NCTA

Glenn Barger, Catawba County
Commissioner
2210 Startown Road
Newton, NC 28658
828.324.2854
State Board of Education /County
Commissioner

Steve Ballard,
Chancellor
East Carolina University
East Fifth Street
Greenville, NC 27858-4353
UNC Board of Governors

Rodney Shotwell
Superintendent
Rockingham County Schools
511 Harrington Highway
 Eden, NC 27288
Speaker of the House/Superintendent

Peter Asmar
Associate Superintendent/Chief
Information Officer
Technology Services
Department of Public Instruction
301 North Wilmington Street
Raleigh, NC 27601-2825
State Board of Education

Staff to the Commission
Myra Best, Executive Director
Business Education Technology Alliance
PMB 318, 514 Daniels Street
Raleigh, NC 27605

Kathryn Moore
Dean, College of Education
North Carolina State University
Box 7801
Raleigh NC 27695-7801
Speaker of the House/Administrator

Larry Price, Ed.D
Superintendent
Wilson County Schools
PO Box 2048
Wilson, NC 27894
Senate President Pro Tempore/
Superintendent

Rita Wyss
391 Gilmer Edwards Road
Rutherfordton, NC 28139
R S Middle Rutherford County
Computer and Information Teacher
Senate President Pro Tempore/ Teacher

School Technology Commission

Mr. Frederick Bartholomew, Co-Chair
104 Bartholomew Drive
P. O. Box 38
Princeton, NC   27569
Senate President Pro Tempore

The Honorable A. B. Swindell
North Carolina State Senate
629 Legislative Office Building
Raleigh, NC 27601
Senate President Pro Tempore

Mrs. LaHarve M. Johnson
Retired Educator
1410 Green Street
Durham, NC 27705
Senate President Pro Tempore

The Honorable Joe P. Tolson
North Carolina House of
Representatives
P. O. Box J, Pinetops, NC   27864
Speaker of the House of the House

The Honorable Linda P. Johnson
North Carolina House of Representatives
Legislative Building, Room 1006, 16 W.
Jones St., Raleigh, NC 27601
Speaker of the House

Arthur R. Kamm, Ph.D.
President, Kamm Consulting, Inc.
4036 Chaumont Drive, Apex, NC 27539
Speaker of the House of the House

Dr. Carl E. Harris
Superintendent
Durham County Schools
511 Cleveland St., Durham, NC 27702
Governor

The Honorable Vernon Malone
North Carolina State Senate
300-G Legislative Office Building
Raleigh, NC 27601
Senate President Pro Tempore

Mr. J. Reid Parrott, Jr.
Retired: President Emeritus
Nash Community College
2917 Ridgecrest Drive
Rocky Mount, NC 27803
Senate President Pro Tempore

Dr. F. Vincent Allison, III
Practicing General Dentist
6208 Fayetteville Road, Suite 102,
Durham, NC 27713
Senate President Pro Tempore

Mr. Frank A. Daniels, III
CEO
Vital Source Technologies, Inc.
Business Address: 234 Fayetteville St.,
Suite 300, Raleigh, NC 27601
Speaker of the House of the House

Ms. Marsha Davis Jones
UNC School of Medicine, Department of
Psychiatry, Division TEACCH, CB#
7180, Chapel Hill, NC 27599-7180
Speaker of the House of the House

Ms. Angela Rice Jones
2 Miles Court
Pinehurst, North Carolina 28374-9641
Speaker of the House of the House

Ms. Jane Smith Patterson
Executive Director
e-North Carolina Authority
NC Rural Economic Development Center
4021 Carya Drive, Raleigh, NC 27610
Governor

Dr. William C. Harrison (Bill)
Superintendent
Cumberland County Schools
Business Address: P. O. Box 2357,
Fayetteville, NC 28302
Governor

The Honorable June St. Clair Atkinson
State Superintendent
Department of Public Instruction
301 North Wilmington St.
Raleigh, NC   27601-2825
North Carolina Department of Public
Instruction

Staff to the Commission
Frances B. Bradburn, Director
Instructional Technology Division
Department of Public Instruction
301 N. Wilmington St.
Raleigh, NC   27601-2825

Shirley Iorio, Staff
NCGA General Research Division
Legislative Office Building, Suite 545
Raleigh, NC 27603

Adam Levinson, Staff
NCGA Fiscal Research Division
Legislative Office Building, Suite 619
Raleigh, NC 27603

Karlynn O'Shaugnessy, Staff
NCGA Fiscal Research Division
Legislative Office Building, Suite 619
Raleigh, NC 27603

Mr. John C. Boling, Interim Director
North Carolina Virtual Public School
NC Virtual Public School
The William and Ida Friday Institute for
Educational Innovation
1890 Main Campus Drive, Raleigh, NC
27606
Governor

Mr. Peter Asmar
Associate Superintendent/Chief
Information Officer
Technology Services
Department of Public Instruction
301 North Wilmington Street
Raleigh, NC 27601-2825
North Carolina Department of Public
Instruction

Joint Legislative Oversight Committee on Information Technology

The Honorable Vernon Malone, Co-Chair
North Carolina Senate
16 W. Jones Street, Room 2113
Raleigh, NC 27601-2808
Senate President Pro tempore

The Honorable Joe P. Tolson, Co-Chair
North Carolina House of Representatives
300 N. Salisbury Street, Room 402
Raleigh, NC 27603-5925
Speaker of the House

The Honorable Austin Murphy Allran
North Carolina Senate
300 N. Salisbury, Room 516
Raleigh, NC 27603-5925
Senate President Pro tempore

The Honorable Debbie Anne Clary
North Carolina House of Representatives
300 N. Salisbury Street, Room 303
Raleigh, NC 27603-5925
Speaker of the House

The Honorable Robert C. Atwater
North Carolina State Senate
200 N. Salisbury Street, Room 522
Raleigh, NC 27603-5925
Senate President Pro tempore

The Honorable Mark K Hilton
North Carolina House of Representatives
16 W. Jones Street, Room 1021
Raleigh, NC 27601-1096
Speaker of the House

The Honorable Janet Cowell
North Carolina Senate
16 W. Jones Street, Room 1028
Raleigh, NC 27601-2808
Senate President Pro tempore

The Honorable Earline W. Parmon
North Carolina House of Representatives
300 N. Salisbury Street, Room 632
Raleigh, NC 27603-5925
Speaker of the House

The Honorable Katie G. Dorsett
North Carolina Senate
16 W. Jones Street, Room 2106
Raleigh, NC 27601-2808
Senate President Pro tempore

The Honorable Raymond C Rapp
North Carolina House of Representatives
16 W. Jones Street, Room 2213
Raleigh, NC 27601-1096
Speaker of the House

The Honorable Kay R. Hagan
North Carolina Senate
300 N. Salisbury Street, Room 411
Raleigh, NC 27601-2808
Senate President Pro tempore

The Honorable Russell E. Tucker
North Carolina House of Representatives
300 N. Salisbury Street, Room 416-B
Raleigh, NC 27603-5925
Speaker of the House

The Honorable Jim Jacumin
North Carolina Senate
16 W. Jones Street, Room 1113
Raleigh, NC 27601-2808
Senate President Pro tempore

The Honorable Edith Doughtie Warren
North Carolina House of Representatives
300 N. Salisbury Street, Room 416-A
Raleigh, NC 27603-5925
Speaker of the House

The Honorable Richard Yates Stevens
North Carolina Senate
300 N. Salisbury Street, Room 406
Raleigh, NC 27601-2808
Senate President Pro tempore

The Honorable Thomas E. Wright
North Carolina House of Representatives
300 N. Salisbury Street, Room 528
Raleigh, NC 27603-5925
Speaker of the House

Staff to Committee

Peter Capriglione, Information Systems
Division
Brenda Carter, Research Division
Karlynn O'Shaughnessy, Fiscal Research
Phyllis Pickett, Bill Drafting

Feedback Team

The Joint Technology Commission Report on Information Technology was initially written by Rebecca Garland, Executive Director, NC State Board of Education; Frances Bradburn, Director of Technology, NC Department of Public Instruction and Myra Best, Executive Director of the BETA/E-Learning Commissions.   The report was reviewed and refined after receiving input and review by members of the following:

- Business Education Technology Alliance (BETA)
- School Technology Commission
- Joint Legislative Oversight Committee for Information Technology
- State Board of Education
- Governor's Education Office
- Lt. Governor's Office
- NC Department of Public Instruction (NCDPI)
- North Carolina Technology Association (NCTA)
- NC Business Committee for Education (NCBCE)
- NC Association of Educators (NCAE)
- NC Citizens for Business and Industry (NCCBI)
- NC School Boards Association (NCSBA)
- NC Education Technology Corporation (Technology Directors) (NCeTC)
- NC Association of School Administrators (NCASA)

Preface:

This is the first joint report of the Business Education Technology Alliance (BETA), the School Technology Commission and the Joint Legislative Oversight Committee for Information Technology to the North Carolina General Assembly.   These commissions are charged to develop recommendations for technology in North Carolina's Public Schools.   Due to the shared interests of the commissions as charged by the General Assembly, the chairmen of the commissions initiated this joint report to ensure a comprehensive and focused effort to infuse technology in all North Carolina's Public Schools so that public school students are Future Ready for the global economy.

Purpose of the Joint Report:

Comply with GS115C-102.15 for the Business Education Technology Alliance to report annually to the Joint Education Oversight Committee of the NC General Assembly, and the State Board of Education on changes needed to any law, rule or policy that would improve education technology in the public schools.

Comply with the GS115C-102 requirements for the School Technology Commission with regard to the NC Education Technology Plan and other pertinent requirements as noted in the general statute.

Comply with the request for the Joint Legislative Oversight Committee on Information Technology to:
- Review the newly revised NC Education Technology Plan developed by the State Board of Education
- Review best practices for using technology to enhance teaching and learning in NC schools
- Review existing research-based practices such as the IMPACT model, NC WISE OWL, and successful 1:1 (computer to student) initiatives across the state and nation
- Receive recommendations from the Business Education Technology Alliance, E-Learning Commission, the business community, and the NC Center for 21st Century Skills.

Desired Outcomes for the Joint Report:

- One Comprehensive Report for the use of information technology that builds on North Carolina's strengths and current State investments that is supported by BETA, School Technology Commission and the Joint Legislative Oversight Committee on Information Technology.

- Recommendations for more effective and efficient use of state funding for technology in schools with strong accountability.

- Recommendations for using technology that creates capacity for providing high quality education to all students, shares resources, and creates learning options for all students across PreK-12, Community Colleges, Universities and Colleges.

The **4** *Essential Elements for Future-Ready Schools in North Carolina*

Not since the launch of Sputnik in 1957 has the American education community given such close examination to student achievement in science, mathematics, and technology. The scrutiny is the result of disappointing student performance on international science and math tests, admonishments regarding globalization in publications such as Thomas Friedman's *The World is Flat*, and tough business realities triggered by strong competition from India, China and many other countries who's workforces are becoming increasingly competitive and who's economies are experiencing robust growth. Whether one accepts all the premises regarding globalization outlined in Friedman's book, the data support the notion that American students are not choosing science and math careers in numbers large enough to satisfy the needs of both the public and private sector in the United States. Nor are students, in their K-12 experience, provided with a foundation of technological, teamwork, and critical thinking skills required by today's sophisticated workplaces.

Several skills are cited by North Carolina's major employers as necessary for a highly competitive workforce in todays and tomorrows global economy. These skills translate into 4 essential elements that are necessary for all North Carolina public schools if they are to continue making the transition from an industrial age to knowledge based economy. Those elements are as follows:

1. Delivery of 21st century Curriculum, Instruction, Assessments and Accountability (content)
2. Presence of Technology Tools in the Classrooms (infrastructure)
3. Existence of robust and relevant Personnel and Professional Development (infrastructure)
4. Pervasive existence of high bandwidth connectivity and scalable networks (infrastructure)

Skills for a Globally Competitive Workforce

The North Carolina Business Committee for Education (NCBCE) conducted a survey of its members in January 2006 to determine the most important skills or qualities a high school graduate needs to succeed in the 21st century workplace. The results found that the top five (5) choices fall into two classes of skills: fundamental or core skills and sound personal values.

The fundamental or core skills cited most include:

- Applying basic mathematical concepts and skills

- Reading and comprehending materials of varying complexity, and
- Using and integrating information and communications technology

The sound personal values cited most include:

- Conducting oneself appropriately in line with social responsibility and sound ethics, and
- Working effectively as a member of a team

The results of the NCBCE survey are consistent with the national survey conducted during April and May 2006 by The Conference Board, Corporate Voices for Working Families, the Partnership for 21st Century Skills, and the Society for Human Resource Management.   Its objective was to examine employers' views on the readiness of new entrants to the U.S. workforce — recently hired graduates from high schools, two-year colleges or technical schools, and four-year colleges.
The four participating organizations jointly surveyed over 400 employers across the United States. These employers articulate the skill sets that new entrants—recently hired graduates from high school, two-year colleges or technical schools, and four-year colleges—need to succeed in the workplace. Among the most important skills cited by employers:

• Professionalism/work ethic
• Oral and written communications
• Teamwork/collaboration and
• Critical thinking/problem solving

These are applied skills and refer to those skills that enable new entrants to use the basic knowledge acquired in school to perform in the workplace. In order to be able to use the applied skills effectively, workers must have a command of the basic knowledge (core skills) as noted in the chart below.

Basic Knowledge/Skills	Applied Skills
- English language (spoken) - Reading comprehension (in English) - Writing in English (grammar, spelling, etc.) - Mathematics - Science - Government/economics - Humanities/arts - Foreign languages - History/Geography	- Critical thinking/problem solving - Oral communications - Written communications - Teamwork/collaboration - Diversity - Information technology application - Leadership - Creativity/innovation - Lifelong learning/self direction - Professionalism/work ethic - Ethics/social Responsibility

Nearly three-quarters of survey participants (70 percent) cite deficiencies among incoming high school graduates in "applied" skills, such as professionalism and work ethic, defined as "demonstrating personal accountability, effective work habits, e.g. punctuality, working productively with others, time and workload management."

More than 40 percent of surveyed employers say incoming high school graduates hired are deficiently prepared for the entry-level jobs they fill. The report finds that recent high school graduates lack the basic skills in reading comprehension, writing and math, which many respondents say were needed for successful job performance.

Furthermore, when asked how their hiring practices will change:

- 28 percent of employers project that their companies will reduce hiring of new entrants with only a high school diploma over the next five years.
- 49.5 percent said the percentages of two-year college graduates they hire would increase.
- 60 percent said their hires of four-year college graduates would increase.
- 42 percent said their hires of post-graduates would increase over the next five years.

The findings of both the NCBCE and the Conference Board make it clear that today's students need to be critical thinkers, problem solvers and effective communicators who are proficient in new, 21st century content areas such as global awareness and financial and civic literacy.   Businesses understand that the access to core curriculum and supplemental content that is enabled by information and communications technology is essential in helping students develop the requisite skills for the work force and higher education.   Using technology to enhance learning equips students with the skills to take advantage of and thrive in the technology-intensive future of the 21st century.
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Businesses also understand that a superior network with reliability, security, scalability and massive bandwidth is critical to the success of both business and education. The network provides a platform that "connects" multiple populations and enriches their experiences by providing a mechanism for communicating with each other, enhances opportunities for problem solving, creativity and teambuilding. More importantly, it provides access to information, learning options and eliminates the "zip code" limitations experienced by many students today and replaces it with a "planet code" that connects Rocky Mount with Russia as easily as it does with Roanoke Rapids.
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Essential Element 1: 21st Century Curriculum, Instruction, Assessments and Accountability

New Mission, Goals and Priorities

Cognizant of the need for schools to change to meet the growing demands of the 21st Century economy, the NC State Board of Education made a bold move and adopted new goals and priorities in August 2006 designed to increase the rigor and relevance in the public schools. The priorities emphasize the need for globally competitive academic programs, technologically savvy and globally aware students and teachers, and appropriate infrastructures and systems. The mission, goals, and priorities of the Board serve as the policy framework for North Carolina's public schools and the driver and organizational tool for the state's local education agencies. The priorities serve as the template for each local school's School Improvement Plan, the fluid document that outlines strategies for improving student achievement. The new mission and goals are as follows:

FUTURE-READY STUDENTS

The guiding mission of the North Carolina State Board of Education is that every public school student will graduate from high school, globally competitive for work and postsecondary education and prepared for life in the 21st Century.

Goal 1: NC public schools will produce globally competitive students.

- Every student excels in rigorous and relevant core curriculum that reflects what students need to know and demonstrate in a global 21st Century environment, including a mastery of languages, an appreciation of the arts, and competencies in the use of technology.
- Every student's achievement is measured with an assessment system that informs instruction and evaluates knowledge, skills, performance, and dispositions needed in the 21st Century.
- Every student will be enrolled in a course of study designed to prepare them to stay ahead of international competition.
- Every student uses technology to access and demonstrate new knowledge and skills that will be needed as a life-long learner to be competitive in a constantly changing international environment.
- Every student has the opportunity to graduate from high school with an Associates Degree or college transfer credit.

Goal 2: NC public schools will be led by 21st Century professionals.

- Every teacher will have the skills to deliver 21st Century content in a 21st Century context with 21st Century tools and technology that guarantees student learning.
- Every teacher and administrator will use a 21st Century assessment system to inform instruction and measure 21st Century knowledge, skills, performance, and dispositions.
- Every education professional will receive preparation in the interconnectedness of the world with knowledge and skills, including language study.
- Every education professional will have 21st Century preparation and access to ongoing high quality professional development aligned with State Board of Education priorities.
- Every educational professional uses data to inform decisions.

Goal 3: NC public school students will be healthy and responsible.

- Every learning environment will be inviting, respectful, supportive, inclusive, and flexible for student success.
- Every school provides an environment in which each child has positive, nurturing relationships with caring adults.
- Every school promotes a healthy, active lifestyle where students are encouraged to make responsible choices.
- Every school focuses on developing strong student character, personal responsibility, and community/world involvement.
- Every school reflects a culture of learning that empowers and prepares students to be life-long learners.

Goal 4: Leadership will guide innovation in NC public schools.

- School professionals will collaborate with national and international partners to discover innovative transformational strategies that will facilitate change, remove barriers for 21st Century learning, and understand global connections.
- School leaders will create a culture that embraces change and promotes dynamic continuous improvement.
- Educational professionals will make decisions in collaboration with parents, students, businesses, education institutions, and faith-based and other community and civic organizations to impact student success.
- The public school professionals will collaborate with community colleges and public and private universities and colleges to provide enhanced educational opportunities for students.

Goal 5: NC public schools will be governed and supported by 21st Century systems.
- Processes are in place for financial planning and budgeting that focuses on resource attainment and alignment with priorities to maximize student achievement.
- Twenty-first century technology and learning tools are available and are supported by school facilities that have the capacity for 21st Century learning.
- Information and fiscal accountability systems are capable of collecting relevant data and reporting strategic and operational results.
- Procedures are in place to support and sanction schools that are not meeting state standards for student achievement.

The implementation of the State Board of Education's new priorities will require an intensive review of the current work done by the NC Department of Public Instruction, Local Education Agencies and schools. It means reviewing current curriculum standards, policies, programs, processes and structures (including financial, instructional, etc.) that guide the work of learning in North Carolina's Public Schools to determine if these meet the required standards of academic rigor necessary for preparing all students for a knowledge based and global economy. As the changes are made and new standards, policies, programs, processes and structures are identified, intensive professional development that is designed to coach and support people will be needed to help teachers, administrators and agency staff implement the changes effectively.

New Initiatives and Programs
In order to improve student achievement and ensure that North Carolina students are better prepared for college and the workplace, the State Board of Education is involved in a variety of innovative projects. The projects are a result of partnerships with the Office of the Governor, the Office of the Lieutenant Governor, the Bill and Melinda Gates Foundation, the constituent campuses of the University of North Carolina, The Community College System, and ACHIEVE, Inc. to name a few. Some are described below:

New Schools Project
Backed by $22.5 million in grants from the Bill and Melinda Gates Foundation and additional appropriations from the NC General Assembly, the North Carolina New Schools Project (NCNSP) provides leadership and planning grants to school systems to create small high school environments that focus on personalization and rigor for every student. All schools in the NCNSP use technology as a core tool for students to access core and supplemental curriculum and to complete their work. Some of the new schools, for example New Technology, use technology tools as the organizing factor. In New Technology Schools students: have one to one access to a networked computer; access the bulk of their learning information from the Internet; complete, present, and submit all assignments using technology; and receive all

teacher feedback in digital format. All student information is stored in a digital warehouse.

Even in a relatively short period – seven years in total for the Gates Foundation's giving in this area and three years for the work in North Carolina specifically – there are clear and promising signs of success.

- Nationally, improvement in student achievement has come most quickly in reading. This comes as no surprise – throughout the period in which states put standards and testing in place, math scores have generally trailed reading scores.
- Nationally, a significant percentage of small schools are showing better attendance and promotion rates than their home school districts.
- In North Carolina, student attendance in redesigned high schools has exceeded their school districts by 1 percentage point and attendance in early college high schools has exceeded their districts' by about 2 percentage points.
- In North Carolina, the passing rate for college courses taken by students at early college high schools was 90 percent or better at three-quarters of the schools, with no passing rate below 75 percent,
- In North Carolina, the percentage of teachers at redesigned and early college high schools who "strongly agree" on the teacher working conditions survey that their school is a "good place to teach and learn" is almost **two times** the percentage (48 percent compared to just 26 percent in regular high schools).

Learn and Earn Early College Schools
In 2004 Governor Easley developed a new high school initiative, *Learn and Earn Early College Schools*, that offers high school students an opportunity to graduate after five years with an Associate's Degree or two years of college transfer credit. The Community College System partners with the public schools in this effort. The work of *Learn and Earn* has important implications such as driving the expectation of student matriculation to post secondary education, which is essential in the global economy and easing the transition from high school to higher education.

NC Virtual Public School
The 21st century is known as the information age, the knowledge economy, the digital revolution. A student's future success in life will be a function of what curricula and what teachers the student has access to and the extent to which the student has acquired life long skills for learning

The ubiquity of the Internet, technology, and information provides access to knowledge and teaching and learning resources anywhere, anytime, any place, and any pace. Technology literacy skills are a pre-requisite for career success in the 21st century.

The North Carolina Virtual Public School will extend the local course offerings of the

student's base school to include access to additional on-line courses and teachers that otherwise would not be available. Based on the student's interest and academic needs a customized learning profile and environment can be created and be available twenty four hours a day to accommodate the student's schedule differences and help the student realize his or her learning potential. The North Carolina Virtual public school will also be a clearinghouse for relevant links and resources that supplement the core curriculum, thus enhancing and deepening the learning experience.

American Diploma Project
In the spring of 2006 North Carolina's three governing boards committed to participate in the American Diploma Project (ADP) under the direction of Achieve, Inc., an initiative designed to add rigor to the curriculum and ensure that high school diplomas indicate that graduates have the skills and knowledge to be successful at any post secondary path they choose. The ADP partnering agencies along with business and education representatives have developed standards in English and mathematics that are necessary for college and work. Feedback on the North Carolina Standard Course of Study indicate that NC math standards are "bellwether" and worthy of replication. The review noted that the English Language Arts standards are weak in the area of work-ready skills, particularly information communication. North Carolina students need additional work in being able to draw meaning and manipulate digital information. Again, technology is the core for improved student achievement.

Literacy Coaches
In the fall of 2006 one hundred literacy coaches were allocated to middle schools to improve student reading skills in English Language Arts and across all content areas. The secondary purpose of the coaches is to train teachers in Information, Communication, and Media Literacy. Skills include, among others, analyzing and manipulating data from all media, using technology to make observations and predict results, and creating charts and graphs to demonstrate information.

IMPACT
During the 2003-2004 school year, 11 schools were awarded IMPACT Model School Grants based on the federal Enhancing Education Through Technology priorities of high poverty, high technology need. Ten schools completed the grant at the end of the 2005-2006 school year. These schools were front-loaded with the hardware and software, personnel, and connectivity, based on the North Carolina Educational Technology Plan, so that North Carolina State University and the Friday Institute for Educational Innovation could evaluate whether an optimum resource-rich, technology-rich environment could make a difference in teaching and learning.

While NCSU is still analyzing final data, the results have been promising. Both reading and math scores have increased and surpassed the IMPACT schools' comparison school students even among the most at-risk populations. Teachers report real changes in student attendance, behavior, and motivation. Teachers also

report their own higher rate of satisfaction as they teach in a more collaborative, supportive environment.

<u>Center for 21st Century Skills</u>
The Center was established in 2005 and is a public-private partnership operating out of the Office of the Governor that works actively with business leaders, educators and policymakers to create new curricula, new assessments, and new ways of linking student work in the classroom to the workplace in the 21st century. It is bringing together current innovative reform efforts as well as implementing new ones to develop meaningful assessments and curricula that reflect the knowledge necessary for success in the 21st century. The Center is also working to improve and expand professional development for educators that focus on 21st century skills.

The current assessments, including the End of Grade and End of Course Tests, were developed to monitor how well each teacher was covering the NC *Standard Course of Study*. In 1999, the role of these assessments was expanded to measure student achievement through the student accountability standards. In addition to these multiple choice tests, students must demonstrate mastery on two performance-based measures before they can earn a diploma - the computer skills test and a graduation project.

In order to provide comprehensive feedback to students on 21st Century workplace skills, formative assessments including the use of technology are critical. These assessments require students apply knowledge in a relevant situation, work in teams, and employ critical thinking skills. The assessments should also provide information to teachers regarding the effectiveness of their instruction and allow them to redirect emphasis when necessary. Technology is the core for these assessments, not only as the tool for student performance, but also as the vehicle for delivery from the state to the field.

If teachers are to participate in these formative assessments, schools will need sufficient hardware and technology infrastructure including bandwidth.

<u>Essential Element 2</u>: **Technology Tools in the Classrooms**

Twenty-first Century schools are exciting places in which to teach and learn. In general, there are more small group learning activities and less whole-class, teacher-centered instruction. Since the goal of education is to teach children how to learn, not necessarily what to learn, most teachers use an inquiry-based, constructivist approach in which students solve problems. Learning is based on prior knowledge and focused around guided research and systematically cultivated higher order thinking skills. All schools are supported by a team of school library media and technology specialists who collaborate with classroom teachers to provide a resource-rich, technology-rich teaching and learning environment while

simultaneously lowering student/teacher ratio.

Each school has facilities and personnel that are necessary for a 21st Century education. Besides individual classroom spaces - many with movable walls and flexible desk/table/cubicle configurations - each school has a media center, computer lab(s), and a TV studio. These facilities are open beyond the traditional school day. Students and the community have extended learning opportunities early in the morning, late into the evening, and on weekends. A variety of school library media and technology personnel, both instructional and technical, support all these spaces, working collaboratively with teachers, administrators, and community members to provide technology and resources within a 24/7 learning environment for every citizen.

The resources are ubiquitous! High speed Internet access allows students and teachers to use a wide variety of resources like NC Wise Owl, video streaming, online courses, video conferencing, and project-based collaborative environments. The Web and Internet 2 are all options, as teachers' help students learn to discern which resources, experts, or platforms are the most appropriate for their particular project or course of study.

The technology itself is ubiquitous as well. Every student has access to a computing device at school and at home, with a variety of peripherals to supplement its use including assistive/adaptive devices for special needs. Teachers and administrators are provided a variety of tools—handheld devices for easy, walk-around assessment and classroom/building management chores; a tablet computer for field trips, work at home, meetings, and note taking; and a desktop for data analysis, multimedia production, and creating documents and reports.

Each classroom is outfitted with an interactive digital white board and data projector, a classroom set of individual student response devices, digital and video cameras, a telephone, one or more multimedia work stations that include printers, science probe ware for experiments, digital microscopes, and graphing scientific calculators for the upper grades. Technology is transparent, with students and teachers naturally using appropriate technology resources as needs arise, treating them as problem-solving, enabling tools.

The technology is used developmentally, with applications and tools chosen based on the educational- and age-appropriateness for the students involved. For instance, in primary schools learning centers abound, with computers sharing the stage with housekeeping stations, sand and water play stations, and spaces for small-group instruction and quiet reading. Children walk up to the interactive digital white board to identify vowels or solve simple addition problems while their classmates watch from their seats, eagerly waiting their turns for teacher praise and validation. At reading assessment time, teachers follow along and log students' progress using hand-held devices, eventually downloading their data for comparative analysis. Even the youngest children take digital pictures or videos, using them to tell a story or to

document a process or project. Their teachers demonstrate early science concepts using digital microscopes and probe ware, building on all children's natural curiosity of the world around them.

These young students learn to use the library media center immediately, moving back and forth between it and their classrooms with great regularity, even several times a day. They are thrilled with the responsibility they have been given of checking in and out their books through the automated circulation system. The library media coordinator and technology facilitator collaborate consistently with these classroom teachers in providing research projects so that these primary students learn what it is to become problem-solvers and independent learners. They are using early reading Web sites and software, making their own classroom books, hosting school-wide television shows, and sending encouraging e-mails to sick classmates early in their school careers.

As these children move into upper elementary grades, they are gradually introduced to one-to-one computing. Students use their own computing device for research, project development, and possibly extra assistance in grasping complex tasks. The learning center approach of the primary grades morphs into small group work, with children of various interests and abilities taught how to accept responsibility for their own and others' work within the project-based learning environment. The media coordinator, technology facilitator, and classroom teachers' work together to design units and projects based on the curriculum found in the North Carolina Standard Course of Study that supplement, expand, and enhance instruction. Students move in and out of the media center, continuing to explore their reading interests, both personal and curriculum-related. They also begin the exciting process of small group research work that combines blocks of classroom and media center time, as they gather a variety of resources—books, websites, videos, personal interviews—and pull information from all these sources to create new knowledge-based projects. These projects could be as diverse as an extended interview or video for the school's daily TV program, a PowerPoint presentation for the next PTO program, a group-created Web site, or a project book bound and housed in the school's library media center.

This independent-learner-centered environment is continued and increased throughout a student's middle school career. Once again student abilities and skills are acknowledged and built upon as teachers use technology resources and project-based learning to differentiate instruction. Interactive digital whiteboards and individual student response systems help teachers to determine the percentage of students who understand certain skills or concepts, allowing re-teaching for either the whole class or individual students as necessary. Some students will be introduced to online courses. Others may use online modules from a learning object repository that illustrate specific concepts for review or that enrich instruction. Still others will be paired with community members, distant experts, or students from other states or countries as they work together on common classroom or personal projects. Teachers continue to plan, structure, and guide these endeavors carefully.

They rely upon media and technology personnel to move in and out of their classrooms, just as students' cycle through the media and technology facilities. This effectively reduces class size, provides individual attention where needed, and offers the chance to encourage early adolescents to develop special relationships with positive role models.

In high schools, students use technology to transform their educational environment. Some students may choose to expand their school day, taking traditional face-to-face classes during school hours and online courses at other times. Others may choose to supplement the school day with one or more online courses while a small number of teens may opt out of traditional high school altogether and graduate from an online program. Colleges and universities provide video and online instruction so that high school students can begin to gain college credit. High school graduation projects are enabled by technology tools that help students collaborate with scientists or researchers from around the world. Students may physically leave the high school campus and remain connected to their schools via e-mail, cell phones, webcams, and chat. Media and technology personnel and facilities continue to be vital in this learning equation as they help students research potential learning partners and situations, complete large projects and papers, and explore and provide new learning technologies and resources.

Technology is especially helpful to our most challenged students. Computers help Attention Deficit Disorder (ADD) and Learning Disabled (LD) children focus on the task at hand; interactive drill-and-practice programs provide extra help to slower students; assistive technologies give physically challenged children the tools to communicate; successful experiences with interactive digital white boards can produce a smile or a few first words from an autistic child; and a school television studio can convince an abused child that life is worth living. Technology success can equal self-esteem and confidence in children who need hope and encouragement, opening doors where they thought there were none.

Technology in schools is an amazing accelerator and motivator, yet it is meaningless without the careful guidance and nurturing of classroom teachers and media and technology personnel. These are the individuals who bring the rigor, relevance, and relationships so important to 21st Century learning; technology is only the tool they use to help them work their magic.

Model Programs
There are two primary models that have been used in North Carolina to demonstrate the use of technology tools including the addition of personnel and training for teachers. One is the North Carolina IMPACT model that has been supported through a federal grant and a second is the NC Technology Association (NCTA) Education Foundations' Technology Demonstration Project which is also supported through federal funding and is a business initiative.

North Carolina's IMPACT Model schools have been part of a front-loaded research study hoping to prove that these tools and the additional personnel make a difference in teaching and learning. Based on North Carolina State University and the Friday Institute of Educational Innovation, the investigator/researchers on the project, the IMPACT model and all its components did improve end-of-grade test scores in reading and math for the grant schools when compared to their comparison schools.

IMPACT vs. Comparison Math Achievement
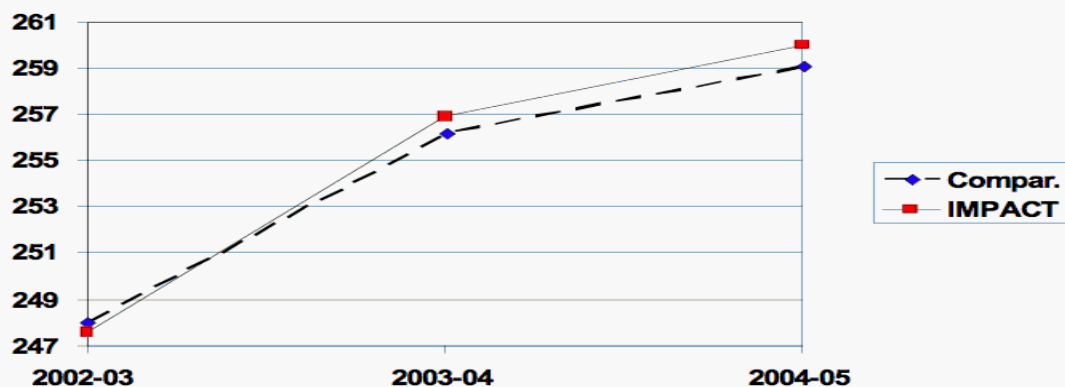
Effect significant at p<. 0001, controlling for grade, race, exceptionality, Free/reduced lunch, sex, absenteeism

Reading Growth 2003-2005, by Grade
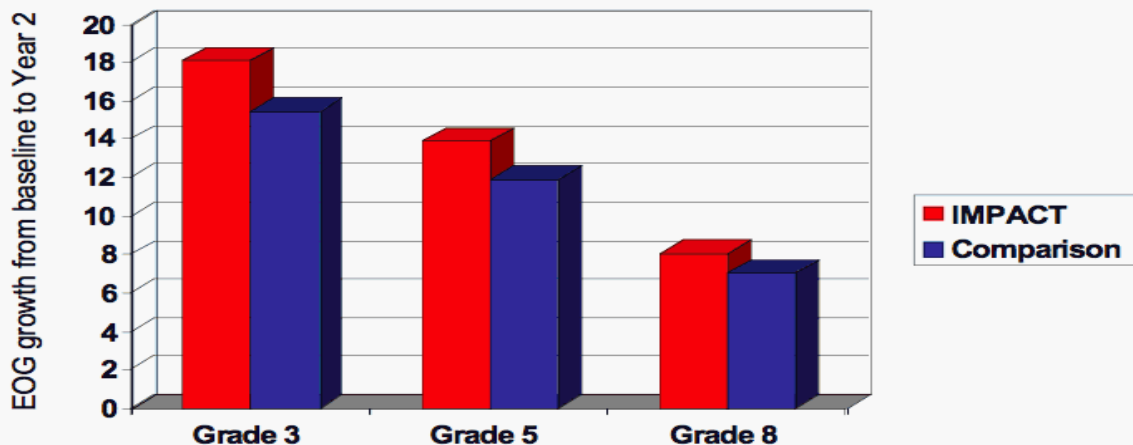
Effect significant at p<. 05, controlling for free/reduced lunch, race, exceptionality, sex, absenteeism, parent education

These schools did not change overnight, however. Each one had to plan carefully for their transition, focusing not only on the technology tools themselves but on the change process, identifying change agents (the principal, media coordinator, and technology facilitator), gathering support from the School Improvement Team/Media and Technology Advisory Committee, and getting parent and community buy-in. Professional development is at the heart of the change--in change management, technology training, and above all, the collaboration process. Scheduling collaborative planning time with classroom teachers, the school library media coordinator, and the technology facilitator is critical to changing from traditional teaching methods to 21st Century teaching methods. It is also a skill critical to understand and model for our students; it will be an expectation for future success.

NCTA Demonstration Model
NC Technology Association (NCTA) Education Foundation obtained federal funding from the U. S. Department of Education to conduct seven (7) Technology Demonstration Projects in North Carolina schools.   The seven (7) projects included six (6) elementary schools and one (1) middle school. The purposes of these projects is to power up the participating schools with complete technology tools and provide professional development for all teachers in the schools. NCTA's goal was to bring to the schools the needed resources so that they could work toward implementing their five-year technology plan and demonstrate the effects on student learning.

Based on evaluation of the project, the lessons learned are as follows:

1. The equipment and software installations should be done prior to the completion of training.
2. A strong onsite technology leader to carry out the day-to-day follow-up items is essential.
3. Ensuring that the technical support for equipment and software implementation is ready to go upon equipment receipt is critical.
4. A solid, strong relationship between the district office and the school administration is critical.
5. An ongoing mentoring and training plan to further embellish the technology and utilize all instructional strategies is critical.

Anecdotal comments from teachers about the project include:

"Students who are not academically inclined find a new interest in their education and those who are already plugged in educationally are even more excited about learning."

"Every child is teachable and technology is a means of helping every child to be successful by working at his own pace."

"Our school population consists of many diverse populations both among students and staff. This program has shown how to adapt curriculum to reach students of all backgrounds and abilities."

"This program has strengthened the staff members of our school. We have shared ideas and been able to draw upon one another's' strengths/areas of expertise in order to complete assignments, increase unity among teachers and improve the overall quality of teaching."

"Receiving this grant has leveled the playing field for the children. With this grant the children are able to use technology they need to succeed in their education and in life."

Both models are examples of how providing the necessary tools and support are essential to utilizing technology so that it has an impact on teaching and learning.

As the state continues to invest in technology and move our schools as rapidly as possible into the 21st Century, it is crucial to invest in teacher training so that educators will embrace the use of technology and the classroom benefits it offers. Best practices learned in previous classroom technology implementations strongly support the strategy of getting any new technology into the hands of the teachers first, providing them with the training resources, and allowing for "ramp-up" time so that they are armed with sufficient knowledge and confidence as the technology is rolled out to the students.

Providing teachers and students with the tools to become 21st Century environments is just beginning. Only about 20% of North Carolina schools are currently future-ready in all senses of the term. While 98.8% of our schools are connected to the Internet, the available bandwidth and the individual school network is not adequate or consistent for 21st Century applications. This is particularly true in the far eastern and western areas of the state. In addition, the internal network or operating systems inside the school need to be robust so that schools can take advantage of the bandwidth to use resources inside and outside the school. While we are moving toward 1:1 computer ratios, with a 3.4 student to computer ratio, only 21% of our schools have full-time, building-level technology facilitators. Providing future-ready classrooms will also be a challenge. Currently:

- 7.4% of North Carolina classrooms have at least one digital camera,
- 3.3% classrooms have an interactive whiteboard,
- 11.1% have a digital projector
- 1.8% have a document camera

The estimated costs for equipping each North Carolina classroom with the technology to be "future ready" is $7,233 per classroom. This base-line cost to equip these classrooms includes digital white board technology, data projectors,

computers, document cameras, a technology facilitator and other technical personnel for each school is based on FY 2006-07 estimated costs.

These costs are large, but the larger question has become: Can North Carolina affords NOT to provide a 21st Century teaching and learning environment for its citizens? This is not only the big education question; it is the big economic question.

Essential Element 3: **Personnel and Professional Development**

Research tells us that teachers will use technology more readily and more effectively if they have the proper support. http://www.ed.gov/pubs/EdReformStudies/EdTech/approaches.html#support This support includes not only an individual with the skills to keep the various technologies up and running—the technician—but also another teacher who understands and can teach others how these technologies can be used in the instructional process—the technology facilitator (or 21st Century coach). These individuals join a school's library media coordinator to form a 21st Century learning team that supports teachers and students as they teach and learn with technology.

What are the roles of the technology facilitator and technician? As stated above, technicians keep a school's equipment in good working order. They troubleshoot the network, repair equipment, install new machines and software, and just generally keep all the technologies running. When everything is going smoothly, technicians can be seen throughout the school interacting with teachers and students as part of the 21st Century learning team, facilitating a student tech help team, helping older students complete a PowerPoint project in the computer lab, or advising students as they produce the morning news show.

While technology facilitators are certainly able to make typical equipment repairs, this is not their primary responsibility. Instead, the technicians' presence allows technology facilitators to spend a majority of their time working with teachers and students. The technology facilitator's job description, approved by the State Board of Education, describes a technology facilitator's primary functions as:

- Planning and facilitating teaching and learning
- Planning and facilitating information access and delivery
- Planning and facilitating program administration

It is important to note the phrase "planning and facilitating" in each of the functions. Similar to their school library media coordinator counterparts' function wording, it describes the critical role that the 21st Century learning team plays in the instructional process.

The following specific practices within the technology facilitators' job description amplify their responsibilities:

Planning and facilitating teaching and learning:
1.1 Collaborates with teachers and other instructional staff to develop curriculum materials and specific lesson plans that integrate technology.
1.2 Models the integration of technology in all curriculum areas.
1.3 Facilitates school participation in technology programs and activities.
1.4 Conducts staff development in the areas of technology integration, the North Carolina Computer/Technology Skills Curriculum, and the North Carolina Technology Competencies for Educators.
1.5 Collaborates with the school library media coordinator to provide leadership in the school's use of instructional technology resources to enhance learning.
1.6 Follows a plan for professional development and actively seeks out opportunities to grow professionally.

Planning and facilitating information access and delivery:
2.1 Implements best practices related to technology use in the school program based on research, pilot programs, and state/national standards.
2.2 Works with the principal and school leadership team to provide access to technology resources and services of the technology facilitator at point of need.
2.3 Works with teachers and technology staff in the selection of resources that are compatible with the school technology infrastructure.
2.4 Assists with planning the design of the technology infrastructure so that information resources are continually available to the school community.
2.5 Promotes family, business, and community partnerships that support the academic success, career readiness, and general well-being of all children.
2.6 Adheres to and communicates copyright as well as other laws and guidelines pertaining to the distribution and ethical use of all resources.
2.7 Assists in maintaining hardware, software, and network infrastructure.
2.8 Serves as the school contact for addressing hardware and software issues.

Planning and facilitating program administration:
3.1 Leads, in partnership with the School Library Media Coordinator, the Media and Technology Advisory Committee in effective decision making to promote the media and technology program.
3.2 Provides leadership and collaborates with the Media and Technology Advisory Committee to develop, implement, and update a school instructional technology plan aligned with the system-level technology plan.
3.3 Collaborates with teachers, media and technology staff, and students to evaluate and select resources addressing curricular needs and learning goals.
3.4 Plays a leading role in the school's budgetary process to ensure funding for the instructional technology program to support school-wide goals.
3.5 Leads in the ongoing evaluation of the effectiveness of the instructional technology program.
3.6 Prepares and submits accurate reports as required.

3.7 Carries out non-instructional duties as assigned and/or as needed to ensure student safety.

One of the keys to 21st Century learning support that is offered by the school level technology facilitator and technician is teacher professional development. Professional development is central in ensuring the effective use of technology in the school and classroom. This professional development takes many forms:

- One-to-one, just-in-time training when teachers (or students!) need to learn new skills or how to use a new piece of equipment.
- Modeling the use of technologies within the classroom for teachers so that they might gain the comfort level necessary to use it independently.
- Conducting large group training or workshops.
- Collaborating with the school library media coordinator and classroom teachers to create lessons or units of instruction.

The collaborative planning process, a continuous professional development experience for all involved, is critical to 21st Century teaching and learning, and technology facilitators are major players within these planning meetings. Through the collaborative planning process, teachers are able to brainstorm with other teachers, the school library media coordinator, and the technology facilitator, finding new ways of presenting information, broadening the number and kinds of resources they can bring to the lesson or unit, and making sure each child's learning style has activities and resources to address it.

When the media coordinator and technology facilitator are brought into the team as instructional partners, each can work with small groups of students, thus freeing up classroom teachers to teach their own small groups of students. Class size has been reduced and students have the opportunity to have individual needs addressed several times throughout the school day or week.

Central office technical support is also important to the success of 21st Century schools. Overseeing all technology initiatives, both instructional and technical, is the Technology Director. He or she is primarily concerned with the development, implementation, operation, monitoring, and evaluation of the technology program for the school system. This individual provides leadership in identifying hardware and software purchases, ensuring that they are consistent with the school system instructional technology plan and state technology guidelines. The employee coordinates, and may deliver, staff development. He oversees the work of the remainder of the technical and instructional technology staff.

Central office technicians repair equipment, install hardware and software, and in general support building-level technicians as well as make sure all central office equipment is up and running. Depending on the size of the school system, they can range from Technicians 1 to Technicians 3. More experienced technical expertise is needed for WAN and LAN management.

Members of the Central Office Technology Support team include:

The Wide Area Network (WAN) Engineer. The WAN Engineer is responsible for designing and implementing wide area networks in a local school agency.. He or she:

- Designs and implements wide area networks including network servers, hubs, routers, workstations and other peripheral devices.
  Installs and configures wide area network servers for email, Internet, and Proxy services.
- Installs and configures all necessary telecommunication devices.
- Operates and maintains wide area networks, tracks significant problems, monitors performance, and performs upgrades to hardware and software as required.
  Installs or modifies existing installations of networked computer hardware, software, and other components.
- Participates in long- and short-range technology planning.
- Trains technical staff at the system and building level to follow proper operating procedures necessary to maintain the integrity of the network.
- Maintains documentation regarding network configurations, operating procedures, and service records relating to network hardware and software.
- Assists in developing training for building level faculty and staff in the proper operation of the wide and local area networks.

The Local Area Network (LAN) Engineer is responsible for designing and implementing local area networks in a school environment.

- Installs local area networks including network servers, hubs, routers, workstations, printers, and other peripheral devices.
- Operate and maintain local area networks, track significant problems, monitor performance, and perform upgrades to hardware and software as required. Install or modify existing installations of networked computer hardware, software, and other components.
- Participates in long and short range technology planning.
- Trains technical staff at the building level to follow proper operating procedures necessary to maintain the integrity of the network.
- Maintains documentation regarding network configuration, operating procedures, and service records relating to network hardware and software.
- Assists in developing and providing training to building level faculty and staff in the proper operation of the local area network.

All these individuals, in collaboration with the school library media coordinator at the building level and the media supervisor at the central office level support the infrastructure needed for 21st Century teaching and learning.

Essential Element 4: Connectivity, Networks and Accountability

Essential Element 1 provides information about the policy framework adopted by the State Board of Education and the content (instruction, curriculum, and assessments) necessary for 21st learning. Essential Elements 2 and 3 provides examples and explanations about the kinds of infrastructure and technology tools needed to help facilitate the content. They also explain the staff support necessary to use 21st century technology tools and the help they provide to facilitate teaching and learning. Providing the necessary content, tools and personnel alone are not sufficient to operate in a 21st century school or workplace.   Teachers and students need the capacity to connect to each other, to other classrooms, to other schools, universities, colleges, the internet and other places to access high quality resources and information.   This brings us to the 4th and final essential element-connectivity and networks- the mechanism to create the interaction and access to information. Connectivity is more than the available bandwidth. Essential elements 1, 2 & 3 are about preparing the school to use this bandwidth and a robust, scalable and secure network to provide access and opportunity.   For instance, it creates the capacity to connect not just to the content via the internet but to people, ideas and conversations that are the real crux of innovation and success in a global economy.

The participants attending the October 18, 2006 meeting of the Joint Technology Commissions at Nortel had the opportunity to participate in a live interaction with one of North Carolina's public schools.   The content and information shared by the teachers and students at this school was all about 21st Century skills, project based learning and how they were changing teaching and learning in that school. However they did not have the capacity to work with and learn from other students and teachers within their school, colleagues and students from schools within their own district, from across the state, or from the Universities, Community Colleges and other places in the world where they might learn from others or others learn from them due to a lack of infrastructure. Nortel staff followed up that demonstration by providing a live connection with a colleague in its United Kingdom office so that participants could experience the benefits of a high quality internal infrastructure and a network with huge bandwidth. This kind of connectivity and network is a part of how they do business and is necessary for their economic competitiveness and survival in a global economy. If North Carolina public schools are to prepare all students for the 21st Century then the state needs to invest in a network that provides equal access and opportunity to all its students.

At the present time, each Local Education Agency (LEA) is responsible for providing its own connectivity and internal infrastructures using resources provided by the state, federal or local governments. They are dependent on the local service providers for connectivity in the absence of a statewide network. Noted in the section for Element 2 of this report, 98% of North Carolina's schools are connected to the internet. However, the robustness of this school connectivity nor the existing

network infrastructure allows for implementation of the 21st Century learning model. As part of the 2005 BETA recommendations, the General Assembly provided funding for the e-NC Authority to conduct a study on Developing Regional Education Networks. The purpose of the study was to explore the viability of the state providing the same type of connectivity and network for education such as the one Nortel and other companies provide to its businesses. The results of the study completed in May 2006, initiated a recommendation for the state to invest in a statewide network to support the public schools by expanding the current NC Research and Education Network (NCREN) which provides connectivity and networking for the North Carolina's Universalities, some of the private Universities and some of the Community Colleges.

The overall goals of the study include:

1. A three year implementation phase in at 24 million in recurring funds based on a 60% e-rate reimbursement to connect all of NC public schools to NCREN by bringing on one-third (1/3) of the districts per year.
2. Allocation of connectivity/bandwidth to all Pre-k –12 Schools based on the recommendation for bandwidth to public schools in the March 2006 E-Learning Commission Phase II report.
3. Regional Staffing teams to provide sustained support for maintaining the network, connectivity and provide support to schools with technology infrastructure. The team would include a network engineer, technology instructional facilitator or 21st Century coach and an e-rate specialist.
4. Optimizing the federal *e-rate reimbursement program established in 1996 through the Universal Service Fund for making telecommunications services and internet access more affordable for public schools and libraries across the nation.

    *e-rate is a federal program that reimburses qualifying schools and public libraries for connectivity. The funds for e-rate are provided by provider companies that is charged to customers on their phone bills.

Under this model, as LEAs are connected to the statewide network, the LEA funds being used to provide connectivity can be reinvested back into the schools to upgrade internal networks and technology tools. "Last mile" connectivity to schools and classrooms to the State network is an important part of the plan. Private sector providers of this service are integral to provision of this connectivity, LEAs and private providers should seek to work together to meet school connectivity needs.

The General Assembly provided 6 million to fund a pilot phase for connecting public schools to the NCREN during its 2006 session. The planning team for the pilot determined that 3 to 6 sites would be identified in various stages of maturity with technology and connectivity. The goals for the pilot sites support the 4 essential elements outlined in this report and the premise that all 4 essential elements must be in place in order to sustain 21st Century schools. The goals include:

1. Expand the number of public schools serving PreK-12 with broadband connectivity;
2. Provide "last mile" connectivity and enhance development of regional broadband networks;
3. Infuse technology into schools' instructional efforts;
4. Maximize the use of e-Rate;
5. Revise school technology plans.

A project team has been developed in partnership with businesses that are committed to helping North Carolina schools become "future ready". Businesses have "loaned" to the project two (2) full time engineers along with other resources to work with representatives from the Friday Institute and the NCDPI to execute the project. As selected sites participate in the pilot, teams of network engineers, e-rate consultants, and instructional technology facilitators will audit the schools infrastructure, assist in revising technology plans to ensure alignment with the school's instructional program and the SBE's priority and goals.

The chart on page 39 titled "Comprehensive pre K-20 Statewide Education Network" provides a visual of the technology tools, technical and personnel infrastructure needed from the classroom to the district. It shows how the LEA connects to the statewide backbone or network and the services and resources that can be provided to all classrooms and schools. For instance, the content box located at the right side of the page lists the NC Virtual School, Internet, Internet2, Universities, Community Colleges, Learning Object Repository and NC WISE. By having these available on the Network, all teachers and students have access to them at the same quality of delivery.

The one network provides greater potential for sharing resources across all of education and increased professional development and learning opportunities. It also creates the capacity for Universities, Colleges and Community Colleges to interact in real time with each other and public schools, better use of resources, and elimination of duplication just to mention a few possibilities. While it is the intent of this report to address the public schools, it is important to note that the Universities, Colleges and Community Colleges also stand to benefit from the further development of a statewide network. The March 2006 E-Learning Commission Phase II report includes recommendations for creating the seamless transfer of learning from PreK-12 throughout life which will be the responsibility of the Education Cabinet to pursue. Finally, it is a demonstration of proper stewardship of the public trust, taking an asset that the state has built (NCREN) and using it at greater capacity for the good of all North Carolina citizens, especially its children.

Finally, the last box on page 40 shows services provided. Right now, LEAs are managing all services with limited resources and support. The statewide network will become their technology utility plant just as they have a public utilities provider and water and sewer provider. This enables the LEA to focus their time and

attention on the business of education and leaves the operation of the network to technical engineers.

The chart on page 41 titled NC Research and Education Network and proposed areas of expansion shows the nine exiting "points of presence" or "pops" from which LEAs can be connected. Consideration has been given to the areas of greatest academic needs, ie the Manning schools noted in red and the Easley schools noted in green. The other areas under consideration are existing regional networks. By using a mix such as that shown, data can be gathered so that the project can be scaled across the state designed more effectively as well as valid costs.
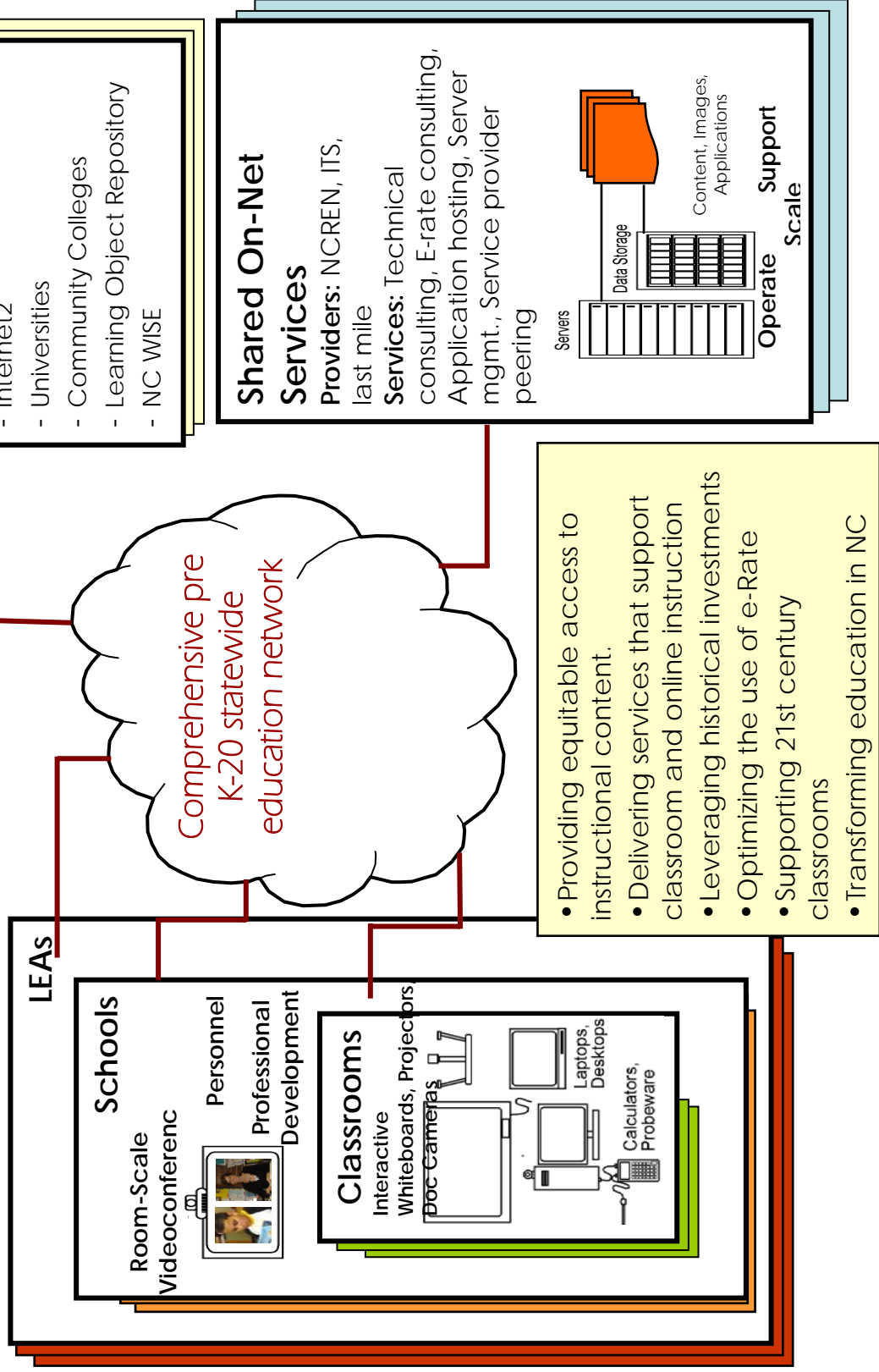
The implementation will not stop with the public schools, the E-learning Commission will continue its work with planning and establishing the NCVirtual (NCV) at the Education Cabinet level to include Universities, Colleges and the community colleges.

<u>Conclusion</u>

Getting the public schools connected to a statewide network where resources, services and learning options are available will level the playing field and eliminate barriers caused by zip codes. As noted in this report connectivity is just one element and will not solve the challenge the schools face with getting all students prepared for higher education and a global economy. The state still needs to continue to invest in developing the content necessary so that students are learning and teachers are teaching 21st century skills. Students and teachers also need to be provided with successful models, the necessary technology tools, and ongoing support to take advantage of options provided through connectivity as explained in elements 2 and 3. Each of these four elements presented are needed. One in isolation of the other will have a negative impact on making the transition from an industrialized education system to a knowledge based system.

While we are working on our public schools, we need to remember the initial statement about *The World is Flat* and tough business realities triggered by strong competition from India, China and other formerly second tier economies. Many of these countries have invested in connectivity and are moving ahead of the United States. Their investment is paying off and has provided them opportunities not just in their schools but also in their communities. Students don't just learn from 8-3:00, and technology has given them, their families and all citizens access to learning 24/7 if they have that opportunity at home and in their communities. North Carolina needs to continue investing in its public schools, universities and community colleges, however thought and planning needs to be given to providing access to all access in all homes and the greater community.

Comprehensive pre K-20 Statewide Education Network

Shared Content
- NC Virtual School
- Internet
- Internet2
- Universities
- Community Colleges
- Learning Object Repository
- NC WISE

Shared On-Net Services
Providers: NCREN, ITS, last mile
Services: Technical consulting, E-rate consulting, Application hosting, Server mgmt., Service provider peering

Servers

Data Storage

Content, Images, Applications

Operate   **Scale**   **Support**

Comprehensive pre k-20 statewide education network

- Providing equitable access to instructional content.
- Delivering services that support classroom and online instruction
- Leveraging historical investments
- Optimizing the use of e-Rate
- Supporting 21st century classrooms
- Transforming education in NC

LEAs

Schools

Room-Scale Videoconferenc

Personnel

Professional Development

Classrooms
Interactive Whiteboards, Projectors, Doc Cameras

Laptops, Desktops

Calculators, Probeware

Existing NC Research Education Network and proposed areas of expansion.